Nyack Former Manufactured Gas Plant Site

ROCKLAND COUNTY, NEW YORK

Site Management Plan

NYSDEC Site Number: 344046

Prepared for:

Orange and Rockland Utilities, Inc.
Former Nyack MGP Site
Gedney St.
Nyack, NY

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision #	Submitted Date	Summary of Revision	DEC Approval Date

APRIL 2016

CERTIFICATION STATEMENT

I, JOHN T. FINN, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

_________________________ P.E.

_________April 5, 2016______DATE

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1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 INTRODUCTION

This document is required as an element of the remedial program at the Nyack Former Manufactured Gas Plant ("MGP") Site (hereinafter referred to as the "Site") under the New York State ("NYS") Inactive Hazardous Waste Disposal Site Remedial Program administered by the New York State Department of Environmental Conservation ("NYSDEC"). The Site was remediated in accordance with Order on Consent Index # D3-0001-98-08, Site #344046, which was executed on March 11, 1999.

1.1.1 General

Orange and Rockland Utilities, Inc. ("O&R") entered into the above-referenced Order on Consent with the NYSDEC to remediate the former MGP Site located along Gedney Street in the Village of Nyack, Rockland County, New York. This Order on Consent required the Remedial Party, O&R, to investigate and remediate contaminated media at the Site. A figure showing the site location and boundaries of this approximately four-acre site is provided in Figure 1. The boundaries of the Site subject to this Site Management Plan ("SMP") are more fully described in the metes and bounds site description that is part of the Environmental Easement required for the Eastern Parcel of the Site (the "Environmental Easement").

After completion of the remedial work described in the NYSDEC-approved Remedial Action Work Plan for the Site, some contamination was left in the subsurface at this Site, which is hereafter referred to as "remaining contamination." This SMP was prepared to manage the remaining contamination at the Site until the NYSDEC-approved Environmental Easement for the Site is extinguished in accordance with NYS Environmental Conservation Law (ECL) Article 71, Title 36. All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

This SMP was prepared by GEI Consultants, Inc., P.C. ("GEI") on behalf of O&R, in accordance with the requirements in Title 6 of the New York Code of Rules and Regulations Part 375 (6 NYCRR Part 375), NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing the Institutional Controls ("ICs") and Engineering Controls ("ECs") that are required by the Environmental Easement for the Site.

1.1.2 Purpose

The Site contains contamination left after completion of the remedial action. Engineering Controls have been incorporated into the Site remedy to control exposure to remaining contamination during the use of the Site to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Rockland County Clerk, will require compliance with this SMP and all ECs and ICs placed on the Site. The ICs place restrictions on Site use, and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. This SMP specifies the methods necessary to ensure compliance with all ECs and ICs required by the Environmental Easement for contamination that remains at the Site.

This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

This SMP provides a detailed description of all procedures required to manage remaining contamination at the Site after completion of the Remedial Action, including: (1) implementation and management of all Engineering and Institutional Controls; (2)

media monitoring; and (3) performance of periodic inspections, certification of results, and submittal of Periodic Review Reports.

To address these needs, this SMP includes two plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; and (2) a Monitoring Plan for implementation of Site Monitoring.

This plan also includes a description of required Periodic Review Reports for the periodic submittal of data, information, recommendations, and certifications to the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement for the Site. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Satisfactory Completion letter issued by the NYSDEC for the Site;
- Failure to comply with this SMP is also a violation of the NYS Environmental Conservation Law, 6NYCRR Part 375 and the Order on Consent (Index #D3-0001-98-08; Site #344046) for the Site, and thereby subject to applicable penalties.

1.1.3 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.2 SITE BACKGROUND

1.2.1 Site Location and Description

The Site is located in the Village of Nyack, County of Rockland, New York. The Site is owned by Athene Annuity & Life Assurance Company of New York (formerly known as Presidential Life Insurance Company). The Site boundaries, as defined by the March 2004 Record of Decision ("ROD") for Operable Unit Number 1 ("OU1") of the

Site and the March 2011 ROD for Operable Unit Number 2 ("OU2") of the Site, consist of the former MGP works and an off-site area adjacent to the south of the Site with remaining contamination at 41 Gedney Street, Nyack, NY (Tax ID 66.39-01-02) referred to in the RODs and in this SMP as the "Hudson Vista Associates Property."

The Site was divided into two operable units (OUs) by the NYSDEC:

OU1 - The portion of the Site above the 100 year flood line, including the Hudson Vista Associates Property

OU2 - Land below the 100 year flood line and above the mean high water mark of the Hudson River and the Hudson River sediment which was impacted by Site-related contamination.

The relative locations of the former MGP plant on the Site and nearby properties are shown on Figure 2. The main part of the Site where the MGP was formerly located occupies a parcel with Tax ID 66.39-01-01 and a street address of 55 Gedney Street, Nyack, New York (the "Eastern Parcel"). Directly to the west of the Eastern Parcel across Gedney Street is a parcel where a single manufactured gas holder was formerly located with Tax ID 66.38-02-14 and a street address of 26 Lydecker Street, Nyack, New York (the "Western Parcel").

The Eastern Parcel occupies an approximately 4-acre area in total, which includes about 2.17 acres of land and 1.8 acres of submerged land in the Hudson River, and is bounded by the Nyack Boat Club to the north, the commercial property known as the Hudson Vista Associates Property to the south, the Hudson River to the east, and Gedney Street to the west. The Eastern Parcel consists of an upper area along Gedney Street (the "Upper Terrace") separated by a steep slope from a lower area along the Hudson River (the "Lower Terrace"). The entire Eastern Parcel is landscaped to the riprap shoreline. The Eastern Parcel is fenced to prevent trespassing. The Eastern Parcel, including the shoreline and off-shore portion of the Eastern Parcel, is subject to control under this SMP, as shown on Figure 5.

The Western Parcel includes the parking area on the south west corner of Lydecker Street and Gedney Street. It was evaluated for the potential presence of MGP contamination because it was the historical location of a manufactured gas storage holder and found not to be contaminated. The Western Parcel is not the subject of any requirements in this SMP.

The lower parking lot area of the Hudson Vista Associates Property located immediately south of the Eastern Parcel has been remediated through in-situ solidification ("ISS") of soils as a part of the OU1 remedial action for the Site (see Figure 5). The Hudson Vista Associates Property's lower parking lot area is considered an off-Site area but is subject to the requirements of this SMP. The boundaries of the Site subject to this SMP are more fully described in Appendix C – Metes and Bounds.

1.2.2 Site History

An MGP operated at the Site from 1852 until 1965. Gas was made at the Site by heating coal and/or petroleum products in closed vessels. The gas produced was cooled, purified, and stored at the Site and then distributed through a network of underground pipes in surrounding communities, where it was used in much the same way that natural gas is used today. Routine use of the MGP at the Site was discontinued in 1938. From 1938 until 1965, the MGP was used only during times of peak demand, a practice known as "peak shaving." All of the MGP structures were razed from the Site by 1974. The former MGP structures on the Site included underground tar storage tanks, gas holders and wells, tar drainage pits, a tar separator, a tar pump house, above ground petroleum storage tanks (ASTs), an oil pump house, gas holder pits and foundations, purifier areas and MGP process buildings.

The history of the Site's ownership and MGP operations is presented below.

History of Ownership, Nyack MGP Property

Date	Source	Description
1852	O&R	start of operations by "the Haupwait brothers"
1859	History of Rockland Co.	incorporation of the Nyack and Warren Gaslight Company
1872	O&R	transfer of property due to bankruptcy to A.M. Voorhis and associates
1887	Browns and Sanborn	first listing as Nyack & Warren Gas Light Co. - only the northern half of the upper eastern parcel included (river side of parcel shown as a coal storage site)
1890	O&R	ownership reorganized as Nyack Gas Light & Fuel Co.
1892	Sanborn	river side of parcel listed as J.F. Hazard Coal & Wood Yard - parcel to south shown as a boat builder
1894	Browns	ownership listed as Nyack Gas Light & Fuel Co.
1902	Sanborn	boundaries of eastern parcel expanded northward
1909	Browns	ownership listed as Rockland Light & Power Co.
1910	Sanborn	coal and lumber yard on lower eastern parcel no longer shown - eastern parcel expands southward
1919	Sanborn	further expansion of eastern parcel to the south, and development of the western parcel
1924	Browns	note indicates company acquired Orange County Public Service Co.
1925-1938	Browns	note indicates the site is "managed and supervised" by C.H. Tenney and Co., Boston, Mass.
1935	O&R	natural gas becomes available
1964	O&R	plant retired on December 14th
1967	County Records	former service center property sold
About 1972	Various	eastern and western parcels sold
1980	County Records	eastern and western parcels acquired by Presidential Life

Note: This site ownership history is based on a combination of sources and is for general information purposes only. It should not be used for legal purposes without further verification.

It should be noted that the Western Parcel has been utilized as a parking lot and the Eastern Parcel has been vacant since 1972.

1.2.3 Geologic Conditions

1.2.3.1 Regional and Site-Specific Geology

The following refers to the general Site conditions found prior to the Site's remediation. The Site is located within the Brunswick Formation. A layer of fill material covered the majority of the Site in varying thickness ranging up to 13 feet. The fill was thickest in a jetty area in the Lower Terrace of the Eastern Parcel that juts into the Hudson River. Underlying the fill is a unit comprised of silty sand. A discontinuous deposit of glacial till was found at one location on the Site.

The bedrock unit is comprised of fractured and weathered sandstone which was found between 4 feet below ground surface (bgs) in the western portion of the Site and 30-feet below the ground surface along the Hudson River. In the submerged portion of the Site in the Hudson River, a thick, clayey marine silt unit is present overlying the bedrock.

1.2.3.2 Hydrogeology

Surface water flows in general from west to east across both parcels of the Site via sheet flow and discharges to the Hudson River. Two water bearing units were identified during the investigation: an overburden unit situated on the Lower Terrace of the Eastern Parcel adjacent to the Hudson River, and the bedrock unit which underlies the entire Site. Water level measurements prior to the Site's remediation indicated that groundwater in the overburden unit was approximately 5 feet bgs in the Lower Terrace area. Water level measurements also indicated that the bedrock unit water table in the Western Parcel and Upper Terrace of the Eastern Parcel was approximately 20 to 30 feet bgs.

The remedial action performed at the Hudson Vista Associates Property's lower parking lot area and the Eastern Parcel's Lower Terrace included ISS, which has likely influenced localized groundwater flow pattern, directing the water flow around the ISS mass due to the low ISS monolith permeability. Conceptualized flow paths for groundwater movement at the Site are shown on Figure 11. The flow paths show that the ISS mass blocks the direct natural west - to - east groundwater flow at the water table. Groundwater flow is directed around the ISS mass to the north and south, as well as beneath the mass through bedrock.

The Village of Nyack is serviced by a municipal water system. There are no known users of groundwater in the vicinity of the Site.

1.3 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

Between 1999 and 2008, a number of Remedial Investigations (“RIs”) were performed to characterize the nature and extent of the contamination at the Site. The results of the RI are described in detail in the following reports:

- The RETEC Group, Inc. (RETEC), 2002. Remedial Investigation Report, Former Manufactured Gas Plant Site, Nyack, New York, prepared for Orange and Rockland Utilities, January 2002.
- RETEC, 2003. Supplemental Sediment Remedial Investigation. Letter report prepared for Orange and Rockland Utilities, April 8, 2003.
- AECOM, 2009. Remedial Investigation Report, Operable Unit 2, Former Manufactured Gas Plant Site, Nyack, New York. April 2009.
- GEI, 2012. OU-2 Pre-Design Investigation Report, Nyack Manufactured Gas Plant Site, Nyack, New York, NYSDEC Site #3-44-046, dated January 28, 2012.

The Eastern Parcel and certain off-site areas were remediated due to the presence of contaminants of concern in various media related to the former MGP operations conducted at the Site. The primary contaminant source at the Site is coal tar (a condensate from the gas manufacturing process). Coal tar contains BTEX compounds (benzene, toluene, ethylbenzene, and xylene) and PAHs (polycyclic aromatic hydrocarbons). Investigations showed coal tar and contaminated groundwater to be present at the Site. Site-related contaminants were also observed in the sediment of the Hudson River along the Site’s shoreline area. No Site-related contamination was observed in surface water at levels above applicable standards.

Prior to its remediation, the Site presented an environmental threat due to the presence of coal tar in the subsurface of the Eastern Parcel and certain off-Site areas, and the NYSDEC’s RODs for OU1 and OU2 of the Site were issued to address such contamination. No significant contamination was observed in the Western Parcel.

Below is a summary of Site conditions when the RI was performed in 1999-2008.

1.3.1 Waste Material

Coal tar was found in the subsurface in both the Upper Terrace and Lower Terrace areas of the Eastern Parcel. The sources of the coal tar wastes appeared to be the former MGP structures that operated at the Site. Coal tar did not migrate a significant distance horizontally from these on-Site sources (approximately 20 feet, maximum). Coal tar had migrated vertically into the bedrock underlying the Eastern Parcel to a depth of over 40 feet bgs. Most of the contamination was found at depths of 10 feet or more bgs. One notable exception is the area immediately downgradient of the former MGP "drainage pits," just south of the jetty (see Figure 2). Here tar was present in subsurface soils as shallow as 2.5 feet bgs. This was also the only area coal tar was seen in the Hudson River sediment.

1.3.2 Surface Soil

Surface soil samples (0-6 inches) contained elevated levels of PAHs. Total PAH levels ranged from 6 parts per million (ppm) to 836 ppm. Total carcinogenic PAHs (cPAHs) were detected at levels of 3 ppm to 158 ppm. No BTEX constituents were detected in the surface soil. Cyanide levels ranged from non-detect to 14 ppm. Cyanide detections were co-located with areas of elevated PAHs. One sample showed lead to be present at a level of 1,200 ppm, which is above the typical background level, but within the range which would be expected in an urban environment.

1.3.3 Subsurface Soil

Subsurface soil in direct contact with and in the vicinity of the Site's former MGP structures or related coal tar deposits contained PAHs, BTEX, and cyanide. Total PAH levels in subsurface soils ranged from non-detect to 19,388 ppm, with total cPAH values of non-detect to 1,936 ppm. BTEX levels in subsurface soils ranged from non-detect to 2,860 ppm. Cyanide levels ranged from non-detect to 56 ppm. All samples with elevated BTEX and cyanide levels also had elevated levels of total PAHs. Therefore, total PAH levels were used to delineate subsurface soil impacts.

1.3.4 Groundwater

Groundwater in the vicinity of the subsurface coal tar contamination and coal tar-contaminated subsurface soils contained PAHs and BTEX. BTEX levels in groundwater ranged from non-detect to 199,500 parts per billion (ppb). These results are two to three orders of magnitude above applicable NYSDEC Standards, Criteria, and Guidance ("SCGs"). Total PAH levels in groundwater ranged from non-detect to 11,450 ppb. Carcinogenic PAHs were detected in only one sample, at a level of 717 ppb. Total cyanide levels ranged from non-detect to 495 ppm. All wells with elevated levels of PAHs and cyanide also had elevated levels of BTEX. Therefore, BTEX levels were used to delineate groundwater impacts.

1.3.5 Soil Gas

Soil gas samples contained BTEX at concentrations above typical background levels. Benzene concentrations ranged from non-detect to 61 $\mu g/m^3$ (micrograms per cubic meter), toluene concentrations ranged from 4 to 68 $\mu g/m^3$, ethylbenzene concentrations ranged from non-detect to 23 $\mu g/m^3$, and xylene concentrations ranged from 13 to 130 $\mu g/m^3$. These chemicals appeared to be from a combination of sources, some Site related and some not related to the MGP operations formerly conducted on the Site.

1.3.6 Site-Related Sediment

Hudson River surface sediments in the offshore portion of the Site did not show field indications of impact except in the near-shore area immediately downgradient of the former Lower Terrace seepage pits. Sediment at that location exhibited a hydrocarbon odor and sheen. Non-aqueous phase liquid ("NAPL") was not found in the sediment surface at any location. Field indications of MGP impact were found below the sediment surface in most cores collected in the section of the Hudson River fronting the Site. NAPL and sheens were observed in cores close to the shore, immediately east of the former seepage pit area and the most impacted beach cores. Cores along the north side of the Site's jetty that juts into the Hudson River exhibited light to moderate impacts; with sheens and NAPL blebs found at some locations a foot below the sediment surface.

NAPL-saturated layers were not observed in cores east or north of the jetty. An assessment of benthic fauna in the sediments found no differences which could be attributed to Site impacts when compared to reference locations.

1.3.7 Surface Water

Observations made concerning the condition of surface water in the Hudson River in the vicinity of the Site found that trace amounts of a hydrocarbon-like sheen was present near exposed hydrocarbon-impacted soil in the inter-tidal zone in the jetty area of the Site. Chemical analysis of surface water found that no organic constituents of concern were present in surface water upstream, adjacent to, or downstream of the Site in concentrations greater than method detection limits or standard values.

1.3.8 Western Parcel

Because no significant contamination was found on the Western Parcel of the Site, the ROD that the NYSDEC issued for OU1 in March 2004 did not require the implementation of any NYSDEC-approved remediation for that portion of the Site. Therefore, the Western Parcel is not subject to any requirements under this SMP or the Environmental Easement.

1.4 SUMMARY OF REMEDIAL ACTIONS

The Site was remediated in accordance with the NYSDEC-approved Remedial Action Work Plans, and Remedial Design documents listed below:

- RETEC, 2005. Work Plan for Bedrock In Situ Chemical Oxidation, Nyack Manufactured Gas Plant Site, Nyack, NY, Prepared for Orange & Rockland Utilities, Spring Valley, NY. Prepared by The RETEC Group, Inc., Ithaca, NY. August 22, 2005.
- RETEC, 2006. Remedial Design Package – Excavation of Upper Terrace and In situ Solidification of Hudson Vista Soils, Nyack MGP Site, Nyack, NY, Prepared for Orange and Rockland Utilities, Spring Valley, NY. Prepared by The RETEC Group, Inc., Ithaca, NY. January 4, 2006.
- RETEC, 2006. Remedial Design Package - Remediation of Lower Terrace Soils and Site Restoration, Nyack MGP Site, Nyack, NY, Prepared for Orange

and Rockland Utilities, Spring Valley, NY. Prepared by The RETEC Group, Inc., Ithaca, NY. July 14, 2006.

- GEI, 2013. Operable Unit No. 2. Remedial Design Report - 100% Design Submittal. Nyack Manufactured Gas Plant Site, Nyack, New York. October 2013.

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

- In the Upper Terrace, all former MGP structures, including buried piping, and soils that contained total PAHs at concentrations of over 500 ppm or which were visibly impacted by coal tar were excavated and transported to an off-site permitted treatment/disposal facility. The excavation resulted in the excavation of soil to bedrock as well as the removal of some surficial bedrock. This occurred in a manner which controlled emissions of odors, dust, and volatile organic compounds (VOCs).

- Wells were used to recover flowable NAPL in the bedrock beneath the Site to the extent practicable. NAPL removal actions continued until the volume of NAPL recovered was no longer significant.

- In the Lower Terrace, major obstructions such as rip rap, concrete debris, buried former MGP piping and structures were removed by conventional excavation. This excavation also removed gross contamination in and immediately adjacent to subsurface structures and piping to the extent practicable.

- Soils in the Lower Terrace which contained total PAHs at concentrations over 500 ppm or which were visibly impacted by coal tar were auger-mixed with solidifying agents. This ISS produced overlapping columns of solidified soil, resulting in a low permeability, solidified mass that is referred in this SMP as the “ISS mass” or “ISS monolith.”

- In the steeply sloped area of the Site between the Upper Terrace and the Lower Terrace, all soils which contained total PAHs at concentrations of over 500 ppm or which were visibly impacted by coal tar and were located above the groundwater table of the Site were excavated and transported off site for treatment and/or disposal at appropriately licensed facilities. All soils which contained total PAHs at concentrations of over 500 ppm or which were visibly impacted by coal tar and were located below the Site’s water table, were either excavated, or solidified using ISS.

- Residual contamination in the bedrock underlying the Site was addressed by in-situ chemical oxidation (ISCO).

- MGP-related soil contamination on the Hudson Vista Associates Property's lower parking lot area was treated using ISS.

- Shoreline areas (above the mean high water mark and below the existing ISS monolith which extends to the 100 year flood line) where significant quantities of MGP tar were present were treated using ISS. The ISS created a low permeability cement monolith which effectively isolated the MGP contamination from human contact and the environment, eliminating potential exposure pathways.

- Sediment (below the mean high water mark of the Hudson River) which contained visible MGP tar or which, through multiple lines of evidence, was shown to contain MGP-related contamination resulting in an impact to the environment, was removed by mechanical dredging and transported to a permitted, off-site treatment and disposal facility.

- Because the remedy specified in the RODs that the NYSDEC issued for the Site resulted in certain soil being treated through ISS and remaining on-site with contaminants above individual soil cleanup objectives, all such impacted soils were covered with at least two feet of clean fill across the entire Site and the Hudson Vista Associates Property's lower parking lot area treated with ISS.

The NYSDEC-approved Remedy for the Site also requires the execution and recording of an Environmental Easement for the Eastern Parcel of the Site to restrict land use and prevent future exposure to any contamination remaining at the Site and the following additional controls and measures:

- Implementation of Institutional Controls.

- Development and implementation of a Site Management Plan for long-term management of remaining contamination as required by the Environmental Easement, which includes plans for: (1) Institutional and Engineering Controls, (2) monitoring, and (3) reporting.

The Remedial Action for OU1 of the Site was conducted in three separate phases and included NAPL recovery and ISCO, and excavation and ISS. The first phase was implemented to address impacts in bedrock and included NAPL recovery followed by ISCO. The ISCO phase was completed in November 2005. The second phase addressed soil impacts. Excavation was conducted on the Upper Terrace area of the Eastern Parcel. Soil excavation and ISS were conducted on the impacted off-site Hudson Vista Associates Property's lower parking lot area adjacent to the Site. These actions were completed in June 2006. The third phase addressed the Eastern Parcel's Lower Terrace soil contamination by means of soil excavation and ISS. The last phase of work for OU1 was completed in September 2007.

The Remedial Action for OU2 consisted of ISS between the OU1 Lower Terrace ISS area and the mean high water elevation of the Hudson River. Hudson River sediment impacts were then removed by dredging. The OU2 remedy was completed in April 2015. Figure 5 depicts a remedial summary.

The remainder of this section provides additional details of the remedial actions.

Bedrock

The initial action taken to address MGP impacts in bedrock was periodic recovery of NAPL from wells in the Eastern Parcel's Upper Terrace and Lower Terrace. A total of 59.56 liters of NAPL was recovered. NAPL recovery was followed by ISCO program of the Upper Terrace bedrock. A total of 87,190 gallons of 17% Fenton's Reagent was injected and 28,326 gallons of impacted groundwater was extracted/treated and used as oxidant dilution water. The target of one full pore volume of Fenton's Reagent was delivered to the bedrock zone, resulting in the elimination or reduction of MGP-related contaminants present in the bedrock to the extent practicable (RETEC, 2006a).

Hudson Vista Associates Property - Lower Parking Lot Area

Prior to ISS, excavation was conducted to a depth of between 6 and 7 feet bgs to remove obstructions and provide sufficient volume to contain excess solidified soil generated during ISS. ISS was then performed by auger mixing soil to bedrock with cement-grout mix, for a total treatment of 2,520 cubic yards in situ. Bedrock in this area slopes sharply to the east and the auger configuration left a wedge shape area of most columns without full mixing to the bedrock surface. Final restoration included rough grading of ISS, placement of base course and pavement on the parking lot, placement of riprap along western bank, and storm sewer restoration. Remediation of this parcel was successfully completed in compliance with the requirements of the ROD for OU1 (RETEC, 2006b).

Upper Terrace Excavation

Impacted soils in the Eastern Parcel's Upper Terrace were excavated to bedrock to satisfy the OU1 ROD requirements of removing soil with visible impacts or soils in exceedance of the remedial objective of 500 mg/kg total PAH. Excavation included removal of some surficial bedrock due to the broken, friable nature of that bedrock. The excavation proceeded under a temporary fabric structure to control dust, odor and vapor. A total of 25,377 tons of soil were removed during excavation. All soil confirmation sample locations achieved the remedial goal less than 500 ppm PAHs. A summary of soil analytical results outside of excavation area is presented in Table 6. Figure 6 shows the limits of excavation. Figures 7 through 10 provide cross-sections of the excavation. Remediation of the Upper Terrace was successfully completed in compliance with the requirements of the ROD for OU1 (RETEC, 2006b). The Upper Terrace, which is underlain by a shallow bedrock bench, was restored to be at-grade with Gedney Street using clean fill (AECOM, 2008).

Lower Terrace Excavation and ISS

The Site's Lower Terrace excavation was performed to the approximate high water table during OU1. The purpose of the OU1 excavation on the Lower Terrace was to remove visible obstructions that would inhibit ISS implementation and provide sufficient volume to contain excess ISS. During the OU1 remediation work, 12,634 tons of soil and ISS spoils and 158 tons of wood debris were removed from the Lower Terrace. Impacted soils were remediated by solidifying the impacted soil with a cementitious grout via auger mixing, followed by jet grouting on the perimeter of the ISS area. ISS extended to the depth of bedrock, except in the jetty area where impacts did not extend to bedrock. In the jetty area, the ISS extended to elevation -14, based on the North American Vertical Datum 1988 (NAVD88). ISS using jet grouting was performed on the perimeter of the auger mixed ISS columns and to address impacts beneath obstructions that could not be effectively reached using the auger mix method. Jet grout mixing was also used to treat soil below the auger mixed material and above the sloped bedrock surface. Over 11,400 cubic yards of impacted material was successfully solidified in situ. Common gravel, and clean topsoil backfill was imported and placed to create soil cover of at least 2 feet above the solidified ISS mass (AECOM, 2008).

ISS of the Intertidal Zone and Sediment Dredging

The Intertidal zone between the limit of the OU1 ISS mass and mean high water line of the Hudson River on the Site were solidified in situ using auger mixing technique. ISS using jet grouting was performed on the perimeter of the auger mixed ISS columns in the zones A and D (Figure 5) and to address impacts beneath obstructions that could not be effectively reached using the auger mix method. Over 6,665 cubic yards of impacted material was successfully solidified in place. Sand backfill was imported to the Site, topsoil backfill, which had been previously placed following OU1 restoration, was used to create soil cover of at least 2 feet above the solidified soil mass.

Hudson River sediment (below the mean high water elevation at the Site) which contained visible MGP tar or which, through multiple lines of evidence, had been shown to contain MGP-related contamination resulting in an impact to the environment, was removed by mechanical dredging. The dredged sediment was dewatered on site under a temporary fabric structure, and transported to a permitted, off-site treatment and disposal facility. The total volume of removed sediment was 8,500 cubic yards. Following completion of the required Remedial Action, the affected shoreline area was restored in accordance with the design documents, per the final restoration plan approved by NYSDEC on 04/10/2015 (GEI, 2016 – in progress).

Major remedial activities for OU2 at the Site were completed in February 2015. The final site restoration for OU2 was completed in April 2015.

1.4.1 Site Remediation Objectives

The required Site soil cleanup objectives ("SCOs") were identified in the NYSDEC's RODs for OU1 and OU2 and are presented in Appendix L. The applicable land use for the Site is restricted residential use, commercial use, or industrial use, as defined in 6 NYCRR Part 375-1.8. A list of the SCOs for the primary contaminants of concern (COCs) and applicable land use for this Site is provided in Table 5.

1.4.2 Site-Related Treatment Systems

No long-term treatment systems were installed as part of the Site remedy.

1.4.3 Remaining Contamination

Soil

Achievement of unrestricted SCOs was not the selected remedy for the Site and residual contaminated soil and groundwater/soil vapor remain beneath the Site in the bedrock underlying the Upper Terrace and Lower Terrace areas of the Eastern Parcel and the ISS mass underlying the Lower Terrace area. Soil located on the Upper Terrace and the steep slope between Upper Terrace and Lower Terrace have been remediated by excavating the soils that contained total PAHs at concentrations of over 500 mg/kg or that were visibly impacted by coal tar. The limits of excavation are presented on Figure 5. Clean fill has been placed as backfill in these areas.

Soils on the Lower Terrace as well as the adjacent Hudson Vista Associates Property's lower parking lot area have been remediated by ISS to bedrock or to the NYSDEC-approved design depth, with the deepest ISS boundary extending to 22.4 feet bgs (elevation -19 based of North American Vertical Datum of 1988) southeast of the Site's jetty, along the shoreline.

In general, the remedy resulted in soils remaining on site with PAH in compliance with the remedial action objectives ("RAOs"), but in excess of individual restricted use SCOs. These soils are present around the perimeter of the Upper Terrace excavation (as shown on Figure 13), and also within and underneath the ISS mass. Because soils on Site are generally located above groundwater table, there is a low potential for soil recontamination above bedrock.

On the Upper Terrace, no demarcation layer was placed because excavation was to bedrock and the bedrock surface serves as an effective demarcation layer. Within the ISS areas, no demarcation layer was placed on top of the ISS mass. The top of ISS serves as an effective demarcation layer due to the hardened nature of material.

Cross-sections (Figures 7 through 10) identify the soil condition prior to remediation. Figure 13 identifies soil remaining outside the OU1 excavation and compares the soil analytical results to Restricted SCOs.

Bedrock

Remedial actions performed at the Site met the requirements of the ROD for OU1 and NYSDEC-approved design documents. Specifically, as indicated in the ISCO Completion Report (RETEC, 2006) for the Site, the target of one full pore volume of Fenton's Reagent was delivered to the bedrock zone, resulting in the elimination or reduction of MGP-related contaminants present in the bedrock to extent practicable. Residual MGP impacts may exist in the bedrock on-Site.

Groundwater

The primary groundwater contaminants associated with the Site are BTEX and PAHs. Groundwater contamination in the bedrock in the Upper Terrace was addressed by removing the source material in the overburden, and treating coal tar in the bedrock with chemical oxidation. Both the OU1 and OU2 RODs require institutional controls that restrict the use of groundwater. The required Environmental Easement for the Site restricts the use of groundwater from the Eastern Parcel as a source of potable or process water, without necessary water quality treatment as determined by the NYSDEC, New York State Department of Health (NYSDOH), or Rockland County DOH.

Sediment

The primary sediment contaminants associated with the Site are BTEX and PAHs. Offshore sediments have been remediated by dredging to the horizontal extent and depths in accordance with the NYSDEC-approved design (GEI, 2013) and in conformance with the requirements of the OU2 ROD. No additional impacts were discovered during the remedial action. The deepest dredging was performed adjacent to the ISS platform, to a depth of approximately 12 feet (elevation -10 based of North American Vertical Datum of 1988) southeast of the Site's jetty, along the shoreline. Dredging to the lowest elevation of -14 was performed to the east of the mooring dolphins, where the dredge depth was 2 to 3 feet.

The contamination remaining in sediments does not include tar-saturated sediments, all of which were removed by the remedial action. Some light impacts, which are covered by clean sediment, remain. Sediment impacts in the form of blebs, globs, or sheen remain approximately 120 feet south of the mooring dolphins, limited to the 2 locations shown on Figure 14: SD12 and SD27. At SD 12, the impacted interval is limited to 0.1 feet and is covered by 4.6 feet of clean sediment. At SD27 the impacted interval is limited to 0.7 feet and is covered by 5.1 feet of clean sediment. Neither location has any MGP impact in the surface sediment layer.

2.0 ENGINEERING AND INSTITUTIONAL CONTROL PLAN

2.1 INTRODUCTION

2.1.1 General

Since remaining contaminated soil, groundwater, bedrock, and sediment exist on the Site, Engineering Controls and Institutional Controls (EC/ICs) are required to protect human health and the environment. This Engineering and Institutional Control Plan describes the procedures for the implementation and management of all EC/ICs at the Site.

This plan is one component of the SMP for the Site and is subject to revision by NYSDEC.

2.1.2 Purpose

This plan provides:

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

2.2 ENGINEERING CONTROLS

2.2.1 Engineering Control Systems

2.2.1.1 Soil Cover

Exposure to remaining contamination in the bedrock underlying the Upper Terrace and Lower Terrace of the Eastern Parcel, and the solidified ISS mass beneath the Lower Terrace and at the northeast side of the Hudson Vista Associates Property, is in general prevented by a soil cover that was placed over them as part of the Remedial Action. This cover system is comprised of a minimum of 2 feet of clean material, meeting the requirements of the NYSDEC's Restricted Residential SCOs. The required soil cover system for the Upper Terrace area consists of the bottom two-foot thick layer of clean fill material over the Upper Terrace's bedrock. Although many areas of bedrock in the Upper Terrace were covered with a layer of clean fill material range in thickness from 2 to 15 feet, only the two-foot interval of clean fill directly above the bedrock in the Upper Terrace is considered to comprise the required soil cover system. In the Lower Terrace area and the northeast side of the Hudson Vista Associates Property, the required soil cover consists of the minimum two-foot thick layer of clean fill material that was placed over the ISS mass in that area. The Excavation Work Plan that appears in Appendix A outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection and maintenance of this cover are provided in the Monitoring Plan included in Section 3 of this SMP. The Monitoring Plan also addresses severe condition inspections in the event that a severe condition, which may affect controls at the Site, occurs.

Excavation through the clean soil cover system or into pre-existing soils at the Site may occur if existing underground utility lines require maintenance or replacement, or for the installation of new utilities. Two utility lines are present on the Eastern Parcel of the Site or along its margin:

- An underground Village of Nyack storm sewer line is present near the southern property line of the Eastern Parcel, terminating at an outfall on the Hudson Vista Associates Property. The approximate path of the pipe and the location of the outfall are shown on Figure 15 (note that the path of the storm sewer line shown is inferred and must be field-verified).

- A Village of Nyack water line is present at the fire hydrant located at the western side of the Eastern Parcel.

As discussed above, the soil cover system needs to be at least two feet thick to satisfy the ROD requirements, or be constructed as a barrier acceptable to NYSDEC and NYSDOH (e.g., asphalt or concrete). The location of the clean soil cover is shown in Figure 15. There is no demarcation barrier between the clean soil cover and the underlying bedrock in the Upper Terrace or the ISS mass on the Lower Terrace and Hudson Vista Associates Property, because the bedrock and ISS mass themselves serve as a demarcation layer.

The soil cover system is a passive Engineering Control and no operation of this control is required. The quality and integrity of the system will be ensured by compliance with the Institutional Controls, as discussed below. The soil cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals.

2.2.1.2 Shoreline and Off-Shore Activities Limitations

Shoreline Area

The solidified soils must be protected from erosion. The Site Restoration Plan requires that a minimum of 2 feet of clean cover material be maintained over the ISS soils. Along the shoreline, the ISS materials must be protected not only from contact by site uses, but from erosion. The riprap (both with and without vegetation) must be maintained as an effective barrier to erosion. Alternative shoreline protection system can be utilized with NYSDEC approval. If any part of the shore erosion protection system fails due to movement or undermining of the riprap, the affected area must be repaired and restored to the conditions specified by the Site Restoration Plan, presented on Drawing 18, Revision 3, from 04/10/2015 (Alternative Hybrid Shoreline Restoration Plan), and Drawing 19, Revision 2, form 04/10/2015 (Alternative Hybrid Shoreline Details).

The placement of additional material may be performed (subject to NYSDEC and U.S. Army Corps of Engineers (USACE) permit approvals), but removal or changes to the shore protection system are not allowed without demonstration that the changes are equally protective of the ISS materials.

Off-shore Area

The area off-shore from the protected shoreline is a mix of sandy and silty native sediments. The sediment has been dredged to elevation -6 to -10 feet in accordance with the NYSDEC-approved Remedial Design for the Site, to remove MGP impacts. Small pockets of MGP-related impacts may be present outside of the dredge zone and at depths where they are not expected to be exposed and create a threat to human health or the environment. MGP impacts are also expected to be present in bedrock beneath the sediments. In order to prevent these materials from being exposed at the sediment-water interface, the sediment surface should not be dredged, excavated, or deeply disturbed unless done under a NYSDEC-approved work plan.

Acceptable activities that can be performed with minimal disturbance of sediments include the deployment and retrieval of boat anchors, and the placement and retrieval of weights for semi-permanent boat moorings, and clearing of debris that may become deposited along the shoreline or river bottom that may pose an obstruction to navigation.

Activities that may not be performed unless specifically governed by a NYSDEC-approved work plan (and other permits, as needed) include sediment dredging or excavation, construction of pilings of any sort, pulling of existing wooden pilings, installation of sub-bottom utility lines, or removal of any buried debris that may become exposed by erosion.

2.2.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

2.2.2.1 Soil Cover

The soil cover system is a permanent control and the quality and integrity of this cover will be inspected annually, in accordance with the SMP.

2.3 INSTITUTIONAL CONTROLS

A series of Institutional Controls is required by the NYSDEC RODs for OU1 and OU2 of the Site to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the Eastern Parcel of the Site to restricted residential use, commercial use and/or industrial use only. Adherence to these Institutional Controls on the Site is required by the Environmental Easement and will be implemented under this Site Management Plan. Responsibilities of the Owner of the Site and the Remedial Party for the Site are outlined in Appendix B of this SMP. These Institutional Controls for the Eastern Parcel are:

- Compliance with the Environmental Easement and this SMP by the Grantor and the Grantor's successors and assigns and successors-in-title;
- All Engineering Controls must be maintained as specified in this SMP;
- All Engineering Controls on the Site must be maintained, inspected, and certified at a frequency and in a manner defined in the SMP;
- Monitoring must be performed as defined in this SMP; and
- Data and information pertinent to Site Management of the Site must be reported at the frequency and in a manner defined in this SMP.

Institutional Controls identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement.

The Eastern Parcel of the Site has a series of Institutional Controls in the form of site restrictions. Adherence to these Institutional Controls is required by the Environmental Easement. Site restrictions that apply to the Eastern Parcel of the Site are:

- The property may only be used for restricted residential use, commercial use and/or industrial use provided that the long-term Engineering and Institutional Controls included in this SMP are employed.

- The property may not be used for a higher level of use, such as unrestricted residential use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC.

- All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with this SMP.

- The use of the groundwater underlying the property is prohibited without treatment rendering it safe for intended use.

- The potential for vapor intrusion must be evaluated for any buildings developed in the area of the Site noted on Figure 12, and any potential impacts that are identified must be monitored or mitigated.

- Vegetable gardens and farming on the property are prohibited.

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

2.3.1 Excavation Work Plan

The Site has been remediated for restricted residential use, commercial use and/or industrial use. Any future intrusive work that will penetrate the soil cover system or ISS mass, or that encounters or disturbs remaining contamination, including any modifications or repairs to the existing soil cover system on the Upper Terrace or Lower Terrace areas of the Site or on the ISS area on the Hudson Vista Associates Property, must be performed in compliance with the Excavation Work Plan (“EWP”) that is attached as Appendix A to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the site. A sample

HASP that is in current compliance with DER-10, and 29 CFR 1910, 29 CFR 1926, and all other applicable Federal, State and local regulations is attached as Appendix E to this SMP. Based on future changes to State and federal health and safety requirements, and specific methods employed by future contractors, the HASP and CAMP will be updated and re-submitted for NYSDEC review with the notification provided in Section A-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be reported to NYSDEC.

The Site owner and associated parties performing the work, are completely responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of excavation de-water, control of runoff from open excavations into remaining contamination, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The Site owner will ensure that site development activities will not interfere with, or otherwise impair or compromise, the Engineering Controls described in this SMP.

2.3.2 Soil Vapor Intrusion Evaluation

The potential for soil vapor intrusion (SVI) on the Site exists because residual NAPL still exists in the bedrock underlying the Site. An SVI mitigation system may be installed by the Site owner as an element of the foundation slab of any new building constructed on the Site without first conducting an NYSDEC-approved soil vapor investigation. This mitigation system will include a vapor barrier and a passive sub-slab depressurization system that is capable of being converted to an active system.

Prior to conducting an SVI investigation or installing an SVI mitigation system, a work plan will be developed and submitted by the Site owner to the NYSDEC and NYSDOH for approval. This work plan will be developed in accordance with the most recent NYSDOH "Guidance for Evaluating Vapor Intrusion in the State of New York". Measures to be employed to mitigate potential vapor intrusion will be evaluated, selected, designed, installed, and maintained based on the SVI evaluation, the NYSDOH guidance, and construction details of the proposed structure.

Preliminary (unvalidated) SVI sampling data will be forwarded to the NYSDEC and NYSDOH by the Site owner for initial review and interpretation. Upon validation, the final data will be transmitted to the agencies, along with a recommendation for follow-up action, such as mitigation. SVI sampling results, evaluations, and follow-up actions will also be summarized in the next Periodic Review Report.

2.4 INSPECTIONS AND NOTIFICATIONS

2.4.1 Inspections

Inspections of all remedial components installed at the Site (including both the Eastern Parcel and the ISS area of the Hudson Vista Associates Property) will be conducted at the frequency specified in the SMP Monitoring Plan schedule. Responsibilities of the Owner and Remedial Party are outlined in Appendix B of this SMP. A comprehensive Site-wide inspection will be conducted annually, regardless of the frequency of the Periodic Review Report for the Site required by this SMP. The inspections will determine and document the following:

- Whether Engineering Controls continue to perform as designed;
- Whether these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria;
- Sampling and analysis of appropriate media during monitoring events;
- Whether Site records are complete and up to date; and
- Changes, or needed changes, to the remedial or monitoring system;

Inspections will be conducted in accordance with the procedures set forth in the Monitoring Plan of this SMP (Section 3). The reporting requirements are outlined in the Periodic Review Reporting section of this plan (Section 5).

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the EC/ICs implemented at the site by a qualified environmental professional as determined by NYSDEC.

2.4.2 Notifications

Notifications will be submitted by the Site Owner to the NYSDEC as needed for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of 6NYCRR Part 375, and/or the NYS Environmental Conservation Law. Any construction or other activities that would be expected to disturb the ISS on the Site or the Hudson Vista Associates Property shall be subject to review and approval by the NYSDEC.

- 7-day advance notice of any proposed ground-intrusive activities pursuant to the Excavation Work Plan.

- Notice within 48-hours of any damage to an Engineering Control that reduces or has the potential to reduce the effectiveness of an Engineering Control and likewise any action to be taken to mitigate the damage or defect.

- Verbal notice by noon of the following day of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of Engineering Controls in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the ECs.

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

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of the Order on Consent, and all approved work plans and reports, including this SMP.

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

2.5 CONTINGENCY PLAN

Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions. An Emergency Response Plan and Contingency Plan are included in Appendix E as part of the HASP. A truck transport route is included in Figure 4**.** Directions and a map of the route to the closest hospital are included in Figure 18.

2.5.1 Emergency Telephone Numbers

In the event of any environmentally related situation or unplanned occurrence requiring assistance, the Site Owner or Owner's representative(s) should contact the appropriate party from the contact list included in Table 10. For emergencies, appropriate emergency response personnel should be contacted. Prompt contact should also be made to O&R. These emergency contact lists must be maintained by the Site Owner in an easily accessible location at the Site.

Table 9: Emergency Contact Numbers

Medical, Fire, and Police:	911
One Call Center:	(800) 272-4480 or 811 (3 day notice required for utility markout)
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362

Table 10: Contact Numbers

Name	Company	Contact Phone
Elizabeth Lukowski	NYSDEC	518-402-9683
Jacqueline Nealon	NYSDOH	518-402-7883
Jeffrey Peifer	ORU	845- 577-3332
Maribeth McCormick	ORU	845-294-1757
Erik H. Askelsen SVP, General Counsel & Corporate Secretary, Athene USA	Athene Annuity & Life Assurance Company of NY	515-342-3160 Chip Smith chip.smith@athene.com
William F. Helmer	Hudson Vista Associates	845-942-1330

* Note: Contact numbers subject to change and should be updated as necessary

2.5.2 Map and Directions to Nearest Health Facility

Site Location: 55 Gedney Street, Nyack, New York, 10960

Nearest Hospital Name: Nyack Hospital

Hospital Location: 160 North Midland Ave, Nyack, New York, 10960

Hospital Telephone: (845) 348-2000

Directions to the Hospital:

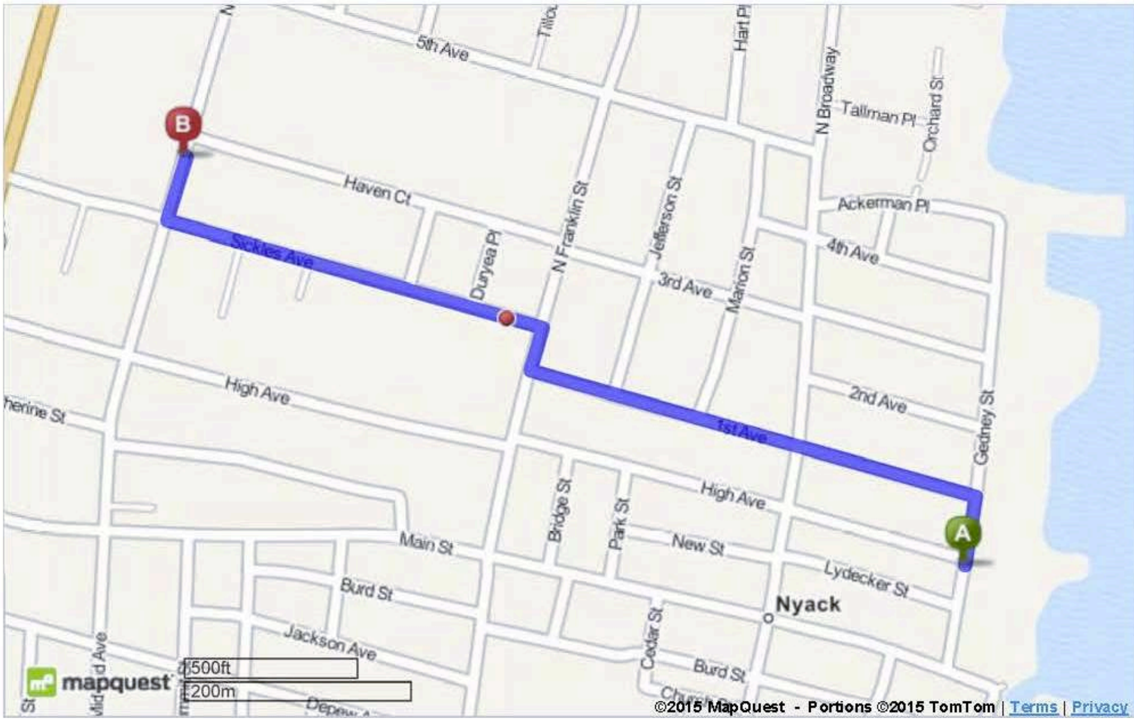
1. Start by going north on Gedney Street towards 1st Ave
2. Turn left onto 1st Ave
3. Turn right onto N Franklin St
4. Take the 1st left onto Sickles Ave
5. Take the 3rd left onto N Midland Ave. Nyack Hospital will be on the left.

Total Distance: 0.7 miles

Total Estimated Time: 3 minutes

Figure 18

Map Showing Route from the Site to the Hospital:



2.5.3 Response Procedures

As appropriate, the fire department and other appropriate emergency response group will be notified immediately by telephone of the emergency.

3.0 SITE MONITORING PLAN

3.1 INTRODUCTION

3.1.1 General

This Monitoring Plan describes the measures for evaluating the performance and effectiveness of the remedy to reduce or mitigate contamination at the Site, the soil cover system over the Upper Terrace and Lower Terrace areas of the Site, and all affected site media identified below. Monitoring of other Engineering Controls is described in Chapter 4, Operation, Monitoring and Maintenance Plan. This Monitoring Plan may only be revised with the approval of NYSDEC.

3.1.2 Purpose and Schedule

This Monitoring Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards;
- Assessing achievement of the remedial performance criteria;
- Monitoring the steps taken to protect the soil cover, which protects the solidified soil from frost damage and wave erosion, and to isolate it from environment;
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring activities.

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

- Sampling locations, protocol, and frequency;
- Information on all designed monitoring systems (e.g., well logs);
- Analytical sampling program requirements;

- Reporting requirements;
- Quality Assurance/Quality Control (QA/QC) requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Annual monitoring of the performance of the remedy and overall reduction in contamination on-site will be conducted for the first five years. The frequency thereafter will be determined by NYSDEC. Trends in contaminant levels in groundwater in the affected areas will be evaluated to determine if the remedy continues to be effective in achieving remedial goals. Monitoring programs are summarized in Table 11 and outlined in detail in Sections 3.2 and 3.3 below.

Table 11: Monitoring/Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
Groundwater Monitoring	Annually	Groundwater	BTEX, PAHs
Site-wide Inspections	Annually	NA	NA

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC and NYSDOH

3.2 SOIL COVER MONITORING

Annual inspections will be conducted to ensure that the soil cover over Upper Terrace and the ISS mass in the Lower Terrace area of the Site and the ISS area on the Hudson Vista Associates Property continues to be effective at preventing direct exposure to residual contamination at the Site. Inspections of the soil cover will also be conducted whenever a severe condition, such as major erosion or flooding occurs at the Site. Inspection reports and records of any repairs made to the soil cover will be included in the Periodic Review Reports, as described in Section **5**.

3.3 MEDIA MONITORING PROGRAM

The presence of NAPL in bedrock (both LNAPL and DNAPL) at the Site makes it technically impracticable to implement a groundwater remedy that will achieve groundwater standards. The focus of the remedial actions for OU1 and OU2 of the Site were on the removal or immobilization of NAPL in soils and bedrock. These actions were expected to reduce groundwater impacts from impacted soils; however, the presence of residual NAPL in bedrock is expected to continue to impact groundwater. The presence of residual NAPL in bedrock will influence groundwater conditions at the Site, with no appreciable attenuation in the near future. The object of the groundwater monitoring program is therefore to monitor the aerial extent of groundwater impact to verify that it does not pose a risk to potential neighboring properties, and to obtain long-term monitoring data to assess any changes in the concentration of contaminants of interest in the dissolved phase in the groundwater. The monitoring plan will also assess whether mobile NAPL is present, and will incorporate a NAPL removal program where necessary.

3.3.1 Groundwater Monitoring

Groundwater monitoring will be performed on an annual basis to assess the performance of the remedy.

A network of new and existing groundwater monitoring wells will be used to monitor both up-gradient, side-gradient, and down-gradient groundwater conditions at the Site. The monitoring wells that will be periodically sampled after the completion of the Remedial Action construction activities are depicted on Figure 11 of this SMP, and are listed in Table 12. Following the NYSDEC's provisions in the ROD for OU1, groundwater samples will be collected from these monitoring wells annually for five years. The first sampling round will be performed six months after Remedial Action construction activities are deemed properly completed by NYSDEC. Approximately five years after completion of the remedy, a recommendation will be made to the NYSDEC to discontinue sampling at those monitoring wells where the analytical results of three consecutive rounds of sampling confirm that the samples from any such wells do not contain MGP-related contaminants at concentrations that exceed New York State AWQS for Class GA Water. The NYSDEC will evaluate recommendation and the groundwater quality data to determine the scope and frequency of any additional future groundwater monitoring requirements.

A network consisting of five existing wells and two new wells (MW-46 and MW-47) will be used for the groundwater monitoring program. The wells proposed for monitoring are as follows:

Well	Location	Purpose
MW-33D	Southern property line between Upper and Lower Terrace	Monitor groundwater flow around the OU1 ISS mass to the south
MW-41	Upper Terrace	Monitor on-site groundwater and residual NAPL conditions in bedrock
MW-43	Lower Terrace	Monitoring groundwater in overburden between bedrock and the hanging OU1 ISS mass
MW-44	Upper Terrace	Monitor on-site groundwater and residual NAPL conditions in bedrock
MW-45	Base of Upper Terrace adjacent to OU1 ISS mass	Monitor potential on-site groundwater mounding at upgradient side of ISS mass
MW-46	Base of Upper Terrace at north side of site	Monitor groundwater flow around the OU1 and OU2 ISS mass
MW-47	West side of Upper Terrace	Monitor upgradient groundwater conditions

Note that all wells except MW-43 are screened at the water table.

All on-site or off-site wells that remain from the RI program that are not part of this monitoring program will be abandoned according to standard NYSDEC-approved protocols.

A representative cross-section showing the relationship between the water table, the monitoring wells, and the subsurface features is provided as Figure 6. Note that as established during the RI, the water table is located within bedrock beneath the Upper Terrace at the Site. Prior to ISS of the Lower Terrace, groundwater moved from bedrock to the overburden soils. This pathway has been blocked by the OU1 ISS mass, therefore it is presumed that groundwater flow now occurs around the outside of the ISS mass and through bedrock beneath the mass.

Construction logs for the existing monitoring wells proposed for use are included in Appendix G.

If Site redevelopment occurs, the Site owner must either protect monitoring wells for continued use, or abandon and replace them with new wells at locations which allow for continued groundwater monitoring at locations approved by the NYSDEC.

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

Deliverables for the groundwater monitoring program are specified below.

3.3.1.1 Sampling Protocol

All monitoring well sampling activities will be recorded in a field book and a groundwater-sampling log presented in Appendix H. Other observations (e.g., well integrity, etc.) will be noted on the well sampling log. The well sampling log will serve as the inspection form for the groundwater monitoring well network.

For each sampling event, a complete round of depth-to-water measurements will be taken for all site wells. All site wells will continue to be gauged for the presence of both LNAPL and DNAPL.

Monitoring wells will be purged and sampled using low flow groundwater sampling procedures and in accordance with the Standard Operating Procedures in Appendix M.

Groundwater samples will be analyzed for benzene, toluene, ethyl benzene and xylenes (BTEX) by the U.S. Environmental Protection Agency (EPA) method 8260C, and polycyclic aromatic hydrocarbons (PAH) by EPA method 8270D as potential contaminants of concern identified in ROD for OU1 (Elements of Selected Remedy #9, page 20).

Laboratory analyses performed will be consistent with previous sampling events, and will the follow requirements of DER-10. A trip blank sample will be analyzed for quality control purposes. The duplicate sample will be completed on a frequency of 1 per sampling event or 1 per 20 samples, whichever is more frequent. An approved ELAP laboratory will perform the analyses.

If measureable (i.e., free product) NAPL is found to be present in any of the wells, the annual groundwater sampling event will be delayed until the NAPL has been purged from the well and the well allowed to stabilize. Groundwater sampling will not be performed in any well where measurable NAPL is present. The following protocol will be implemented prior to groundwater sampling:

- The type, depth, and thickness of the NAPL will be measured.
- The NAPL will be removed by bailing, pumping, or any other method until a measureable quantity is no longer present. The volume of NAPL recovered will be measured.
- The wells will be re-checked one week later. If measurable NAPL is still present, the NAPL will be removed, and the wells re-checked after another one-week waiting period.
- Once all wells are found to not contain a measureable amount of NAPL, the full groundwater monitoring event will be conducted.
- NAPL must never be allowed to overtop the sump or otherwise build up in a well such that it could be released into the formation/overburden back through the screen.

Groundwater sampling will be performed following the Field Sampling Plan provided in Appendix I.

3.3.1.2 Monitoring Well Repairs, Replacement, and Decommissioning

If biofouling or silt accumulation occurs in the monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced (as per the Monitoring Plan), if an event renders the wells unusable.

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

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent periodic report. Well decommissioning without replacement will be done only with the prior approval of NYSDEC. Well abandonment will be performed in accordance with NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.3.2 Soil Vapor Intrusion Monitoring

Based on the current Site conditions (no buildings on site, no potential receptors occupying the site), soil vapor contamination is not a concern. Should the Site be developed in the future, a Soil Vapor Intrusion Monitoring Plan, including sampling and reporting requirements, will be developed for the Site by the Site owner. The Soil Vapor Intrusion Monitoring Plan will be subject to NYSDEC review and approval.

3.3.3 Soil Cover Monitoring

Annual inspections will be conducted to ensure that the soil cover continues to be effective at preventing direct exposure to residual contamination at the Site and above the ISS areas on Site and the Hudson Vista Associates Property. Inspections of the soil cover system will also be conducted whenever a severe condition, such as major erosion or flooding occurs at the Site. Inspection reports and records of any repairs made to the soil cover will be included in the Periodic Review Reports, as described in Section 5.

3.4 SITE-WIDE INSPECTION

Site-wide inspections will be performed on a regular schedule at a minimum of once a year. Site-wide inspections will also be performed after all severe weather conditions that may affect Engineering Controls or monitoring devices. During these inspections, an inspection form will be completed (Appendix K). The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- Soil cover, including riprap, which protects the ISS solidified soil from frost damage, wave erosion and isolation from environment;
- Soil or other cover over ISS solidified soil to prevent exposure to human or ecological receptors;
- The condition of the soil, riprap, and plantings (or other engineered covers) that protect the outer-edge of the ISS area from erosion and exposure to human or ecological receptors;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

3.5 MONITORING QUALITY ASSURANCE/QUALITY CONTROL

All sampling and analyses will be performed in accordance with the requirements of the Quality Assurance Project Plan (QAPP) prepared for the site (Appendix J). Main Components of the QAPP include:

- QA/QC Objectives for Data Measurement;
- Sampling Program:

    - Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.

    - Sample holding times will be in accordance with the NYSDEC ASP requirements.

    - Field QC samples (e.g., trip blanks, coded field duplicates, and matrix spike/matrix spike duplicates) will be collected as necessary.

- Sample Tracking and Custody;

- Calibration Procedures:

    - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.

    - The laboratory will follow all calibration procedures and schedules as specified in EPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.

- Analytical Procedures;

- Preparation of a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method;

- Internal QC and Checks;

- QA Performance and System Audits;

- Preventative Maintenance Procedures and Schedules; and

- Corrective Action Measures.

3.6 MONITORING REPORTING REQUIREMENTS

Forms and any other information generated during regular monitoring events and inspections will be kept on file by O&R. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be (1) subject to approval by

NYSDEC and (2) submitted at the time of the Periodic Review Report, as specified in the Reporting Plan of this SMP.

All monitoring results will be reported to NYSDEC on a periodic basis in the Periodic Review Report. A letter report will also be prepared, subsequent to each sampling event. The report (or letter) will include, at a minimum:

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

Data will be reported in hard copy or digital format as determined by NYSDEC. A summary of the monitoring program deliverables are summarized in Table 12 below.

Table 12: Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Site-Wide Inspection	Annually
Groundwater Monitoring Program	Annually

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

4.0 OPERATION AND MAINTENANCE PLAN

4.1 INTRODUCTION

The site remedy does not presently rely on any mechanical systems, such as sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP. However, in the event that SVI mitigation is deemed necessary by the NYSDEC and/or NYSDOH for any new buildings constructed on the Site and the NYSDEC and/or NYSDOH require the installation of a sub-slab depressurization (or other SVI mitigation system) for any such new building, this SMP will be revised with NYSDEC approval to include operation and maintenance procedures for such system.

5.0 INSPECTIONS, REPORTING AND CERTIFICATIONS

5.1 SITE INSPECTIONS

5.1.1 Inspection Frequency

All inspections will be conducted at the frequency specified in the schedules provided in Section 3 Monitoring Plan of this SMP. At a minimum, a site-wide inspection of the Eastern Parcel and of the ISS area of the Hudson Vista Associates Property will be conducted annually.

5.1.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on the appropriate forms for their respective system which are contained in Appendix H. Additionally, a general site-wide inspection form will be completed during the site-wide inspection (see Appendix K). These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including all media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format in the Periodic Review Report.

5.1.3 Evaluation of Records and Reporting

The results of the inspection and site monitoring data will be evaluated as part of the EC/IC certification to confirm that the:

- EC/ICs are in place, are performing properly, and remain effective;
- The Monitoring Plan is being implemented;
- The site remedy continues to be protective of public health and the environment and is performing as designed in the RAWP and FER.

5.2 CERTIFICATION OF ENGINEERING AND INSTITUTIONAL CONTROLS

After the last inspection of the reporting period, a qualified environmental professional or Professional Engineer licensed to practice in New York State will prepare the following certification:

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

- The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;
- The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;
- Access to the site will continue to be provided to the NYSDEC to evaluate the remedy, including access to evaluate the continued maintenance of this control;
- If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;
- Use of the site is compliant with the environmental easement;
- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and
- The information presented in this report is accurate and complete.
- I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Designated Site Representative (for Owner's certification to RP) or Remedial Party or Remedial Party's representative (for RP's certification to DEC [I have been

authorized and designated by all site owners to sign this certification] for the site.

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

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

- The institutional control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;
- Access to the site will continue to be provided to the NYSDEC to evaluate the remedy, including access to evaluate the continued maintenance of this control;
- If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;
- Use of the site is compliant with the environmental easement.
- The information presented in this report is accurate and complete.
- I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Designated Site Representative (for Owner's certification to RP) or Remedial Party or Remedial Party's Designated Site Representative (for RP's certification to DEC)] [and I have been authorized and designated by all site owners to sign this certification] for the site.

5.3 PERIODIC REVIEW REPORT

A Periodic Review Report will be submitted to the NYSDEC every year, beginning sixteen months after the Satisfactory Completion Letter for the Site is issued by the NYSDEC. In the event that the Site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the Site described in Appendix C (Metes and Bounds). The report will be prepared in accordance with NYSDEC DER-10 and submitted within 45 days of the end of each certification period. Media sampling results will also incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site;
- Results of the required annual site inspections and severe condition inspections, if applicable;
- All applicable inspection forms and other records generated for the site during the reporting period in electronic format;
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, which includes a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends;
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format;
- A site evaluation, which includes the following:
    - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;
    - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring Plan for the media being monitored;
    - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; and
    - The overall performance and effectiveness of the remedy.

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

5.4 CORRECTIVE MEASURES PLAN

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

6.0 REFERENCES

- AECOM, 2008. Remediation of Lower Terrace Soils and Site Restoration: Completion Report. Nyack Manufactured Gas Plant Site, Nyack, New York. December, 2008.
- AECOM, 2009. Remedial Investigation (RI) Report, Operable Unit 2, Former Manufactured Gas Plant Site, Nyack, New York. April, 2009.
- Arcadis, 2010. Feasibility Study Report, Nyack Former MGP Site, Operable Unit 2, Nyack, New York, Site No. 3-44-046. August, 2010.
- GEI, 2012. OU-2 Pre-Design Investigation Report, Nyack Manufactured Gas Plant Site, Nyack, New York, NYSDEC Site #3-44-046, dated January 28, 2012.
- GEI, 2013. Operable Unit No. 2. Remedial Design Report – 100% Design Submittal. Nyack Manufactured Gas Plant Site, Nyack, New York. October, 2013.
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- The RETEC Group, Inc., 2002. Remedial Investigation Report, Former Manufactured Gas Plant Site, Nyack, New York. Prepared for Orange and Rockland Utilities, January 2002.
- The RETEC Group, Inc., 2003. Supplemental Sediment RI. Letter report prepared for Orange and Rockland Utilities, April 8, 2003.
- The RETEC Group, Inc., 2005. Work Plan for Bedrock In Situ Chemical Oxidation, Nyack Manufactured Gas Plant Site, Nyack, NY, Prepared for Orange & Rockland Utilities, Spring Valley, NY. Prepared by The RETEC Group, Inc., Ithaca, NY. August 22, 2005.

- The RETEC Group, Inc., 2006. Remedial Design Package – Excavation of Upper Terrace and In situ Solidification of Hudson Vista Soils, Nyack MGP Site, Nyack, NY, Prepared for Orange and Rockland Utilities, Spring Valley, NY. Prepared by The RETEC Group, Inc., Ithaca, NY. January 4, 2006.

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- RETEC, 2006a. Upper Terrace In Situ Chemical Oxidation: Completion Report. Nyack Manufactured Gas Plant Site, Nyack, New York. November, 2006.

- RETEC, 2006b. Hudson Vista Lower Terrace In Situ Solidification and Presidential Upper Terrace Excavation: Completion Report. Nyack Manufactured Gas Plant Site, Nyack, New York. September, 2006.

TABLES

Table 1
Remedial Investigation Soil Contamination Summary
Nyack Former Manufactured Gas Plant Site
Combined OU1 and OU2 Remedial Investigation Results Performed from September 1999 through October 2008

Surface and Subsurface SOIL	Contaminants of Potential Concern	Concentration Range Detected (ppm)	SCO (ppm)	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND-270	4.8	7 of 110
	Toluene	ND-780	100.0	3 of 110
	Ethylbenzene	ND-1,000	41.0	10 of 110
	Xylene	ND-1,000	100.0	4 of 110
Semivolatile Organic Compounds (SVOCs): Individual PAHs	Naphthalene	ND-8200	100	24 of 110
	Acenaphthylene	ND-2500	100	8 of 110
	Acenaphthene	ND-1400	100	14 of 110
	Fluorene	ND-710	100	11 of 110
	Phenanthrene	ND-2600	100	32 of 110
	Anthracene	ND-760	100	12 of 110
	Fluoranthene	ND-820	100	16 of 110
	Pyrene	ND-1600	100	25 of 110
	Benzo(a)anthracene	ND-450	1	76 of 110
	Chrysene	ND-410	3.9	63 of 110
	Benzo(b)fluoranthene	ND-290	1	70 of 110
	Benzo(k)fluoranthene	ND-240	3.9	53 of 110
	Benzo(a)pyrene	ND-430	1	76 of 110
	Indeno(1,2,3-cd)pyrene	ND-150	0.5	74 of 110
	Dibenzo(a,h)anthracene	ND-58	0.33	67 of 110
	Benzo(g,h,i)perylene	ND-190	100	6 of 110
Inorganic Compounds	Cyanide	ND-56.4	27	2 of 110

SCO Soil Cleanup Objective for Restricted Residential criteria

Table 2
Remedial Investigation Groundwater Contamination Summary
Nyack Former Manufactured Gas Plant Site
Combined OU1 and OU2 Remedial Investigation Performed from
September 1999 through October 2008

Detected Constituents	Concentration Range Detected (ppb)a	SCG (ppb)b	Frequency Exceeding SCG
Benzene	ND-47,000	1	26 of 39
Toluene	ND-4,500	5	10 of 39
Ethylbenzene	ND-62,000	5	18 of 39
Xylene	ND-86,000	5	21 of 39

Notes:

a - ppb: parts per billion, which is equivalent to micrograms per liter, ug/L, in water.

b - SCG: Standard Criteria or Guidance - Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface Water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).

Table 3
Remedial Investigation Soil Gas Contamination Summary
Nyack Former Manufactured Gas Plant Site
Based on OU1 Remedial Investigation Performed through September 1999

SOIL GAS	Contaminants of Concern	Concentration Range Detected (µg/m3)a	SCGb (µg/m3)a	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND - 61	NA	NA
	Toluene	4 - 68	NA	NA
	Ethylbenzene	ND - 23	NA	NA
	Xylene	13 - 130	NA	NA

Table 4
Remedial Investigation Sediment Contamination Summary Prior to Remediation
Nyack Former Manufactured Gas Plant Site
Combined OU1 and OU2 Remedial Investigation Performed from September 1999 through October 2008

Detected Constituents	Concentration Range Detected (ppm)[a]	ERL[b] (ppm)	Frequency Exceeding ERL[b]	ERM[c] (ppm)	Frequency Exceeding ERM[c]
2-Methylnaphthalene	ND-180	0.07	50 out of 104	0.67	6 out of 104
Acenaphthene	ND-170	0.016	87 out of 104	0.5	31 out of 104
Acenaphthylene	ND-9.2	0.044	79 out of 104	0.64	41 out of 104
Anthracene	ND-44	0.0853	81 out of 104	1.1	34 out of 104
Benzo(a)anthracene	ND-41	0.261	80 out of 104	1.6	61 out of 104
Benzo(a)pyrene	ND-34	0.43	78 out of 104	1.6	63 out of 104
Chrysene	ND-38	0.384	78 out of 104	2.8	43 out of 104
Dibenz(a,h)anthracene	ND-3.2	0.0634	76 out of 104	0.26	61 out of 104
Fluoranthene	ND-78	0.6	79 out of 104	5.1	41 out of 104
Fluorene	ND-80	0.019	84 out of 104	0.54	21 out of 104
Naphthalene	ND-160	0.16	37 out of 104	2.1	5 out of 104
Phenanthrene	ND-230	0.24	77 out of 104	1.5	53 out of 104
Pyrene	ND-120	0.665	80 out of 104	2.6	67 out of 104
Polycyclic Aromatic Hydrocarbons (PAHs) Total	Undetected- 1,238	4	79 out of 104	45	33 out of 104

Notes:

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in sediment.

b - ERL: Effects Range-Low - NYSDEC Technical Guidance for Screening Contaminated Sediments.

c - ERM: Effects Range-Medium - NYSDEC Technical Guidance for Screening Contaminated Sediments.

Table 5
Soil Cleanup, Soil Reuse, Soil Import Criteria - Restricted Residential
Nyack Former Manufactured Gas Plant Site
Nyack, New York

Contaminant	CAS Number	Protection of Public Health
		Restricted-Residential
Semivolatiles		
Acenaphthene	83-32-9	100[a]
Acenapthylene	208-96-8	100[a]
Anthracene	120-12-7	100[a]
Benz(a)anthracene	56-55-3	1[c]
Benzo(a)pyrene	50-32-8	1[c]
Benzo(b)fluoranthene	205-99-2	1[c]
Benzo(g,h,i)perylene	191-24-2	100[a]
Benzo(k)fluoranthene	207-08-9	3.9
Chrysene	218-01-9	3.9
Dibenz(a,h)anthracene	53-70-3	0.33[b]
Fluoranthene	206-44-0	100[a]
Fluorene	86-73-7	100[a]
Indeno(1,2,3-cd)pyrene	193-39-5	0.5[c]
Naphthalene	91-20-3	100[a]
Phenanthrene	85-01-8	100[a]
Pyrene	129-00-0	100[a]
Volatiles		
Benzene	71-43-2	4.8
Ethylbenzene	100-41-4	41
Toluene	108-88-3	100[a]
Xylene (mixed)	1330-20-7	100[a]

Notes:

All soil cleanup objectives (SCOs) are in parts per million (ppm).

[a] The SCOs for residential, restricted-residential and ecological resources use were capped at a maximum value of 100 ppm. See TSD section 9.3.

[b] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the SCO value.

[c] For constituents where the calculated SCO was lower than the rural soil background concentration as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 2 SCO value for this use of the site.

Table 6
Summary of Remaining Soil Contamination Above Restricted Residential Levels
Nyack Former Manufactured Gas Plant Site
Nyack, New York

Sample ID / Date Sampled	NYSDEC SCOs, ppm	SB2(8.5-10.0) 9/28/1999		SB9(14.0-15.5) 10/7/1999		SB22(7.0-7.3) 5/16/2001		SB28(7-10) 5/16/2001		SB55(8-9.3) 6/4/2008	
PAH Compunds (ug/Kg)											
Naphthalene	100	0.41	U	0.009	J	0.36	U	0.06	J	0.29	J
2-Methylnapthalene	#N/A	0.41	U	0.38	U	0.27	J	0.37	U	0.15	J
Acenaphthylene	100	0.092	J	0.007	J	0.53		0.15	J	0.055	J
Acenaphthene	100	0.44		0.017	J	0.87		0.37	U	0.11	J
Fluorene	100	0.33	J	0.38	U	3.8		0.048	J	0.069	J
Phenanthrene	100	1.2		0.041	J	3.2		0.23	J	0.24	J
Anthracene	100	0.38	J	0.012	J	3		0.11	J	0.081	J
Fluoranthene	100	0.54		0.038	J	0.79		0.73		0.22	J
Pyrene	100	0.98		0.065	J	1.7		0.063	J	0.26	J
Benzo(a)anthracene	1	0.37	J	0.018	J	3.9		0.13	J	0.16	J
Chrysene	3.9	0.36	J	0.017	J	0.4	J	0.1	J	0.14	J
Benzo(b)fluoranthene	1	0.13	J	0.007	J	6.5		0.37	U	0.17	J
Benzo(k)fluoranthene	3.9	0.16	J	0.012	J	0.33	J	0.37	U	0.054	J
Benzo(a)pyrene	1	0.24	J	0.015	J	1.1		0.48		0.17	J
Indeno(1,2,3-cd)pyrene	0.5	0.084	J	0.008	J	0.076	J	0.37	U	0.096	J
Dibenzo(a,h)anthracene	0.33	0.036	J	0.38	U	5.3		0.37	U	0.027	U
Benzo(g,h,i)perylene	100	0.11	J	0.021	U	7		0.29	J	0.13	J
Total PAHs		5.452		0.266		38.766		2.391		2.395	

Notes:
U = The material was analyzed for, but not detected. The associated numerical vanlue is the sample quantitation limit
J = The associated numerical value is an estimated quantity.
Highlighted values are in exceedance of the NYSDEC Restricted Residential Soil Cleanup Objective.

Table 7
Emergency Contact Numbers and Hospital Directions
Nyack Former Manufactured Gas Plant Site
Nyack, New York

Important Phone Numbers		Directions to: Nyack Hospital 160 North Midland Ave Nyack, New York 10960
Medical, Fire, and Police	911	Start by going north on Gedney Street towards 1st Ave. Turn left onto 1st Ave. Turn right onto N Franklin St. Take the 1st left onto Sickles Ave. Take the 3rd left onto N Midland Ave. Nyack Hospital will be on the left
Occupational Health Clinic Land, Sea & Air Medical Review Specialists	(631) 225-3060 (Directions can be found in HASP)	Refer to Hospital Route Map On Figure 18 of the SMP.
Nyack Hospital	General (845) 348-2000	
NYSDEC Spill Hotline	(518) 457-7362	
Chemtrec	1-800-424-9300	Poison Control Center 1-800-222-1222
NYSDEC Site Manager	Elizabeth Lukowski	(518) 402-9683 - office
NYSDOH Site Manager	Jacqueline Nealon	(518) 402-7883 - office
Orange and Rockland Site Investigation and Remediation	Jeffrey Peifer	(845) 222-3570 - office
	Maribeth McCormick	(845) 783-5534 - office

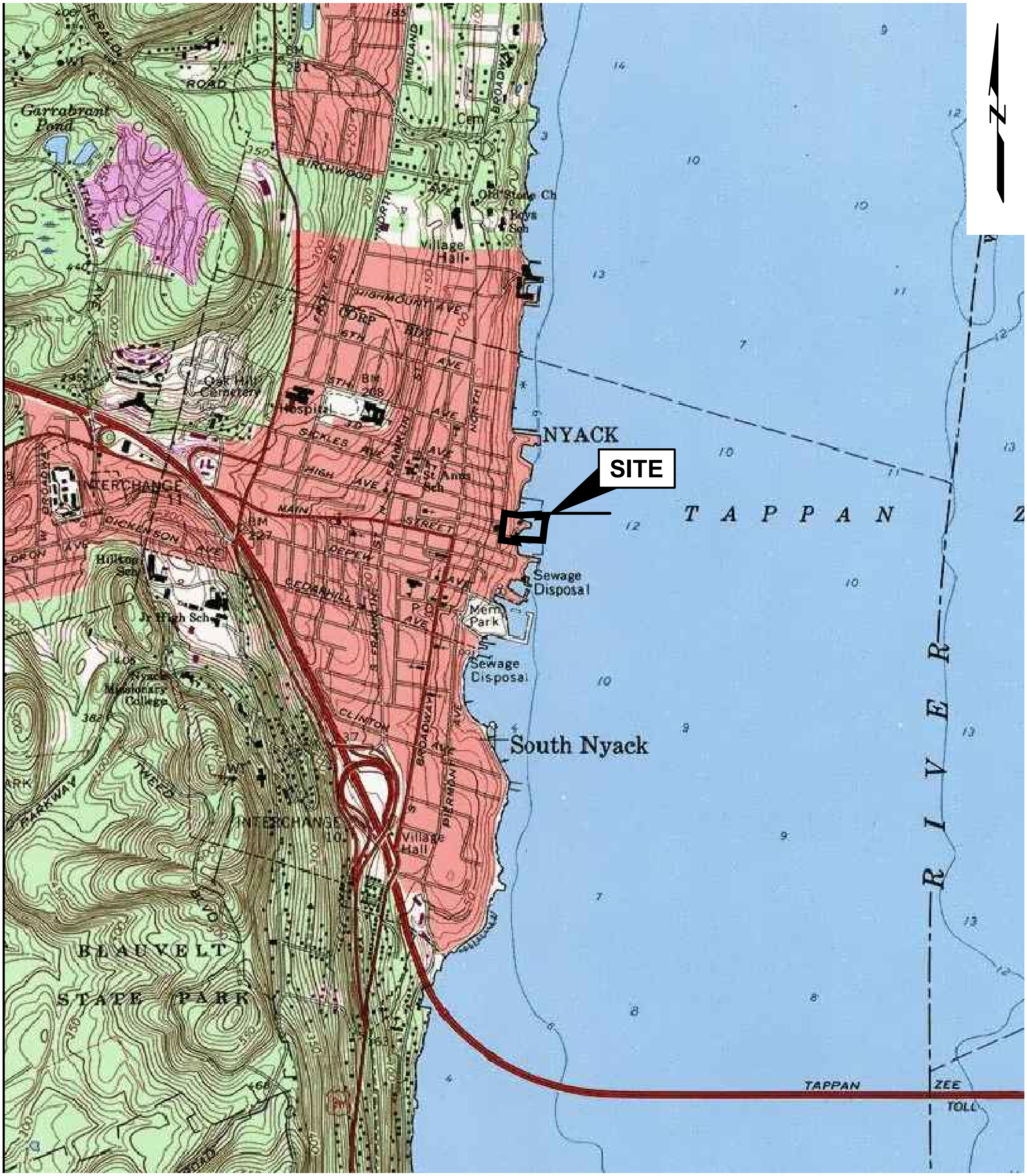
Table 8
Previous and Proposed Monitoring Well Construction Summary, and Laboratory Analyses
Nyack Former Manufactured Gas Plant Site
Nyack, New York

Well Construction Summary												Laboratory Analyses		
Designation	**Rationale / Zone Monitored**	**Installation Date**	**Ground Surface Elevation (Feet NAVD88)**	**Top of PVC Riser Elevation (Feet NAVD88)**	**Northing (NAD83)**	**Easting (NAD83)**	**Latitude**	**Longitude**	**Screened Interval (Elevation NAVD88)**	**Depth to Water (Feet)**	**Water Elevation (Feet NAVD88)**	**Sample Depth**	**BTEX**	**PAHs**
Existing Monitoring Wells														
MW33D	water table along south side of site, cross-gradient to flow	8/31/2004	25.33	25.16	822865.99	653222.97	41.090936	-73.91552	-0.16 to 15.16	9.61	15.55	Center of saturated screened interval	X	X
MW41	bedrock water table in Upper Terrace	5/19/2008	34.07	33.79	823022.67	653236.45	41.091366	-73.91547	-0.71 to 14.29	23.04	10.75	Center of saturated screened interval	X	X
MW43	downgradient groundwater conditions in soil between ISS and bedrock	5/22/2008	6.16	5.78	823061.51	653448.31	41.091469	-73.9147	-19.22 to -14.22	4.90	0.88	Center of saturated screened interval	X	X
MW44	bedrock water table in Upper Terrace	5/20/2008	33.84	33.55	823072.61	653244.4	41.091503	-73.91544	1.55 to 16.55	25.50	8.05	Center of saturated screened interval	X	X
MW45	water table in bedrock at upper to Lower Terrace transition	5/23/2008	14.15	13.84	822983.34	653307.75	41.091257	-73.91521	-13.66 to 1.34	4.95	8.89	Center of saturated screened interval	X	X
Proposed Monitoring Wells														
MW46	water table along north side of site, cross-gradient to flow	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Center of saturated screened interval	X	X
MW47	up-gradient sampling and water level	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Center of saturated screened interval	X	X
Existing Monitoring Wells to be Abandoned														
MW-1D	up-gradient western parcel - not needed for monitoring				822981.43	653009.59	41.091257	-73.91629				NA	NA	NA
Surface Water Gauging Point														
SG-1	water level monitoring point	TBD	NA	NA	TBD	TBD	TBD	TBD	NA	TBD	TBD	NA	NA	NA

TBD - To be determined
NA = Not Applicable
Horizontal Coordinates are New York State Plane, Central Zone, NAD83 North American Datum 1983 (NAD83), and latitude and longitude.
Vertical Coordinates are North American Datum 1988 (NAVD88).

NOTES: Staff gauge location will be installed and used for river water level monitoring at the time of groundwater monitoring.
The groundwater data included in this table may not be reflective of future groundwater conditions.

FIGURES



SOURCE:
U.S.G.S. TOPOGRAPHIC MAP CREATED WITH TOPO! ® ©2004
NATIONAL GEOGRAPHIC (www.nationalgeographic.com/topo)

0 2000' 4000'
SCALE: 1" = 2000'

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	SITE LOCATION MAP
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 1

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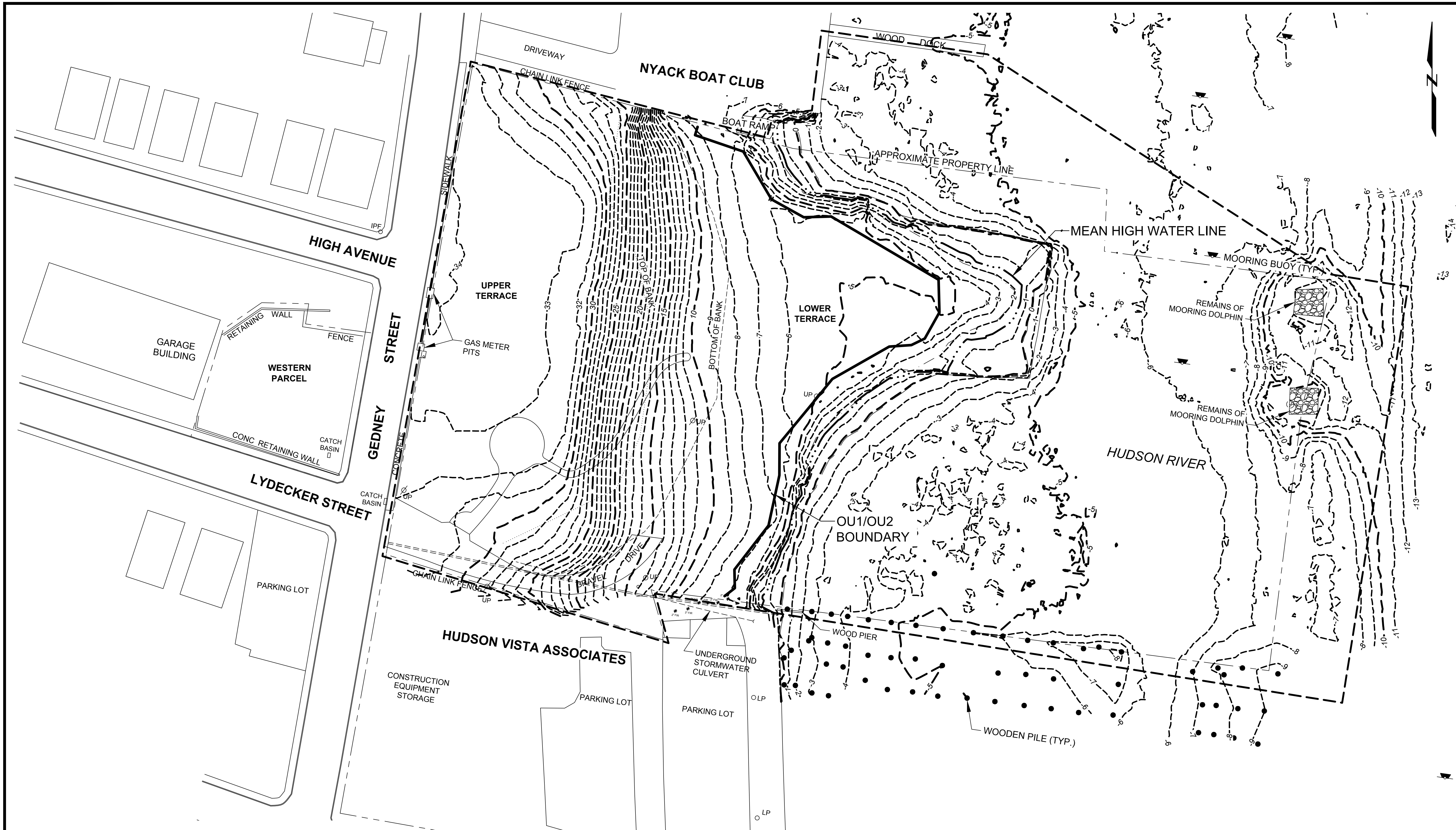

LEGEND:

- PROJECT LIMIT
- 5-FOOT CONTOUR - MAJOR
- 1-FOOT CONTOUR - MINOR

NOTES:

1. TOPOGRAPHY BASED ON SURVEY COMPLETED 9/10/2012 BY THEW SURVEYORS.

0 60' 120'

SCALE: 1" = 60'

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	SITE PLAN - TOPOGRAPHY
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 2

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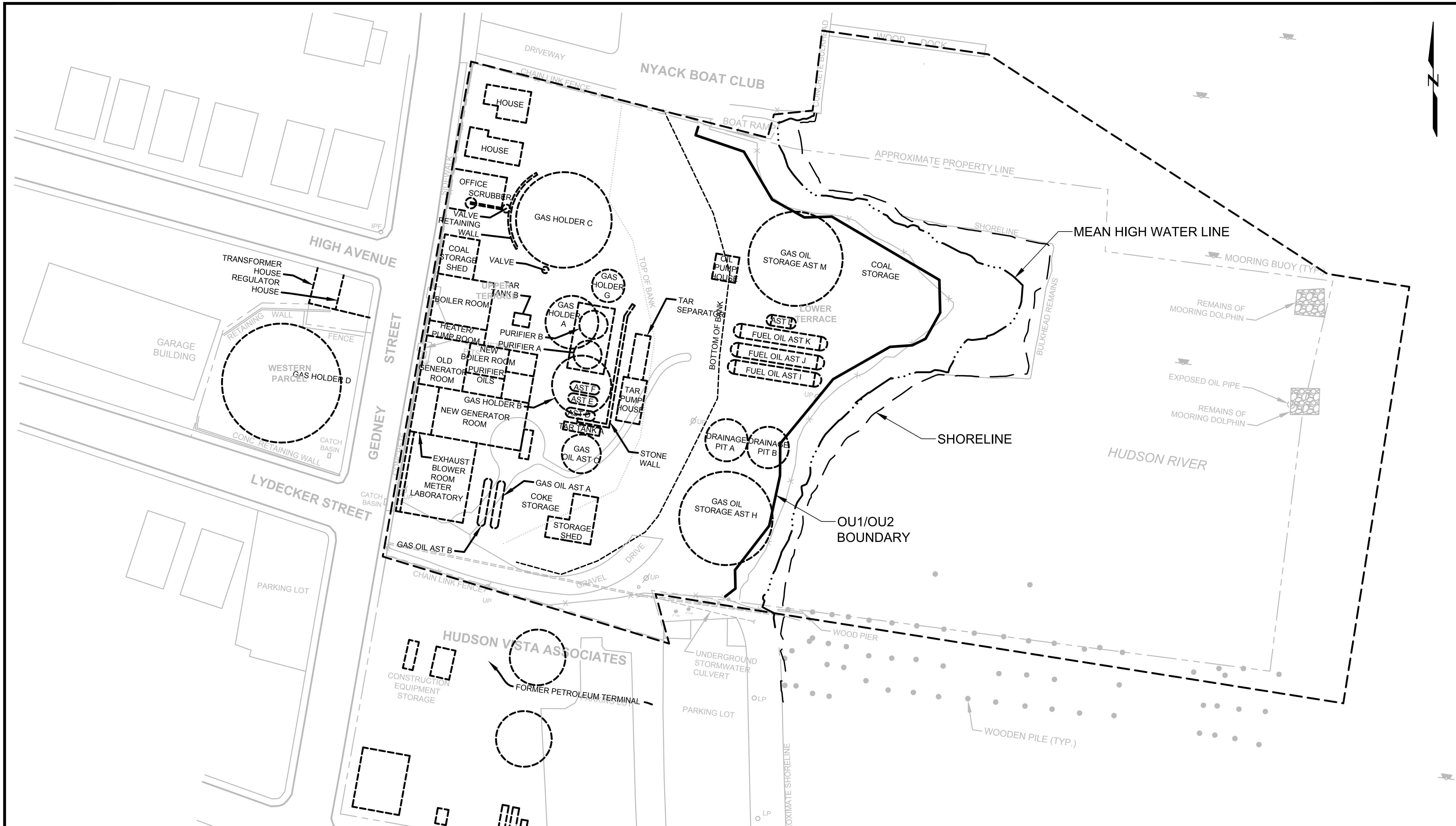

LEGEND:

PROJECT LIMIT

FORMER MGP FEATURE

SHORELINE

0 60' 120'

SCALE: 1" = 60'

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	FORMER MGP FEATURES
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 3

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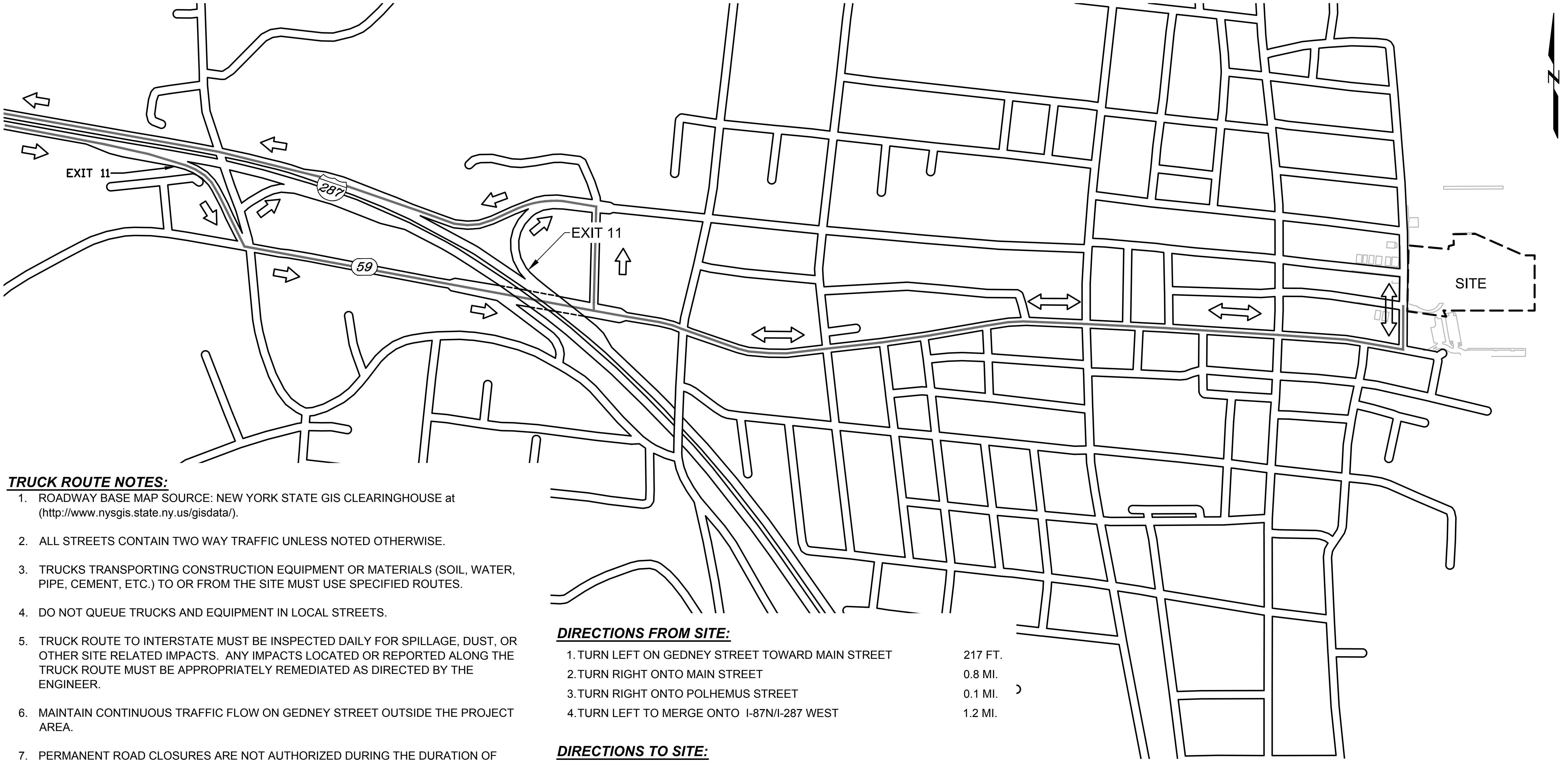

TRUCK ROUTE NOTES:

1. ROADWAY BASE MAP SOURCE: NEW YORK STATE GIS CLEARINGHOUSE at (http://www.nysgis.state.ny.us/gisdata/).
2. ALL STREETS CONTAIN TWO WAY TRAFFIC UNLESS NOTED OTHERWISE.
3. TRUCKS TRANSPORTING CONSTRUCTION EQUIPMENT OR MATERIALS (SOIL, WATER, PIPE, CEMENT, ETC.) TO OR FROM THE SITE MUST USE SPECIFIED ROUTES.
4. DO NOT QUEUE TRUCKS AND EQUIPMENT IN LOCAL STREETS.
5. TRUCK ROUTE TO INTERSTATE MUST BE INSPECTED DAILY FOR SPILLAGE, DUST, OR OTHER SITE RELATED IMPACTS. ANY IMPACTS LOCATED OR REPORTED ALONG THE TRUCK ROUTE MUST BE APPROPRIATELY REMEDIATED AS DIRECTED BY THE ENGINEER.
6. MAINTAIN CONTINUOUS TRAFFIC FLOW ON GEDNEY STREET OUTSIDE THE PROJECT AREA.
7. PERMANENT ROAD CLOSURES ARE NOT AUTHORIZED DURING THE DURATION OF THE REMEDIAL ACTION.
8. NEGOTIATE TEMPORARY ROAD CLOSURES WITH THE VILLAGE OF NYACK, IF NECESSARY.
9. PERFORM MAINTENANCE AND PROTECTION OF TRAFFIC IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITION, AND TO THE SATISFACTION OF THE VILLAGE AND ENGINEER.

SOURCES:

1. GIS: NYS STREETS- NEW YORK STATE OFFICE OF CYBER SECURITY (OCS), ACCESSED FROM NYS GIS CLEARINGHOUSE (HTTP://WWW.NYSGIS.STATE.NY.US/INDEX.CFM)
2. GOOGLE MAPS, MAP DATA © 2012 (http://maps.google.com)

DIRECTIONS FROM SITE:

1. TURN LEFT ON GEDNEY STREET TOWARD MAIN STREET	217 FT.
2. TURN RIGHT ONTO MAIN STREET	0.8 MI.
3. TURN RIGHT ONTO POLHEMUS STREET	0.1 MI.
4. TURN LEFT TO MERGE ONTO I-87N/I-287 WEST	1.2 MI.

DIRECTIONS TO SITE:

1. FROM ROUTE 287 EAST/I-87 SOUTH	
TAKE EXIT 11 TOWARD US-9 W/NYACK/S NYACK	0.1 MI.
2. TURN LEFT ONTO NY-59 E	0.4 MI.
3. CONTINUE ONTO MAIN STREET	0.7 MILES
4. TURN LEFT ONTO GEDNEY STREET	217 FT.
5. TURN RIGHT TO THE SITE	

0 500' 1000'

SCALE: 1" = 500'

LEGEND:

SITE

TRANSIT ROUTE FROM SITE

DIRECTION OF TRAFFIC

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	TRUCK TRANSPORT ROUTE
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 4

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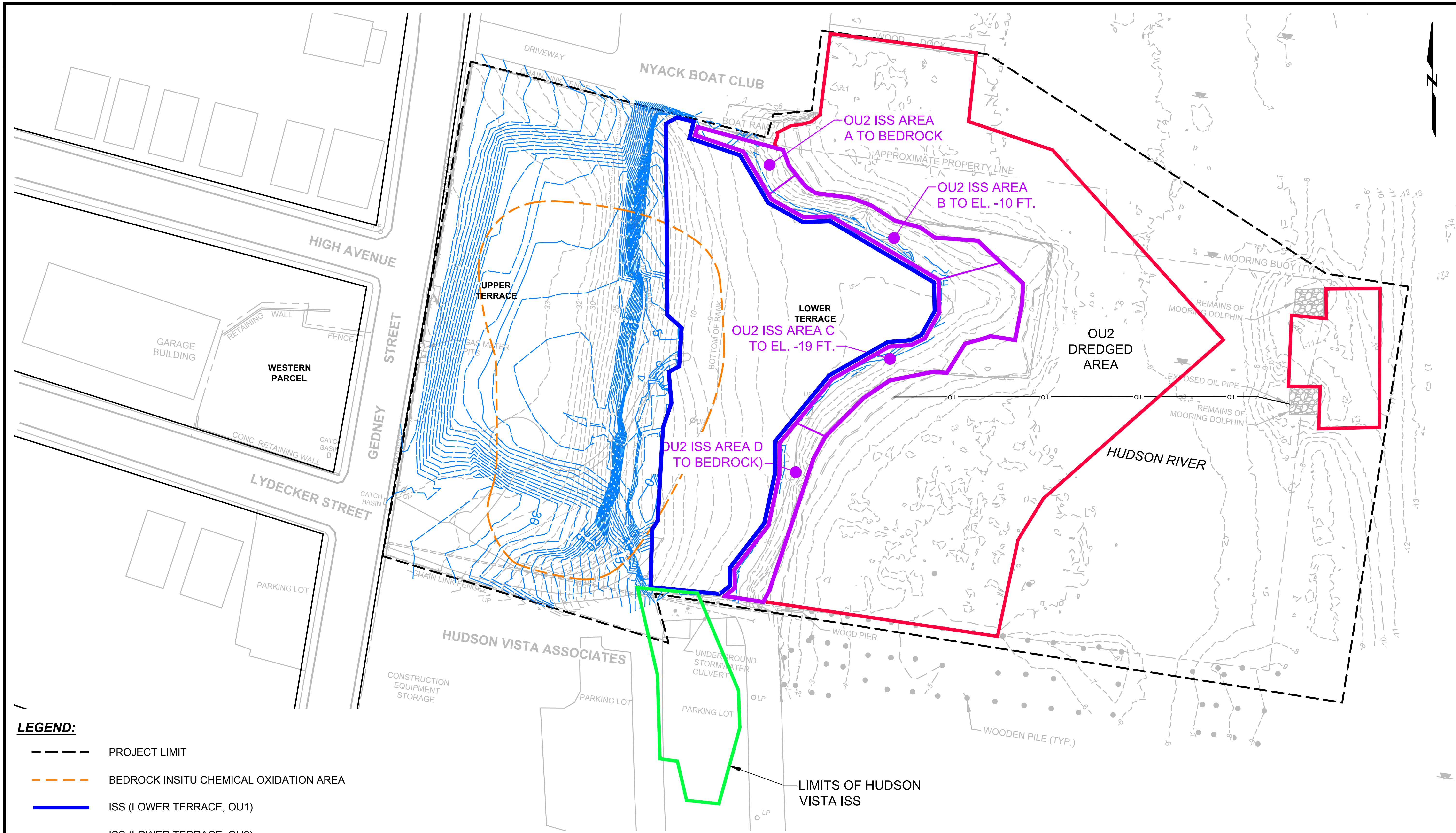

LEGEND:

PROJECT LIMIT

BEDROCK INSITU CHEMICAL OXIDATION AREA

ISS (LOWER TERRACE, OU1)

ISS (LOWER TERRACE, OU2)

HUDSON VISTA ISS

DREDGE AREA (OU2)

OU1 EXCAVATION CONTOURS

0 60' 120'

SCALE: 1" = 60'

Nyack Site Management Plan
Nyack Former MGP
Nyack, New York

Orange and Rockland Utilities, Inc.
Goshen, New York

GEI Consultants

Project 1502200

REMEDIATION OVERVIEW

April 2016

Fig. 5

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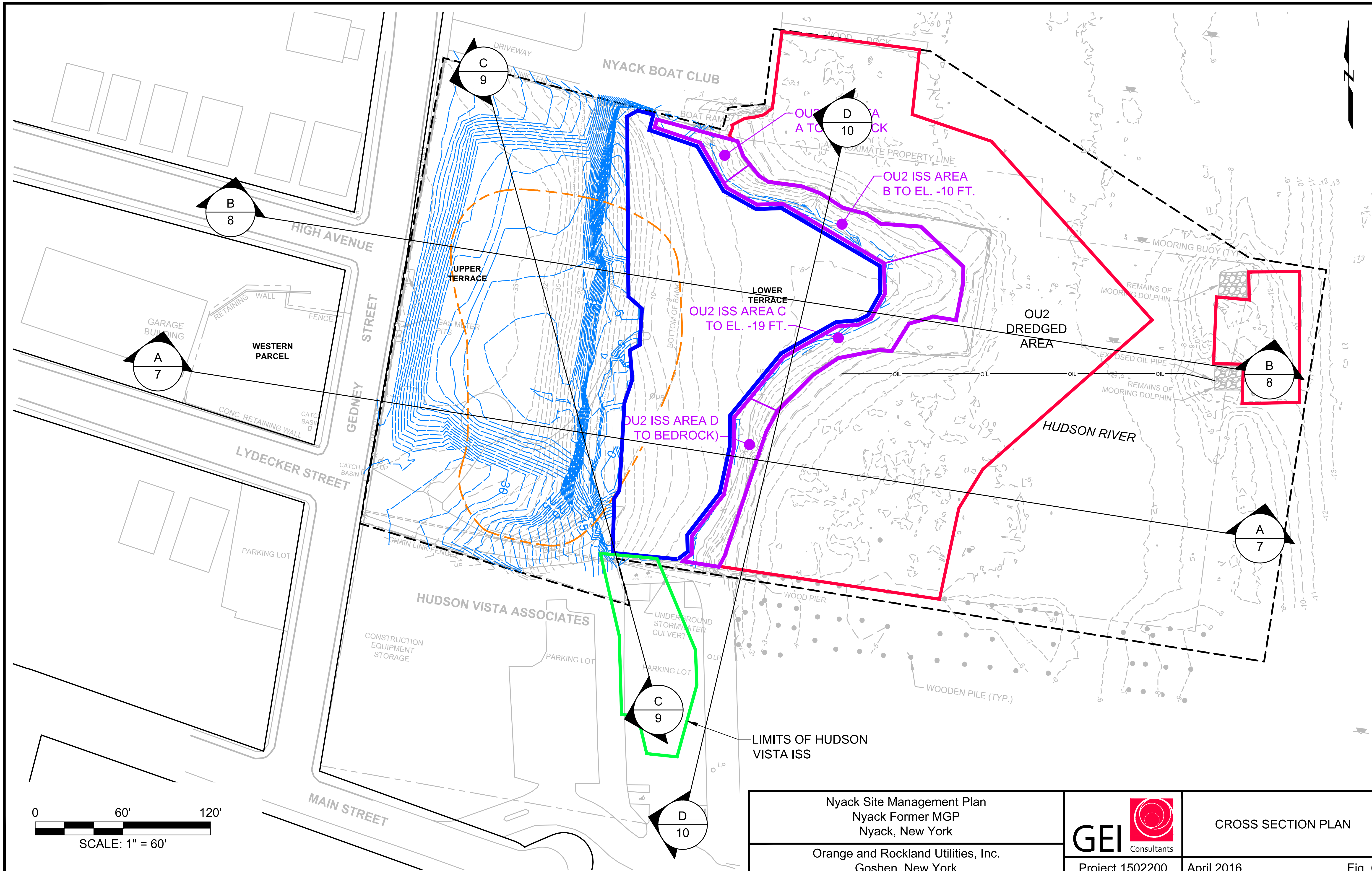

Nyack Site Management Plan
Nyack Former MGP
Nyack, New York

Orange and Rockland Utilities, Inc.
Goshen, New York

GEI Consultants

CROSS SECTION PLAN

Project 1502200

April 2016

Fig. 6

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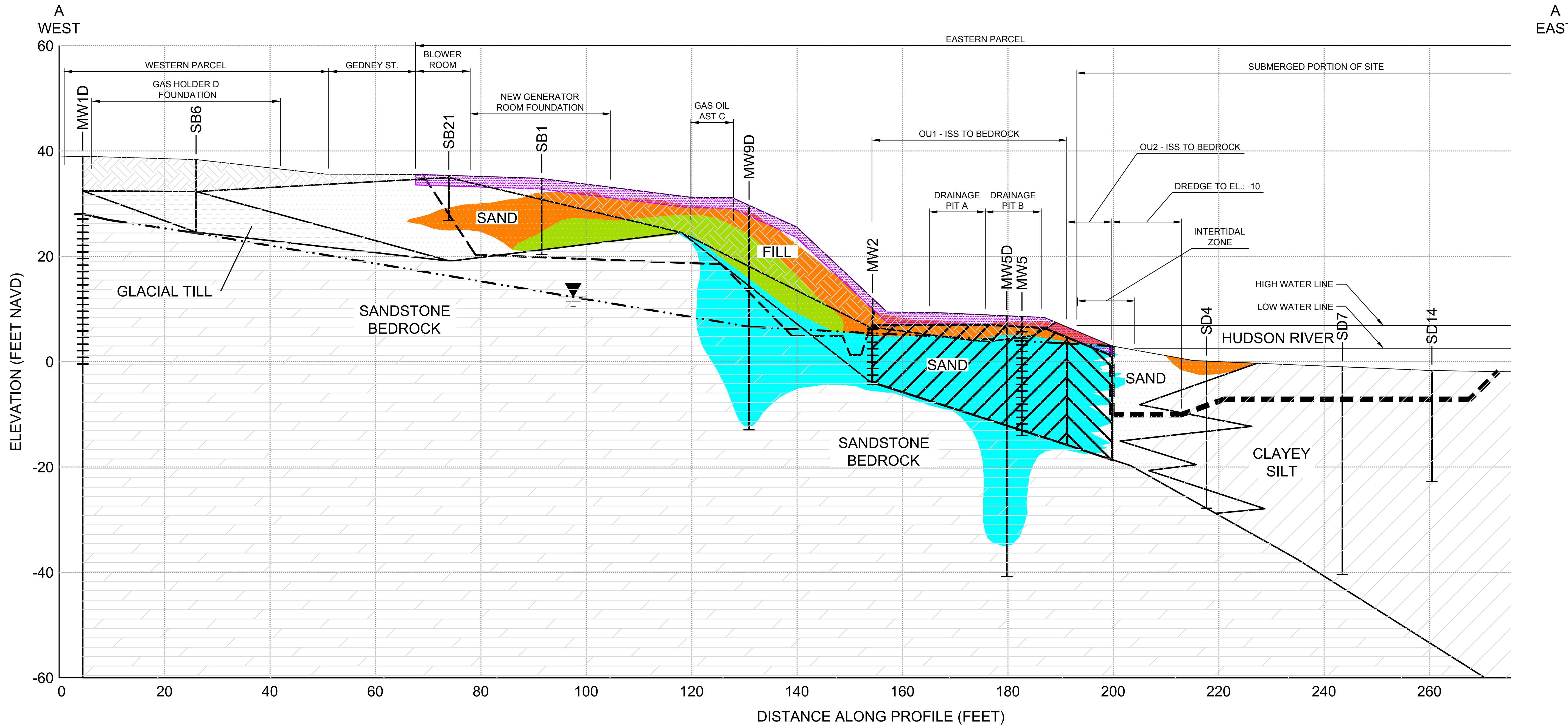

LEGEND:

ISS (OU1)

ISS (OU2)

EXCAVATION OR DREDGING LIMIT

CLEAN SOIL COVER (AT LEAST 2 FEET)

WATER TABLE - BEDROCK WELLS 11/30/99

LITHOLOGY AND IMPACTS:

SANDSTONE BEDROCK

GLACIAL TILL

FILL

SAND

CLAYEY SILT

ODORS OR SPOTS OF SHEEN

NAPL BLEBS, LENSES OF HEAVY HYDROCARBON SHEEN OR STAINING

NAPL SATURATED SOIL MATRIX OR NAPL OBSERVED IN BEDROCK FRACTURES

HORIZONTAL SCALE: 1" = 40'

0 40' 80'

0 20' 40'

VERTICAL SCALE: 1" = 20'

NOTE: 2x VERTICAL EXAGGERATION

SOURCE:

1. SECTION BASED ON CROSS SECTIONS FROM THE RETEC GROUP, INC. (RETEC) 2002. REMEDIAL INVESTIGATION REPORT, FORMER MANUFACTURED GAS PLANT SITE, NYACK, NEW YORK. PREPARED FOR ORANGE AND ROCKLAND UTILITIES, JANUARY 2002.

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	CROSS SECTION A
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 7

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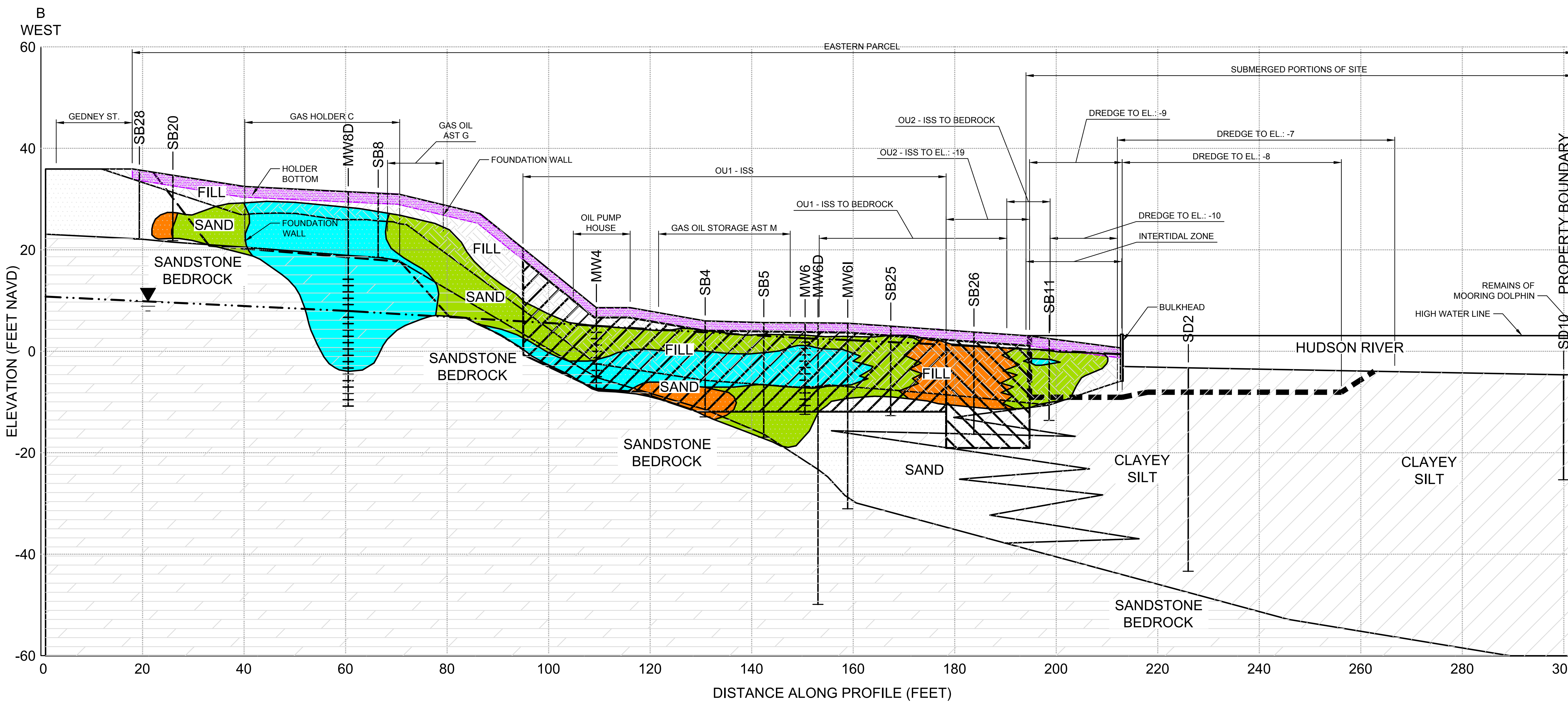

LEGEND:

- ISS (OU1)
- ISS (OU2)
- EXCAVATION OR DREDGING LIMIT
- CLEAN SOIL COVER (AT LEAST 2 FEET)
- WATER TABLE - BEDROCK WELLS 11/30/99

LITHOLOGY AND IMPACTS:

- SANDSTONE BEDROCK
- GLACIAL TILL
- FILL
- SAND
- CLAYEY SILT
- ODORS OR SPOTS OF SHEEN
- NAPL BLEBS, LENSES OF HEAVY HYDROCARBON SHEEN OR STAINING
- NAPL SATURATED SOIL MATRIX OR NAPL OBSERVED IN BEDROCK FRACTURES

HORIZONTAL SCALE: 1" = 40'
0 40' 80'

0 20' 40'
VERTICAL SCALE: 1" = 20'
NOTE: 2x VERTICAL EXAGGERATION

SOURCE:

1. SECTION BASED ON CROSS SECTIONS FROM THE RETEC GROUP, INC. (RETEC) 2002. REMEDIAL INVESTIGATION REPORT, FORMER MANUFACTURED GAS PLANT SITE, NYACK, NEW YORK. PREPARED FOR ORANGE AND ROCKLAND UTILITIES, JANUARY 2002.

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	CROSS SECTION B
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 8

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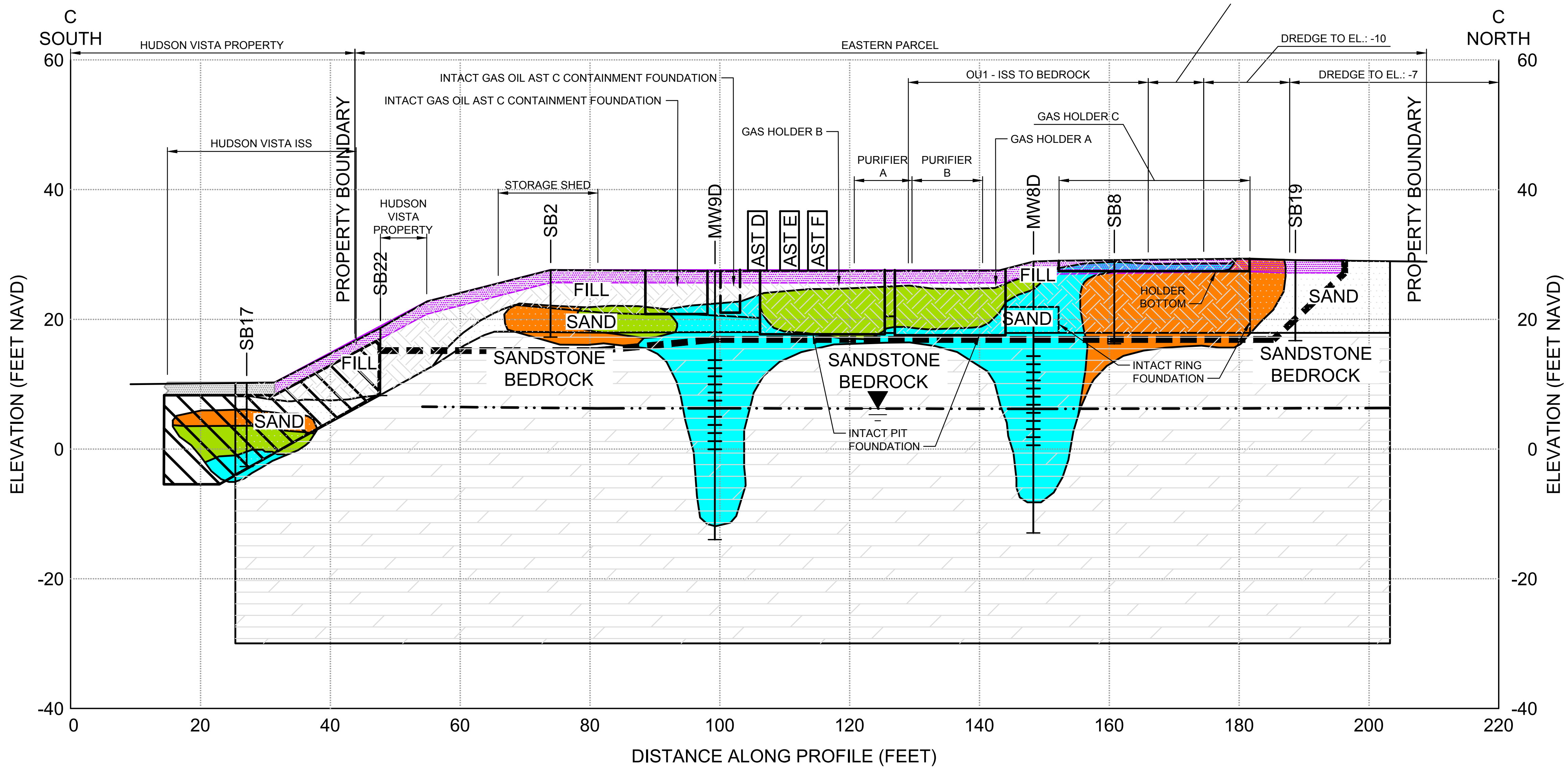

LEGEND:

- ISS (OU1)
- ISS (OU2)
- EXCAVATION OR DREDGING LIMIT
- CLEAN SOIL COVER (AT LEAST 2 FEET)
- ASPHALT
- WATER TABLE - BEDROCK WELLS 11/30/99
- EXISTING SUBSURFACE STRUCTURE
- FORMER SUBSURFACE STRUCTURE
- HOLDER A — FORMER MGP STRUCTURE LOCATION

LITHOLOGY AND IMPACTS:

- SANDSTONE BEDROCK
- GLACIAL TILL
- FILL
- SAND
- CLAYEY SILT
- ODORS OR SPOTS OF SHEEN
- NAPL BLEBS, LENSES OF HEAVY HYDROCARBON SHEEN OR STAINING
- NAPL SATURATED SOIL MATRIX OR NAPL OBSERVED IN BEDROCK FRACTURES

HORIZONTAL SCALE: 1" = 40'

0 40' 80'

0 20' 40'

VERTICAL SCALE: 1" = 20'

NOTE: 2x VERTICAL EXAGGERATION

SOURCE:

1. SECTION BASED ON CROSS SECTIONS FROM THE RETEC GROUP, INC. (RETEC) 2002. REMEDIAL INVESTIGATION REPORT, FORMER MANUFACTURED GAS PLANT SITE, NYACK, NEW YORK. PREPARED FOR ORANGE AND ROCKLAND UTILITIES, JANUARY 2002.

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	CROSS SECTION C
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 9

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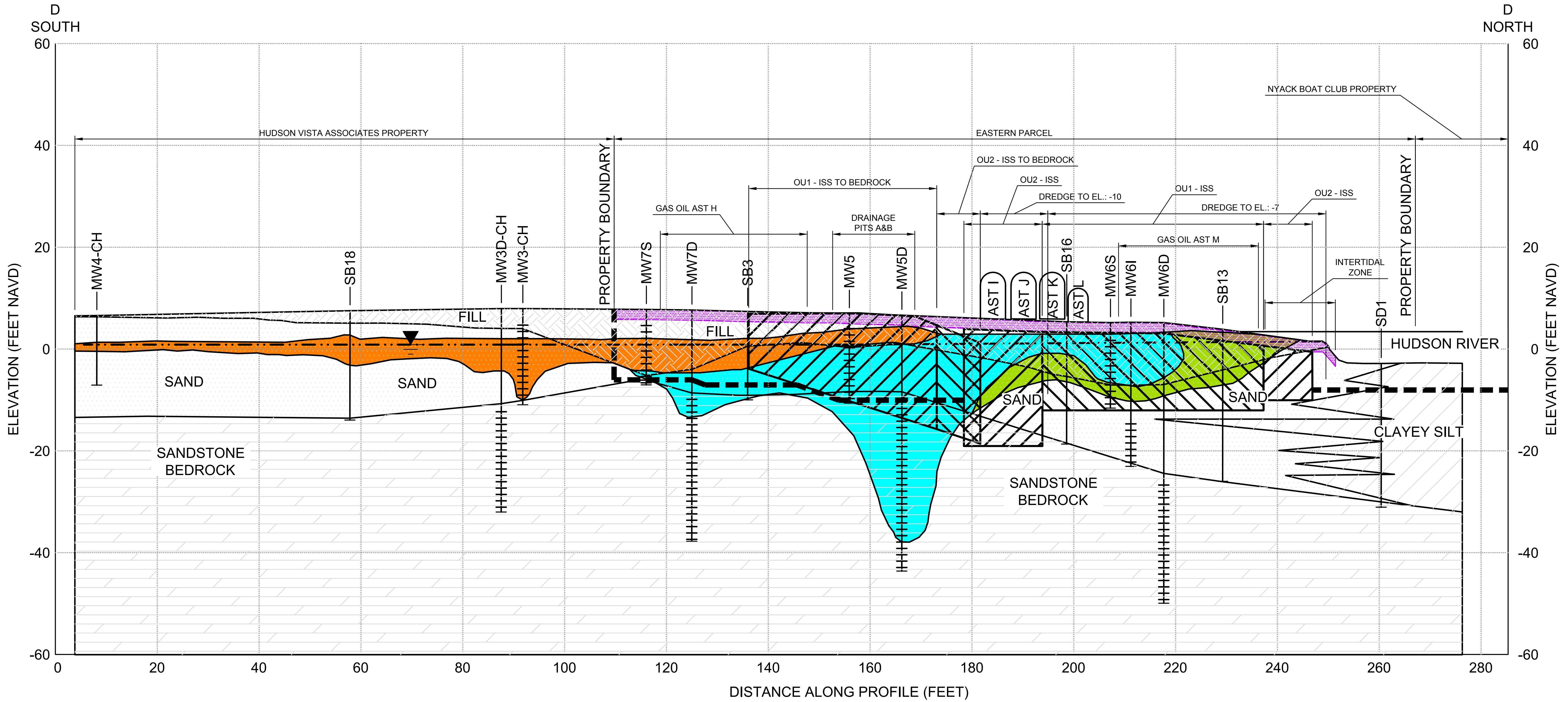

LEGEND:

- ISS (OU1)
- ISS (OU2)
- EXCAVATION OR DREDGING LIMIT
- CLEAN SOIL COVER (AT LEAST 2 FEET)
- WATER TABLE - BEDROCK WELLS 11/30/99
- HOLDER A — FORMER MGP STRUCTURE LOCATION

LITHOLOGY AND IMPACTS:

- SANDSTONE BEDROCK
- GLACIAL TILL
- FILL
- SAND
- CLAYEY SILT
- ODORS OR SPOTS OF SHEEN
- NAPL BLEBS, LENSES OF HEAVY HYDROCARBON SHEEN OR STAINING
- NAPL SATURATED SOIL MATRIX OR NAPL OBSERVED IN BEDROCK FRACTURES

HORIZONTAL SCALE: 1" = 40'
0 40' 80'

0 20' 40'
VERTICAL SCALE: 1" = 20'
NOTE: 2x VERTICAL EXAGGERATION

SOURCE:
1. SECTION BASED ON CROSS SECTIONS FROM THE RETEC GROUP, INC. (RETEC) 2002. REMEDIAL INVESTIGATION REPORT, FORMER MANUFACTURED GAS PLANT SITE, NYACK, NEW YORK. PREPARED FOR ORANGE AND ROCKLAND UTILITIES, JANUARY 2002.

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	CROSS SECTION D
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 10

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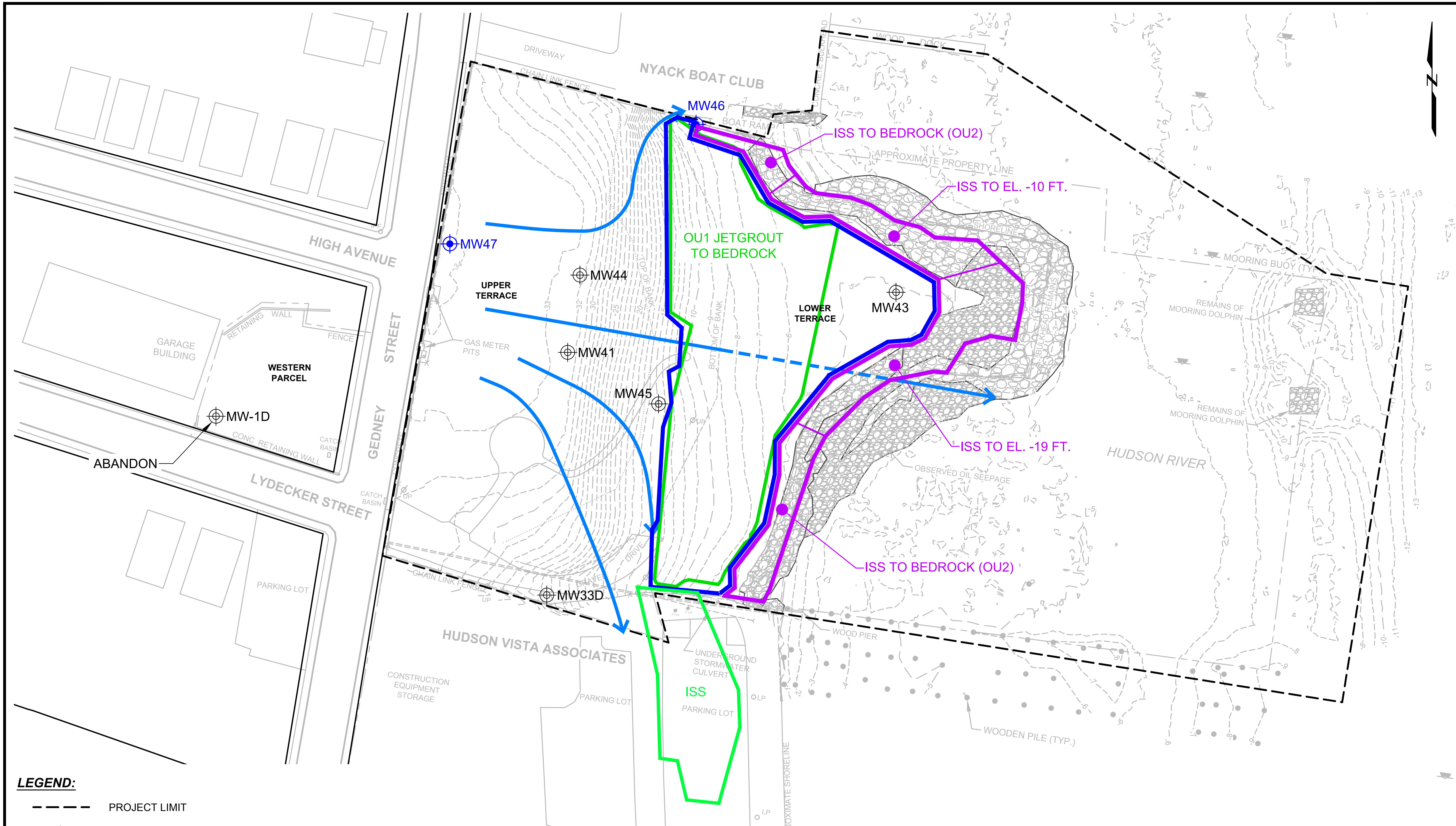

LEGEND:

— — —	PROJECT LIMIT
⊕	EXISTING MONITORING WELL
⊕ (blue)	PROPOSED MONITORING WELL
→	GROUNDWATER FLOW (CONCEPTUAL)
- - -	UNDERFLOW BENEATH ISS

0 60' 120'

SCALE: 1" = 60'

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	CONCEPTUAL GROUNDWATER MONITORING PLAN
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 11

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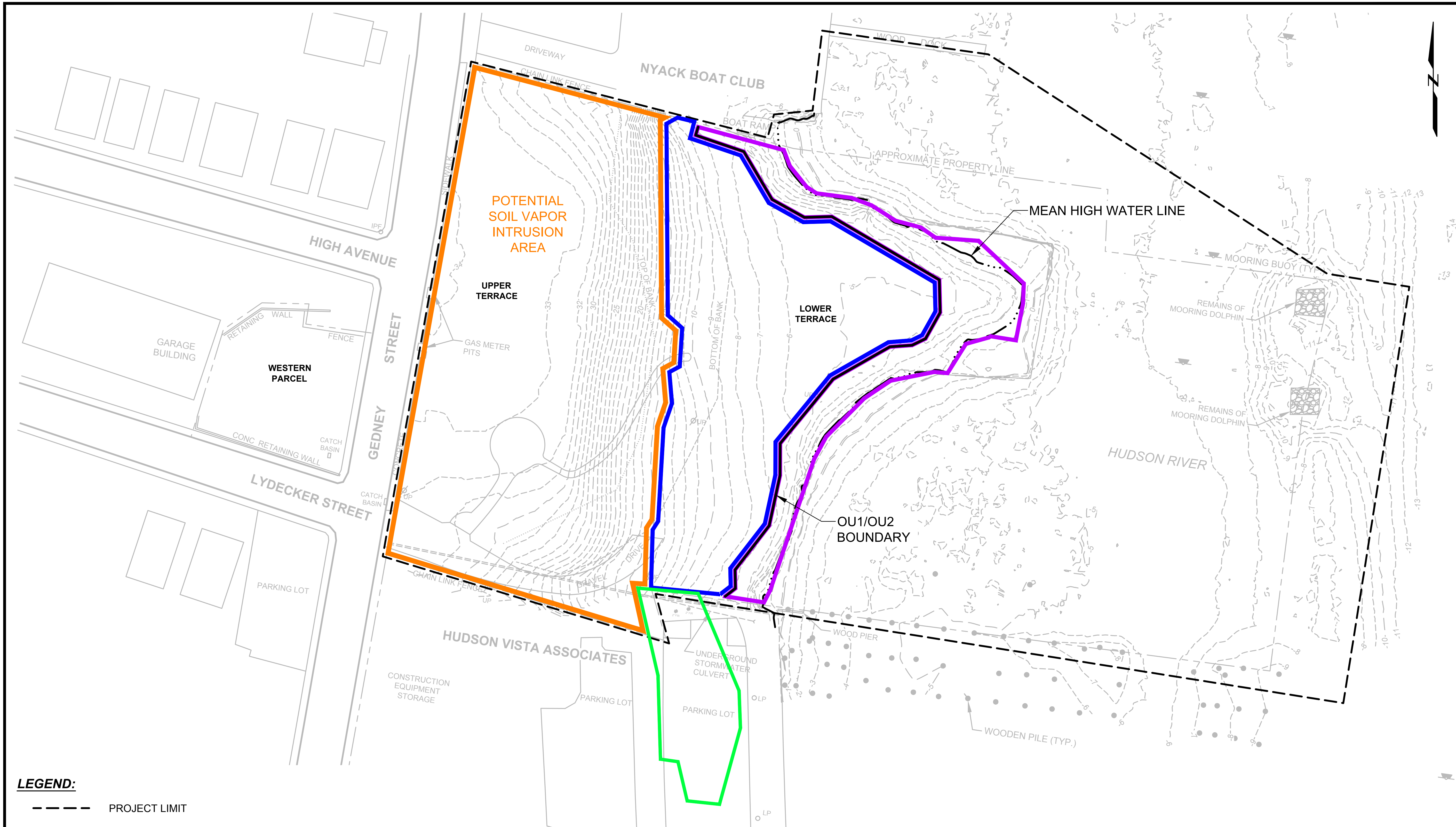

LEGEND:

- PROJECT LIMIT
- ISS (LOWER TERRACE, OU1)
- ISS (LOWER TERRACE, OU2)
- HUDSON VISTA ISS
- AREA OF POTENTIAL SOIL VAPOR INTRUSION

0 60' 120'

SCALE: 1" = 60'

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	AREA OF SOIL VAPOR INTRUSION CONCERN
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 12

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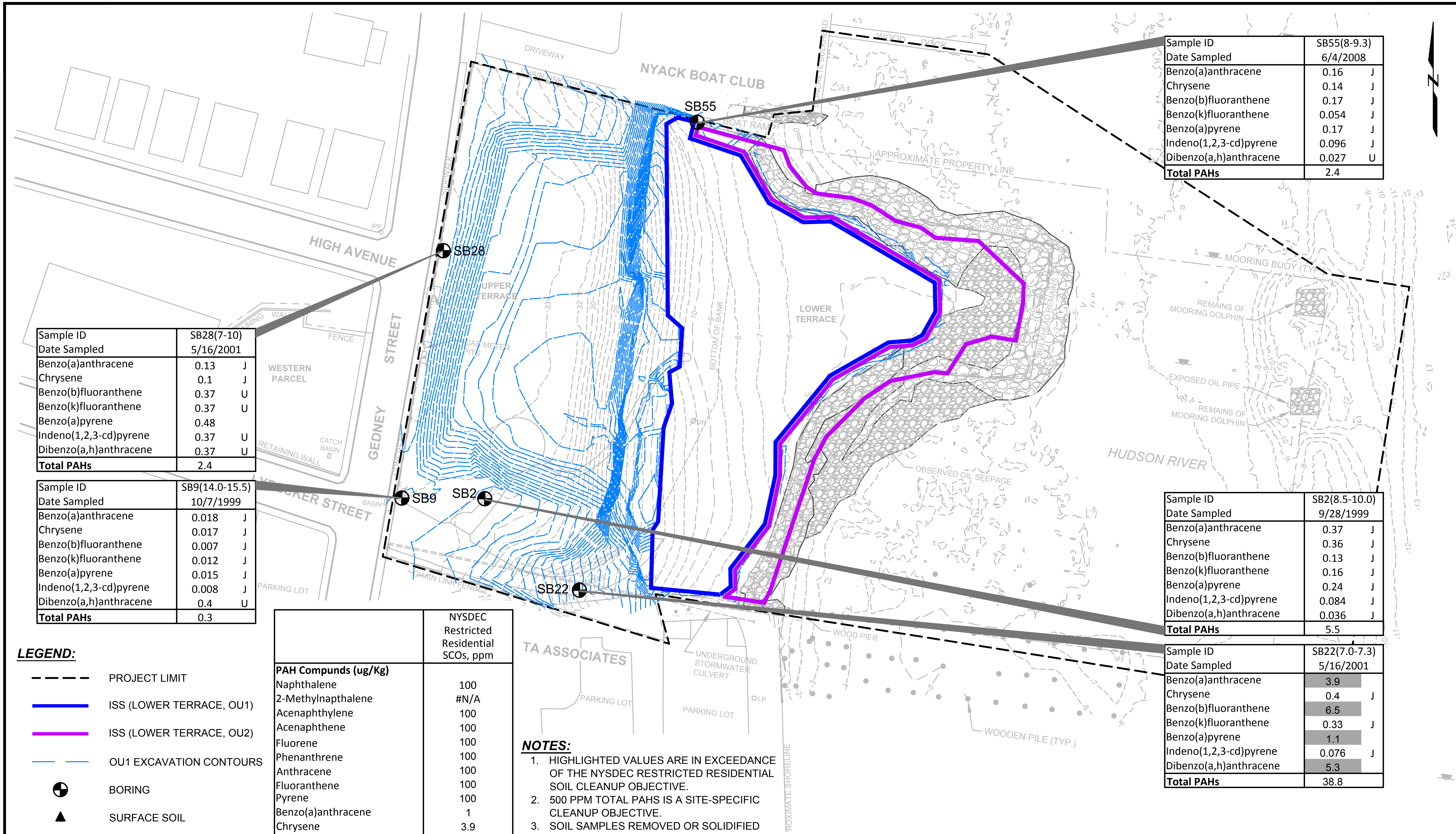

Sample ID	SB55(8-9.3)	
Date Sampled	6/4/2008	
Benzo(a)anthracene	0.16	J
Chrysene	0.14	J
Benzo(b)fluoranthene	0.17	J
Benzo(k)fluoranthene	0.054	J
Benzo(a)pyrene	0.17	J
Indeno(1,2,3-cd)pyrene	0.096	J
Dibenzo(a,h)anthracene	0.027	U
Total PAHs	2.4	

Sample ID	SB28(7-10)	
Date Sampled	5/16/2001	
Benzo(a)anthracene	0.13	J
Chrysene	0.1	J
Benzo(b)fluoranthene	0.37	U
Benzo(k)fluoranthene	0.37	U
Benzo(a)pyrene	0.48	
Indeno(1,2,3-cd)pyrene	0.37	U
Dibenzo(a,h)anthracene	0.37	U
Total PAHs	2.4	

Sample ID	SB9(14.0-15.5)	
Date Sampled	10/7/1999	
Benzo(a)anthracene	0.018	J
Chrysene	0.017	J
Benzo(b)fluoranthene	0.007	J
Benzo(k)fluoranthene	0.012	J
Benzo(a)pyrene	0.015	J
Indeno(1,2,3-cd)pyrene	0.008	J
Dibenzo(a,h)anthracene	0.4	U
Total PAHs	0.3	

Sample ID	SB2(8.5-10.0)	
Date Sampled	9/28/1999	
Benzo(a)anthracene	0.37	J
Chrysene	0.36	J
Benzo(b)fluoranthene	0.13	J
Benzo(k)fluoranthene	0.16	J
Benzo(a)pyrene	0.24	J
Indeno(1,2,3-cd)pyrene	0.084	J
Dibenzo(a,h)anthracene	0.036	J
Total PAHs	5.5	

Sample ID	SB22(7.0-7.3)	
Date Sampled	5/16/2001	
Benzo(a)anthracene	3.9	
Chrysene	0.4	J
Benzo(b)fluoranthene	6.5	
Benzo(k)fluoranthene	0.33	J
Benzo(a)pyrene	1.1	
Indeno(1,2,3-cd)pyrene	0.076	J
Dibenzo(a,h)anthracene	5.3	
Total PAHs	38.8	

PAH Compunds (ug/Kg)	NYSDEC Restricted Residential SCOs, ppm
Naphthalene	100
2-Methylnapthalene	#N/A
Acenaphthylene	100
Acenaphthene	100
Fluorene	100
Phenanthrene	100
Anthracene	100
Fluoranthene	100
Pyrene	100
Benzo(a)anthracene	1
Chrysene	3.9
Benzo(b)fluoranthene	1
Benzo(k)fluoranthene	3.9
Benzo(a)pyrene	1
Indeno(1,2,3-cd)pyrene	0.5
Dibenzo(a,h)anthracene	0.33
Benzo(g,h,i)perylene	100
Total PAHs (site-specific SCO)	500

LEGEND:

— — —	PROJECT LIMIT
(blue line)	ISS (LOWER TERRACE, OU1)
(purple line)	ISS (LOWER TERRACE, OU2)
(blue dashed)	OU1 EXCAVATION CONTOURS
⊕	BORING
▲	SURFACE SOIL
U	THE MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE ASSOCIATED NUMERICAL VALUE IS THE SMPLE QUANTITATION LIMIT
J	THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMAGED QUANTITY

NOTES:

1. HIGHLIGHTED VALUES ARE IN EXCEEDANCE OF THE NYSDEC RESTRICTED RESIDENTIAL SOIL CLEANUP OBJECTIVE.
2. 500 PPM TOTAL PAHS IS A SITE-SPECIFIC CLEANUP OBJECTIVE.
3. SOIL SAMPLES REMOVED OR SOLIDIFIED DURING REMEDIATION ARE NOT SHOWN.

0 60' 120'

SCALE: 1" = 60'

Nyack Site Management Plan
Nyack Former MGP
Nyack, New York

Orange and Rockland Utilities, Inc.
Goshen, New York

GEI Consultants

Project 1502200

SOIL CONCENTRATIONS OUTSIDE OF REMEDIAL AREA

April 2016

Fig. 13

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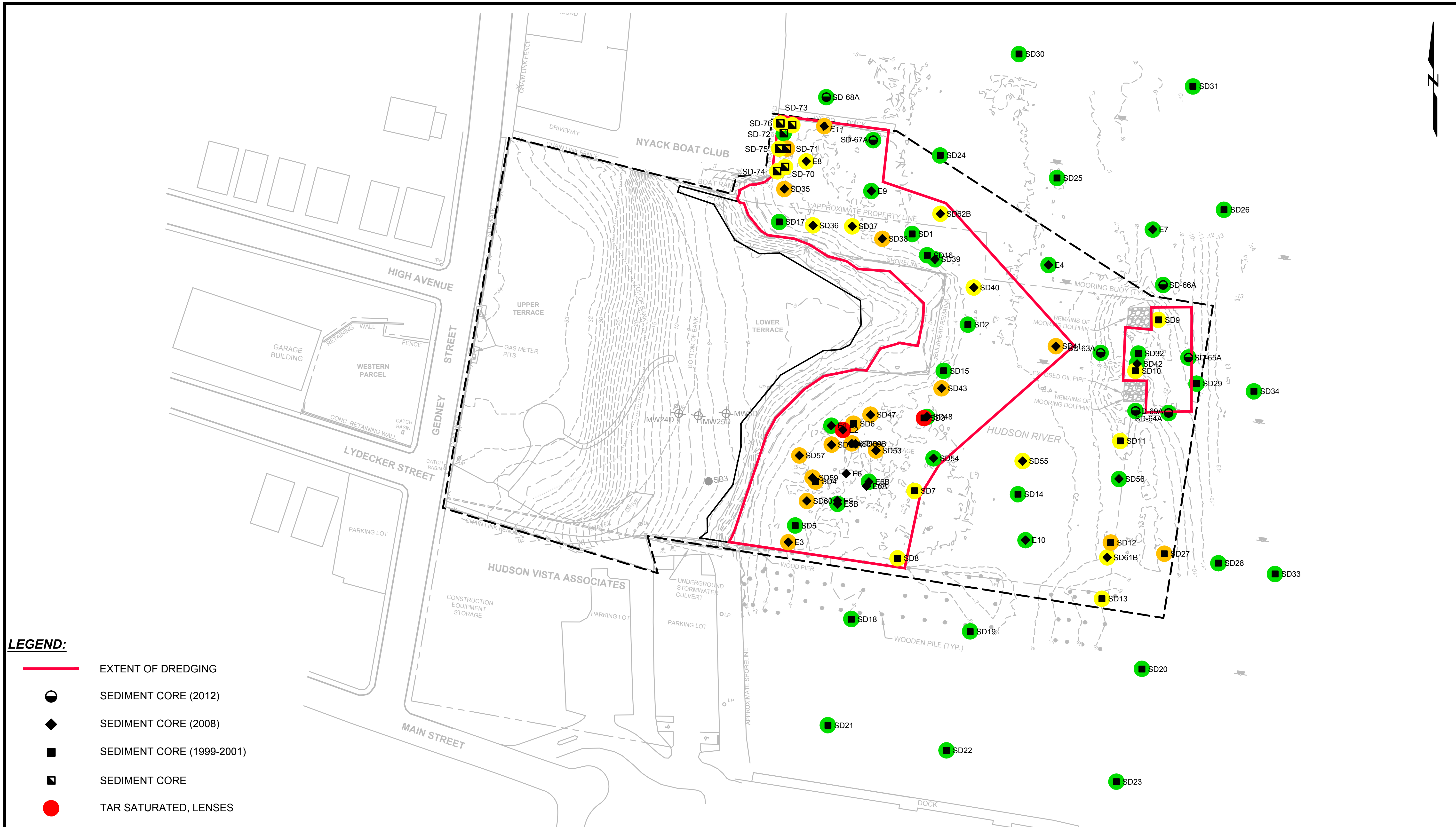

LEGEND:

EXTENT OF DREDGING
SEDIMENT CORE (2012)
SEDIMENT CORE (2008)
SEDIMENT CORE (1999-2001)
SEDIMENT CORE
TAR SATURATED, LENSES
BLEBS, GLOBS, SHEEN
STAINING ODOR
NO OBSERVED IMPACTS

0 80' 160'
SCALE: 1" = 80'

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	SEDIMENT IMPACT PRIOR TO REMEDIATION
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 14

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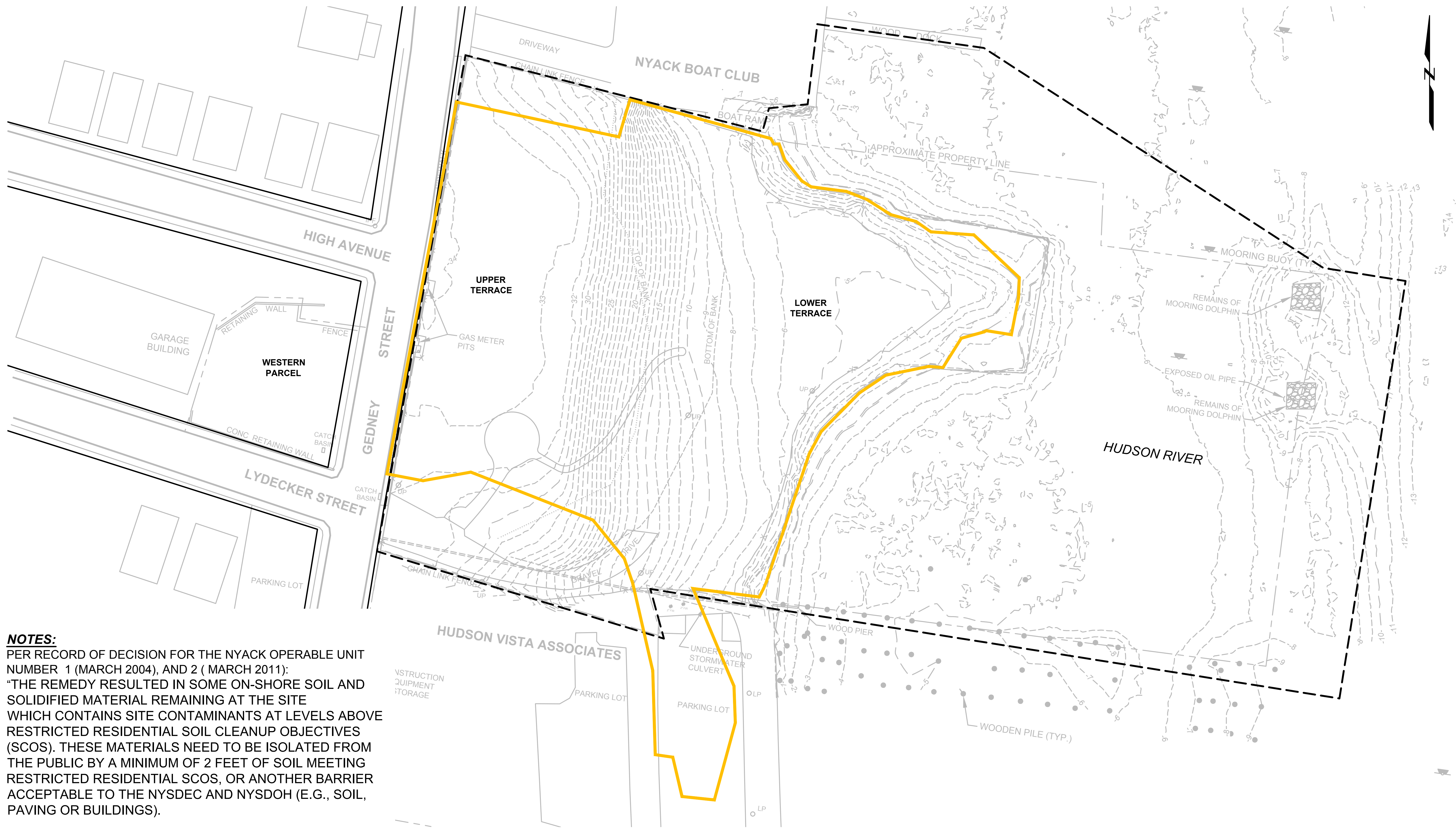

NOTES:

PER RECORD OF DECISION FOR THE NYACK OPERABLE UNIT NUMBER 1 (MARCH 2004), AND 2 (MARCH 2011):
"THE REMEDY RESULTED IN SOME ON-SHORE SOIL AND SOLIDIFIED MATERIAL REMAINING AT THE SITE WHICH CONTAINS SITE CONTAMINANTS AT LEVELS ABOVE RESTRICTED RESIDENTIAL SOIL CLEANUP OBJECTIVES (SCOS). THESE MATERIALS NEED TO BE ISOLATED FROM THE PUBLIC BY A MINIMUM OF 2 FEET OF SOIL MEETING RESTRICTED RESIDENTIAL SCOS, OR ANOTHER BARRIER ACCEPTABLE TO THE NYSDEC AND NYSDOH (E.G., SOIL, PAVING OR BUILDINGS).

LEGEND:

PROJECT LIMIT

CLEAN SOIL COVER IN COMPLIANCE WITH RECORD OF DECISION

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

Nyack Site Management Plan
Nyack Former MGP
Nyack, New York

Orange and Rockland Utilities, Inc.
Goshen, New York

GEI Consultants

Project 1502200

APPROXIMATE EXTENT OF CLEAN SOIL COVER

April 2016 Fig. 15

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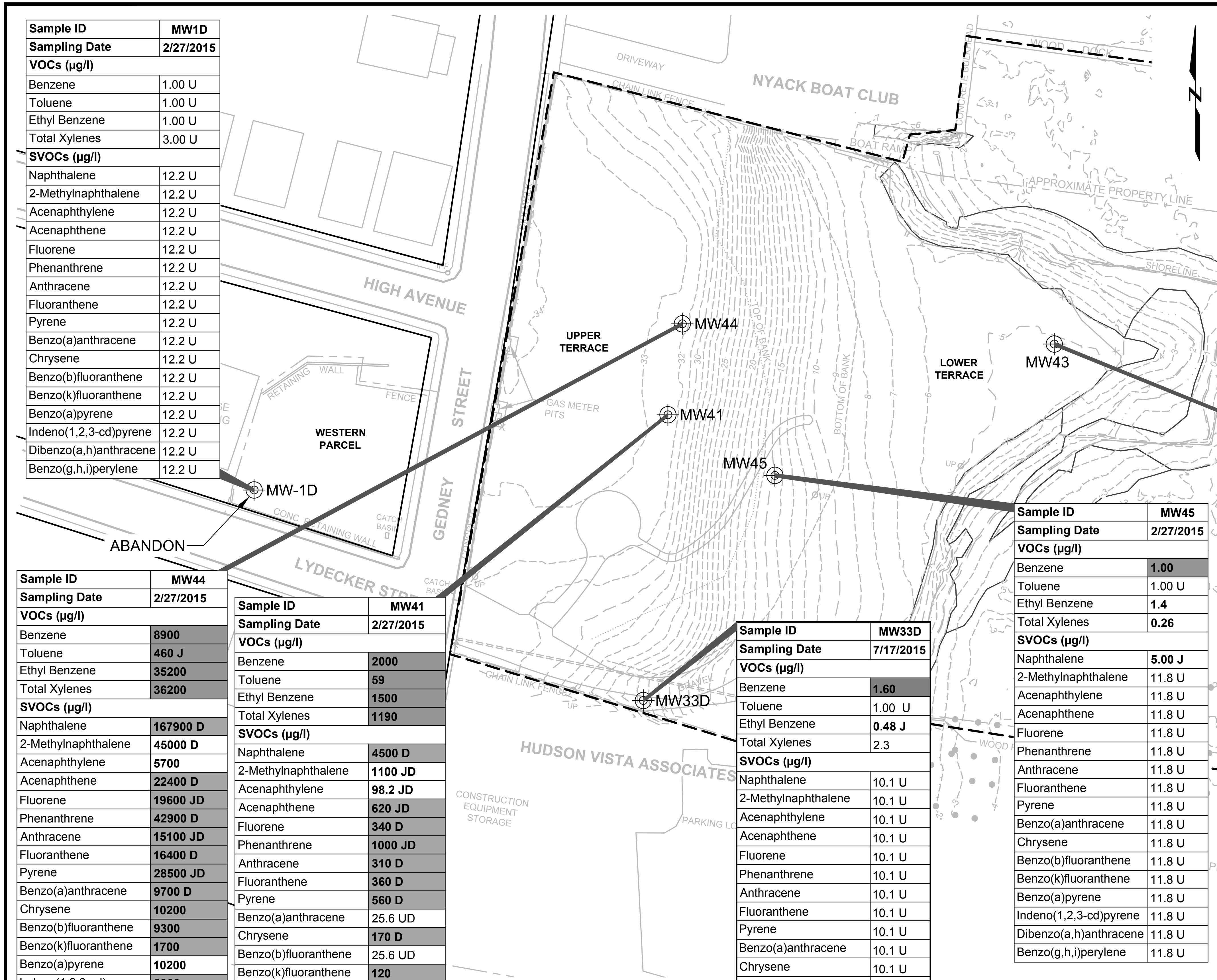

LEGEND:

— — —	PROJECT LIMIT
⊕	EXISTING MONITORING WELL
U	THE RESULT WAS NOT DETECTED ABOVE THE REPORTING LIMIT
J	THE RESULT IS AN ESTIMATED VALUE
D	THE REPORTED VALUE IS FROM A SECONDARY ANALYSIS WITH A DILUTION FACTOR
NE	NOT ESTABLISHED
BOLD	BOLD FONT INDICATES DETECTED COMPOUND
(grey shading)	HIGHLIGHTED CELLS INDICATE THE COMPOUND IN EXCEEDANCE OF THE NEW YORK STATE AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES FOR GA GROUNDWATER
µg/L	MICROGRAMS PER LITER OR PARTS PER BILLION (PPB)

Sample ID	MW1D
Sampling Date	2/27/2015
VOCs (µg/l)	
Benzene	1.00 U
Toluene	1.00 U
Ethyl Benzene	1.00 U
Total Xylenes	3.00 U
SVOCs (µg/l)	
Naphthalene	12.2 U
2-Methylnaphthalene	12.2 U
Acenaphthylene	12.2 U
Acenaphthene	12.2 U
Fluorene	12.2 U
Phenanthrene	12.2 U
Anthracene	12.2 U
Fluoranthene	12.2 U
Pyrene	12.2 U
Benzo(a)anthracene	12.2 U
Chrysene	12.2 U
Benzo(b)fluoranthene	12.2 U
Benzo(k)fluoranthene	12.2 U
Benzo(a)pyrene	12.2 U
Indeno(1,2,3-cd)pyrene	12.2 U
Dibenzo(a,h)anthracene	12.2 U
Benzo(g,h,i)perylene	12.2 U

Sample ID	MW44
Sampling Date	2/27/2015
VOCs (µg/l)	
Benzene	**8900**
Toluene	**460 J**
Ethyl Benzene	**35200**
Total Xylenes	**36200**
SVOCs (µg/l)	
Naphthalene	**167900 D**
2-Methylnaphthalene	**45000 D**
Acenaphthylene	**5700**
Acenaphthene	**22400 D**
Fluorene	**19600 JD**
Phenanthrene	**42900 D**
Anthracene	**15100 JD**
Fluoranthene	**16400 D**
Pyrene	**28500 JD**
Benzo(a)anthracene	**9700 D**
Chrysene	**10200**
Benzo(b)fluoranthene	**9300**
Benzo(k)fluoranthene	**1700**
Benzo(a)pyrene	**10200**
Indeno(1,2,3-cd)pyrene	**2900**
Dibenzo(a,h)anthracene	**1000 J**
Benzo(g,h,i)perylene	**4500**

Sample ID	MW41
Sampling Date	2/27/2015
VOCs (µg/l)	
Benzene	**2000**
Toluene	**59**
Ethyl Benzene	**1500**
Total Xylenes	**1190**
SVOCs (µg/l)	
Naphthalene	**4500 D**
2-Methylnaphthalene	**1100 JD**
Acenaphthylene	**98.2 JD**
Acenaphthene	**620 JD**
Fluorene	**340 D**
Phenanthrene	**1000 JD**
Anthracene	**310 D**
Fluoranthene	**360 D**
Pyrene	**560 D**
Benzo(a)anthracene	25.6 UD
Chrysene	**170 D**
Benzo(b)fluoranthene	25.6 UD
Benzo(k)fluoranthene	**120**
Benzo(a)pyrene	25.6 UD
Indeno(1,2,3-cd)pyrene	**160**
Dibenzo(a,h)anthracene	**46.4**
Benzo(g,h,i)perylene	**180**

Sample ID	MW33D
Sampling Date	7/17/2015
VOCs (µg/l)	
Benzene	**1.60**
Toluene	1.00 U
Ethyl Benzene	**0.48 J**
Total Xylenes	2.3
SVOCs (µg/l)	
Naphthalene	10.1 U
2-Methylnaphthalene	10.1 U
Acenaphthylene	10.1 U
Acenaphthene	10.1 U
Fluorene	10.1 U
Phenanthrene	10.1 U
Anthracene	10.1 U
Fluoranthene	10.1 U
Pyrene	10.1 U
Benzo(a)anthracene	10.1 U
Chrysene	10.1 U
Benzo(b)fluoranthene	10.1 U
Benzo(k)fluoranthene	10.1 U
Benzo(a)pyrene	10.1 U
Indeno(1,2,3-cd)pyrene	10.1 U
Dibenzo(a,h)anthracene	10.1 U
Benzo(g,h,i)perylene	10.1 U

Sample ID	MW45
Sampling Date	2/27/2015
VOCs (µg/l)	
Benzene	**1.00**
Toluene	1.00 U
Ethyl Benzene	**1.4**
Total Xylenes	**0.26**
SVOCs (µg/l)	
Naphthalene	**5.00 J**
2-Methylnaphthalene	11.8 U
Acenaphthylene	11.8 U
Acenaphthene	11.8 U
Fluorene	11.8 U
Phenanthrene	11.8 U
Anthracene	11.8 U
Fluoranthene	11.8 U
Pyrene	11.8 U
Benzo(a)anthracene	11.8 U
Chrysene	11.8 U
Benzo(b)fluoranthene	11.8 U
Benzo(k)fluoranthene	11.8 U
Benzo(a)pyrene	11.8 U
Indeno(1,2,3-cd)pyrene	11.8 U
Dibenzo(a,h)anthracene	11.8 U
Benzo(g,h,i)perylene	11.8 U

Sample ID	MW43
Sampling Date	2/27/2015
VOCs (µg/l)	
Benzene	**7.6**
Toluene	**0.520 J**
Ethyl Benzene	**2.1**
Total Xylenes	**1.47**
SVOCs (µg/l)	
Naphthalene	11.6 U
2-Methylnaphthalene	11.6 U
Acenaphthylene	11.6 U
Acenaphthene	**3.30 J**
Fluorene	11.6 U
Phenanthrene	11.6 U
Anthracene	11.6 U
Fluoranthene	11.6 U
Pyrene	11.6 U
Benzo(a)anthracene	11.6 U
Chrysene	11.6 U
Benzo(b)fluoranthene	11.6 U
Benzo(k)fluoranthene	11.6 U
Benzo(a)pyrene	11.6 U
Indeno(1,2,3-cd)pyrene	11.6 U
Dibenzo(a,h)anthracene	11.6 U
Benzo(g,h,i)perylene	11.6 U

Groundwater Analyte	NYSDEC AWQS
VOCs (µg/l)	
Benzene	1
Toluene	5
Ethyl Benzene	5
Total Xylenes	5
SVOCs (µg/l)	
Naphthalene	10
2-Methylnaphthalene	NE
Acenaphthylene	NE
Acenaphthene	20
Fluorene	50
Phenanthrene	50
Anthracene	50
Fluoranthene	50
Pyrene	50
Benzo(a)anthracene	0
Chrysene	0
Benzo(b)fluoranthene	0
Benzo(k)fluoranthene	0
Benzo(a)pyrene	NE
Indeno(1,2,3-cd)pyrene	0
Dibenzo(a,h)anthracene	NE
Benzo(g,h,i)perylene	NE

Nyack Site Management Plan
Nyack Former MGP
Nyack, New York

Orange and Rockland Utilities, Inc.
Goshen, New York

GEI Consultants

BASELINE POST-REMEDIATION GROUNDWATER QUALITY

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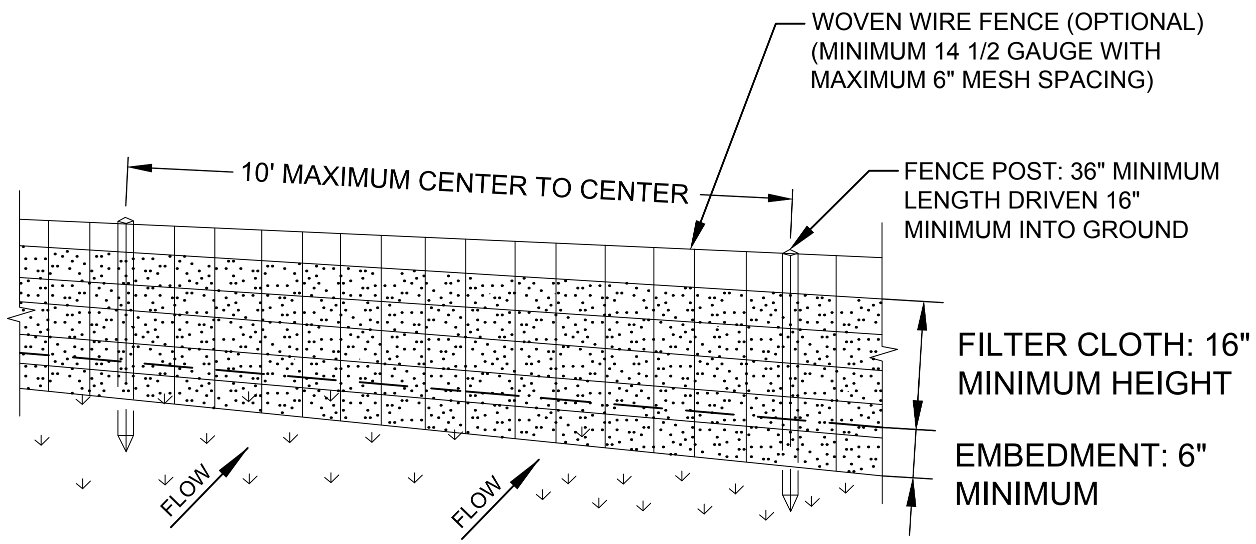
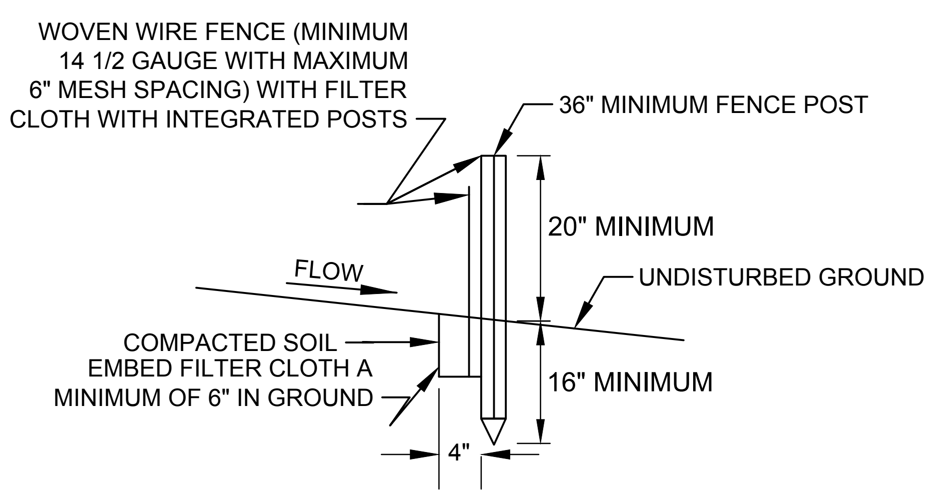


PERSPECTIVE VIEW

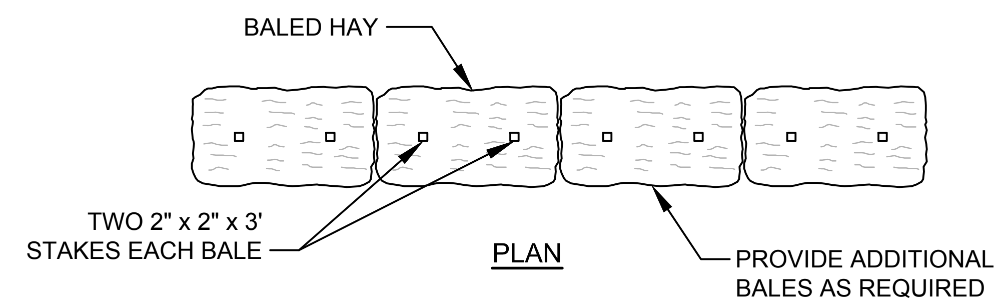


SECTION VIEW

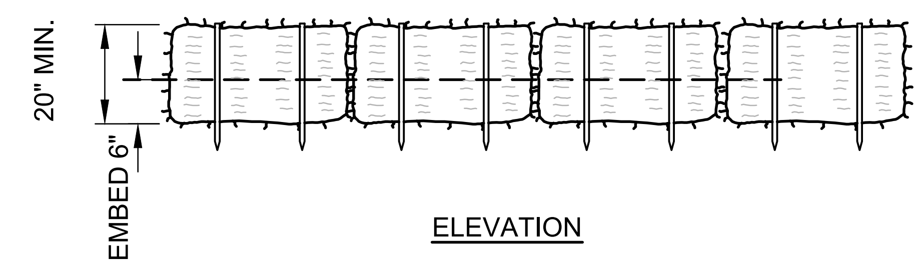
1 / -

DETAIL - WOVEN SILT FENCE

SCALE: N.T.S.



PLAN



ELEVATION

2 / -

DETAIL - STAKED HAY BALES

SCALE: N.T.S.

Nyack Site Management Plan Nyack Former MGP Nyack, New York	GEI Consultants	STORMWATER POLLUTION CONTROL PLAN DETAILS
Orange and Rockland Utilities, Inc. Goshen, New York	Project 1502200	April 2016 Fig. 17

APPENDIX A – EXCAVATION WORK PLAN

Any future intrusive work at the Nyack Former MGP Site located in the Village of Nyack, New York (the "Site") that will penetrate the required soil cover system for the Site, the ISS mass on the Lower Terrace area of the Site or at the Hudson Vista Associates Property, or encounter or disturb the remaining contamination, including any modifications or repairs to the existing soil cover for the Upper Terrace and/or Lower Terrace areas of the Site will be performed in compliance with this Excavation Work Plan (EWP) pursuant to the Site Management Plan (SMP).

A-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the Department. Currently, this notification will be made to:

Elizabeth Lukowski
Project Manager
NYSDEC - Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7014

Edward Moore
Regional Hazardous Waste Remediation Engineer
Region 3
21 South Putt Corners Road
New Paltz, NY 12561

This notification will include:

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

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

A-2 SOIL SCREENING METHODS

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

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing, material that can be returned to the subsurface, and material that can be used as cover soil.

ISS material that is excavated will be disposed of off-site at a permitted facility.

A-3 STOCKPILE METHODS

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

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

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

A-4 MATERIALS EXCAVATION AND LOAD OUT

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

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

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

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

A truck wash will be operated on-site. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete.

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

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

A-5 MATERIALS TRANSPORT OFF-SITE

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

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

All trucks will be washed prior to leaving the site. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

When departing, the Site trucks will use the following route (the map presented in Figure 4):

- Turn left out of the Site onto Gedney Street and follow for approximately 0.2 miles.
- Turn right onto Main Street and follow for approximately 0.8 miles.
- Merge onto the Governor Thomas E. Dewey Thruway (Route 287).

Trucks returning to the Site will follow the above traffic pattern in reverse.

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

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

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

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

A-6 MATERIALS DISPOSAL OFF-SITE

The Site remediation resulted in placement of clean soil/fill material on the Upper Terrace which is compliant with NYSDEC regulation. All potentially contaminated soil/fill/solid waste and ISS material excavated and removed from the Site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. Soil on the Eastern Parcel is considered potentially contaminated if lies outside of the Upper Terrace excavation limit. If disposal of soil/fill from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval. Subject to the foregoing and this Appendix A, clean soil/fill is expected to be disposed of as unregulated in conjunction with site redevelopment.

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

Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

A-7 MATERIALS REUSE ON-SITE

A significant amount of fill that meets unrestricted SCO criterial was placed on the Site as part of the Remedial Action. Any material that is generated during site development will need to be tested. Material that meets the Restricted SCOs listed in Table 375-6.8(a) of 6 NYCRR Part 375, meet the chemical criteria for on-site reuse. Prior to reuse, samples will be collected and analyzed by an Environmental Laboratory Approval Program (ELAP)-certified laboratory for total NYSDEC Part 375-6 VOCs, PAHs, metals, and total cyanide. VOCs via U.S. Environmental Protection Agency (EPA) Method 8260, PAH compounds (SVOCs) via EPA Method 8270, and total cyanide via EPA Method 9010/9014.

Riprap left on the Site after the Remedial Action is considered a clean material and can be reused on site as necessary.

Bedrock and material solidified in-place (ISS material) cannot be reused, and will be disposed of off-site, after testing for disposal facility approval in accordance with Section A-6 hereof

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on site.

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

A-8 FLUIDS MANAGEMENT

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

Contaminated liquids from decontamination of equipment and personnel will be pumped into storage tanks (such as fractionalization (frac) tanks or drums) and disposed of off-site. A licensed liquid waste hauler will remove this liquid from the site and properly dispose of this material in accordance with all applicable regulations. Solid material collected in the frac tank, as a result of settling, will be bulked with soils and sent to an appropriately licensed disposal facility, as necessary. Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

A-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities, the cover system will be restored in a manner that complies with the ROD or a new system installed in a manner that complies with the ROD. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the 'Remaining Contamination'. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the Site Management Plan.

A-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site.

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

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

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

A-11 STORMWATER POLLUTION CONTROL PLAN

A detailed stormwater pollution control plan (SPCP) will be prepared if an excavation exceeding 1 acre is planned. Below are the minimal SPCP requirements. Additional considerations are presented in an Appendix F – Stormwater pollution control plan.

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

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

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

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

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

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

A-12 CONTINGENCY PLAN

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

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for BTEX and 17 PAH, as previously identified contaminants of concern related to former MGP operations.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the periodic reports prepared pursuant to Section 5 of the SMP.

A-13 COMMUNITY AIR MONITORING PLAN

A site-specific Community Air Monitoring Plan ("CAMP") was prepared for the site as part of the Remedial Action. The CAMP is included in Appendix E of the SMP for reference purposes. The CAMP is in compliance with DER-10 and all other applicable Federal, State, and local regulations. Based on future changes to State and Federal health and safety requirements, and specific methods employed by future contractors, the CAMP will be updated and re-submitted for NYSDEC approval prior to intrusive work at the Site.

The CAMP will be designed to provide monitoring procedures, Alert Limits, Action Limits, and contingency measures if Action Limits are approached. An Alert Limit is a contaminant concentration or odor intensity that triggers contingent measures. An Alert Limit does not suggest the existence of a health hazard, but serves instead as a screening tool to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants and odors during intrusive activities. An Action Limit is a contaminant concentration or odor intensity that triggers work stoppage.

During times of ground intrusive activities in areas with remaining contamination, fence line perimeter air monitoring will be conducted using a combination of real-time (continuous and almost instantaneous) air monitoring at fixed locations and walk-around supplemental monitoring using hand-held instruments on an as-needed basis. Contaminants commonly found at former MGP sites will be monitored, including VOCs and dust. The CAMP will include a plan that defines Alert Levels, Action Levels, and specific response activities to be implemented during working hours if an exceedance of an Alert Limit or Action Limit for a measured compound occurs. The response actions, potentially including work stoppage, are intended to prevent or significantly reduce the migration of airborne contaminants from the site.

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

A-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site, if there are residents or tenants on the property. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

Odors can be expected when disturbing the ISS mass, soil outside of the previously excavated areas, and bedrock. Odor suppressant systems consisting of chemical foam (e.g., Rusmar foam, Biosolve®) or other approved methods may be provided to prevent odors, if necessary. The Site owner shall keep sufficient odor suppressant on site to manage the odors generated from the excavated materials, including, but not limited to open excavations, limited stockpiles, or materials loaded into trucks for transportation and disposal. The odor suppressant system will be stored near the excavation and will be easily mobile. Open excavations will be backfilled or covered at the end of each working day to suppress odors, if necessary. Odor mitigation measures should be in place prior to disturbing ISS, bedrock, or soil outside of the previously excavated areas.

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

A-15 DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.

In recognition of this potential hazard, the NYSDOH has promulgated a CAMP that establishes action levels of respirable dust and VOCs that are protective of the surrounding community. The requirements of the CAMP are contained in Appendix 1A of the DER-10 Technical Guidance for the Site Investigations and Remediation. The CAMP is intended to supplement, but be discrete from the air-monitoring program implemented by the Site owner for purposes of evaluating site worker health and safety. Conditions within the excavation area will be monitored in accordance with the Site owner's HASP. Conditions on the perimeter will be monitored in accordance with the CAMP.

A-16 IN SITU SOLIDIFIED MATERIAL

In-situ solidification ("ISS") was conducted in the northeast section of the Hudson Vista Associates Property, which is adjacent to the south boundary of the former MGP site. ISS of impacted soils was also performed at the Lower Terrace of the Site during the two mobilizations: for the main part of the Lower Terrace as a part of OU1 remediation, and the area between the OU1 Lower Terrace ISS and the spring high water elevation of the Hudson River. ISS using jet grouting was performed on the perimeter of

Lower Terrace OU1 and parts of OU2, and to address impacts beneath obstructions that could not be effectively reached using the auger mix method.

The grout mixture consisted of Portland cement, bentonite, and water. The dry reagent to water ratio were determined from the ISS Treatability Studies, preceding the ISS phase. The table below summarizes design mixing parameters and compressive strength results for the auger-mixed solidified soil:

Property	Cement, %	Bentonite, %	W:R	Compressive strength, pounds per square inch
Hudson Vista Associates Property	7.5	0.5	1:1	25.3 to 131
OU1 Lower Terrace	8	0.5	1.5:1	31.9 to 142
OU2 Lower Terrace	9	-	1:1 to 1.2:1	55 to 290

Notes: W:R - water to reagent ratio
psi - pounds per square inch

Jet grouted soil comprises less than 10 percent of the total volume of solidified material Jet-grout solidified material in general has higher compressive strength, than the auger-mixed soil, available testing results show compressive strength between 290 and 1155 psi, as compared to the common concrete strength of 2500 psi and higher.

In accordance with the ROD the entire Site needs to be covered with at least two feet of clean fill (compliant with Restricted Residential SCOs), pavement, or buildings. In addition, solidified soil will need to be protected from frost damage and wave erosion, and isolated from the environment.

APPENDIX B – RESPONSIBILITIES OF OWNER AND REMEDIAL PARTY

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the Nyack Former Manufactured Gas Plant Site (the "Site"), NYSDEC Site # 344046, are divided between the Site owner(s) and Site Remedial Party, as defined below.

The owner(s) is/are currently listed as:

Athene Annuity & Life Assurance Company of New York ("owner" of the Site)
Hudson Vista Associates (the "owner" of the Hudson Vista Associates Property)

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: satisfactory completion letter holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf.

The RP for the Nyack Former MGP Site is:

Orange and Rockland Utilities, Inc.
3 Old Chester Road
Goshen, New York 10924

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the Site.

Owner's Responsibilities:

1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the Site.

2) The owner shall annually certify, in writing, that all Institutional Controls set forth in the required Environmental Easement and SMP for the Site remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the Site's Periodic Review Report (PRR) certification to the NYSDEC.

3) In the event the Site is delisted from the NYS Registry of Inactive Hazardous Waste Disposal Site, the owner remains bound by the Environmental Easement for the Site and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4) The owner shall grant access to the Site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) The owner is responsible for assuring the security of the Engineering Controls (such as the soil cover, monitoring wells) located on its property to the best of its ability. In the event that damage to the Engineering Controls or vandalism is evident, the owner shall notify the Site's RP and NYSDEC in accordance with the timeframes indicated in Section 2.4.2 - Notifications.

6) In the event some action or inaction by the owner adversely impacts the Site, the owner must notify the Site's RP and the NYSDEC in accordance with the time frame indicated in Section 2.4.2 - Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7) The owner must notify the Site RP and the NYSDEC of any change in ownership of the property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site property. 6 NYCRR Part 375 contains notification requirements applicable to any construction or activity changes and changes in property ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4.2 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) The owner will maintain a minimum of a two foot clean soil cover over all bedrock and all areas where ISS has been performed by the RP.

9) If a vapor barrier or soil vapor intrusion mitigation system is needed, the owner is responsible for the installation, operation, maintenance and repair of the system until such time as the NYSDEC deems the vapor mitigation system unnecessary. The owner shall operate and maintain the system, and report any maintenance issues to the RP and the NYSDEC.

10) In accordance with Section 27-2405 of the NYS Environmental Conservation Law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to the structures and that exceeds NYSDOH or OSHA guidelines on the Site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Remedial Party Responsibilities

1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the Site.

2) Subject to the owner's cooperation and certifications, the RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, annual certification, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.

3) Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.

4) If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).

5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

6) The RP shall notify the NYSDEC of any damage to or modification of the systems of which the RP becomes aware as required under Section 2.4.2 - Notifications of the SMP.

7) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit to the NYSDEC for approval an amended SMP.

8) Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX C – METES AND BOUNDS

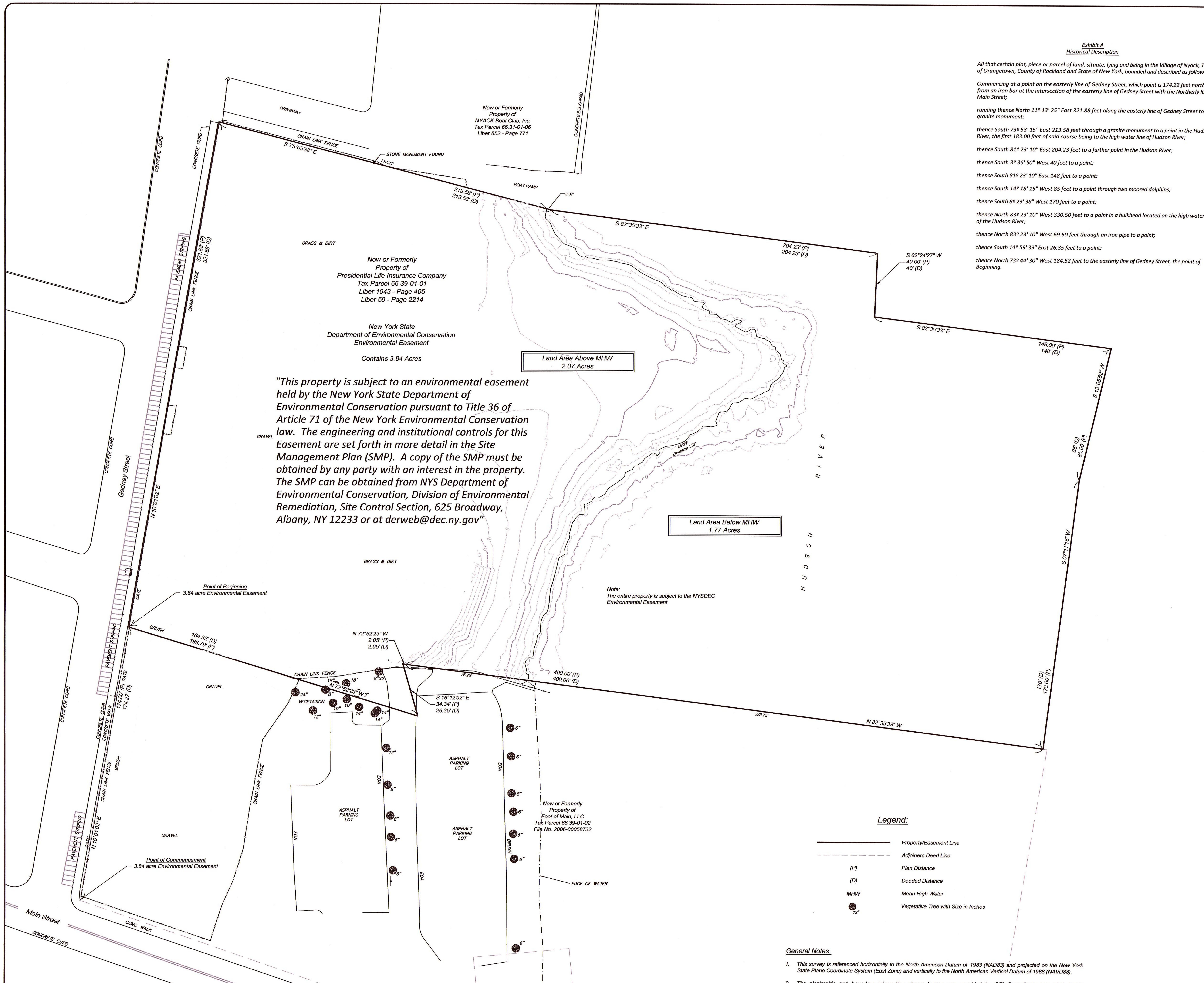


Exhibit A
Historical Description

All that certain plot, piece or parcel of land, situate, lying and being in the Village of Nyack, Town of Orangetown, County of Rockland and State of New York, bounded and described as follows:

Commencing at a point on the easterly line of Gedney Street, which point is 174.22 feet northerly from an iron bar at the intersection of the easterly line of Gedney Street with the Northerly line of Main Street;

running thence North 11º 13' 25" East 321.88 feet along the easterly line of Gedney Street to a granite monument;

thence South 73º 53' 15" East 213.58 feet through a granite monument to a point in the Hudson River, the first 183.00 feet of said course being to the high water line of Hudson River;

thence South 81º 23' 10" East 204.23 feet to a further point in the Hudson River;

thence South 3º 36' 50" West 40 feet to a point;

thence South 81º 23' 10" East 148 feet to a point;

thence South 14º 18' 15" West 85 feet to a point through two moored dolphins;

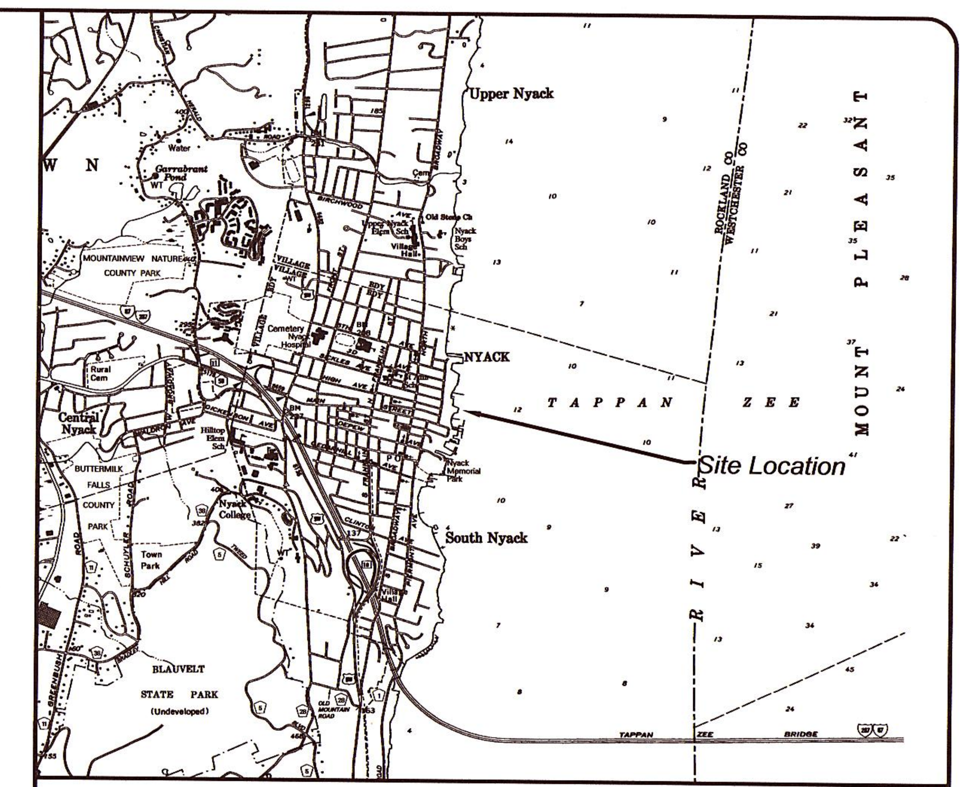
thence South 8º 23' 38" West 170 feet to a point;

thence North 83º 23' 10" West 330.50 feet to a point in a bulkhead located on the high water line of the Hudson River;

thence North 83º 23' 10" West 69.50 feet through an iron pipe to a point;

thence South 14º 59' 39" East 26.35 feet to a point;

thence North 73º 44' 30" West 184.52 feet to the easterly line of Gedney Street, the point of Beginning.



NYSDOT Quadrangle
NYACK, New York
No Scale

Environmental Easement
To Be Acquired By
New York State Department of Environmental Conservation
From
Presidential Life Insurance Company

Surveyor's Modern Description

All that tract or parcel of land situate in the Village of Nyack, County of Rockland, State of New York, and being more precisely described as follows:

Commencing at the intersection of the easterly bounds of Gedney Street with the northerly bounds of Main Street, said point being the southwesterly corner of a parcel of land conveyed by Hudson Vista Associates, Inc. to Foot of Main, LLC by deed dated October 24, 2006 and recorded in the Rockland County Clerk's Office on November 6, 2006 as File No. 2006-00058732;

thence continuing North 10 degrees 01 minutes 02 seconds East, along the easterly bounds of Gedney Street, a distance of 174.00 feet to a point, said point being the **Point of Beginning;**

thence North 10 degrees 01 minutes 02 seconds East, along the easterly bounds of Gedney Street, a distance of 321.88 feet to the southwesterly corner of a parcel of land conveyed by Emily Joan Donato to Nyack Boat Club, Inc. by deed dated December 6, 1968 and recorded in the Rockland County Clerk's office on December 9, 1968 in Liber 852 of Deeds at Page 771;

thence along the southerly line of Nyack Boat Club, Inc., the following four courses and distances:

1. South 75 degrees 05 minutes 38 seconds East a distance of 213.58 feet to a point in the Hudson River, said course passing over the high water line of the Hudson River at a distance of 210.21 feet;
2. South 82 degrees 35 minutes 33 seconds East, within the Hudson River, a distance of 204.23feet;
3. South 02 degrees 24 minutes 27 seconds West, within the Hudson River, a distance of 40.00 feet;
4. South 82 degrees 35 minutes 33 seconds East, within the Hudson River, a distance of 148.00 feet;

thence continuing the Hudson River, the following two courses and distances:

1. South 13 degrees 05 minutes 52 seconds West a distance of 85.00 feet to a point;
2. South 07 degrees 11 minutes 15 seconds West a distance of 170.00 feet to a point on the northerly line of Foot of Main, LLC;

thence along the northerly line of Foot of Main, LLC, the following four courses and distances:

1. North 82 degrees 35 minutes 33 seconds West a distance of 400.00 feet to a point, said course passing over the high water line of the Hudson River at a distance of 323.75 feet ;
2. North 75 degrees 52 minutes 23 seconds West a distance of 2.05 feet to a point;
3. South 16 degrees 12 minutes 02 seconds Eat a distance of 34.34 feet to a point;
4. North 72 degrees 52 minutes 23 seconds West a distance of 188.79 feet to the **Point of Beginning.**

To contain 3.84-acres of land, more or less.

The above-described parcel is intended to be a portion of the same premises conveyed by F. W. D. Properties, Inc. by deed dated May 14, 1980 and recorded in the Rockland County Clerk's Office on May 15, 1980 in Liber 1043 of Deeds at Page 405.

The above mentioned bearings and distances were taken from a map titled "Boundary Survey for TZ VISTA LLC, Section 66.39 Block 1 Lot 1, Section 66.38 Block 2 Lot 14 & 15, Village of NYACK, Rockland County, New York State", dated September 4, 2014, prepared by Maser Consultants P.C., and is distinguished as Project No. 0003038.

	The Battery (Station 8518750)	Tarrytown (Station 8518919)
Reference Datum	NAVD88	NAVD88
Mean Higher-High Water	2.27	1.59
Mean High Water	1.95	1.37
NAVD88	0.00	0.00
Mean Sea Level	-0.21	-0.15
Mean Low Water	-2.58	-1.81
Mean Lower-Low Water	-2.78	-1.95

The Battery (Station 8518750) is the referenced harmonic tide gauge station for the subordinate tide gauge station Tarrytown (Station 8518919). The heights at The Battery are multiplied by 0.70 to obtain the tide gauge elevations at Tarrytown.

GRAPHIC SCALE
(IN FEET)
1 inch = 30 ft.
(IN METERS)
1 cm = 3.6 m

General Notes:

1. This survey is referenced horizontally to the North American Datum of 1983 (NAD83) and projected on the New York State Plane Coordinate System (East Zone) and vertically to the North American Vertical Datum of 1988 (NAVD88).
2. The planimetric and boundary information shown hereon was provided by GEI Consultants, Inc., P.C. in an AutoCAD.DWG file format, prepared by Maser Consultants, P.C. as cited in the reference drawings. Thew Associates PE-LS, PLLC did not perform a boundary retracement survey of the 3.84-acre parcel and relied on the survey prepared by Maser Consultants, P.C. to prepare the legal description of the Environmental Easement.
3. The contours shown hereon were generated in an Autodesk Civil 3D environment, referenced to the North American Vertical Datum of 1988 (NAVD88), and are based on an instrument survey completed by Thew Associates PE-LS, PLLC on February 4, 2015.

Reference Drawings:

1. "Boundary Survey for TZ VISTA LLC, Section 66.39 Block 1 Lot 1, Section 66.38 Block 2 Lot 14 & 15, Village of NYACK, Rockland County, new York State", dated September 4, 2014, prepared by Maser Consultants P.C., and is distinguished as Project No. 0003038.

NYSDEC Environmental Easement Control Notes:

1. This Environmental Easement requires compliance with the Department approved Site Management Plan.
2. This Environmental Easement requires the property owner to complete and submit to the NYSDEC a periodic certification of institutional and engineering control in accordance with Part 375-1.8 (h)(3).
3. This Environmental Easement allows the use and development of the controlled property for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), though land use is subject to local zoning laws.
4. This Environmental Easement restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH.
5. This Environmental Easement prohibits agricultural or vegetable garedens on the controlled property.

Unauthorized alteration or addition to a survey map bearing a licensed land surveyors seal is a violation of Section 7209, Subdivision 2 of the New York State Education Law.

Only copies from the original of this survey marked with an original of the surveyor's inked seal or his embossed seal shall be considered to be valid and true copies.

REV	DESCRIPTION	DATE

STATE OF NEW YORK · JEREMY LEE SWEENEY · No. 050863-1 · LICENSED LAND SURVEYOR

DRAWN:
CHECKED:
SCALE: 1" = 30'
DATE: 06/03/2015
PROJECT NUMBER: CK3615-03-15

Map Showing
NYSDEC Environmental Easement
55 Gedney Street, Nyack, New York 10960
Former Nyack MGP Site

Village of Nyack
County of Rockland
State of New York

P.O. Box 463
6431 US Highway 11
Canton, New York 13617
T: 315/386-2776
F: 315/386-1012
Thew Associates
LAND SURVEYORS
www.ThewAssociates.com
9478 River Road
Marcy, New York 13403
T: 315/733-7278
F: 315/797-1957

APPENDIX D – ENVIRONMENTAL EASEMENT

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

THIS INDENTURE made this 30th day of March, 2016, between Owner(s) Athene Annuity & Life Assurance Company of New York f/k/a Presidential Life Insurance Company, having an office at 69 Lydecker Street, Nyack, New York 10960, County of Rockland, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

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

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

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

WHEREAS, Grantor, is the owner of real property located at the address of 55 Gedney Street in the Village of Nyack, Town of Orangetown, County of Rockland and State of New York, known and designated on the tax map of the County Clerk of Rockland as tax map parcel numbers: Section 66.39 Block 1 Lot 1, being the same as that property conveyed to Grantor by deed dated May 14, 1980 and recorded in the Rockland County Clerk's Office in Liber and Page 1043/405. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 3.84 +/- acres, and is hereinafter more fully described in the Land Title Survey dated June 3, 2015 and last revised January 26, 2016 prepared by Jeremy Lee Sweeney, LLS of Thew Associates, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

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

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D3-0001-98-08 as modified August 31, 2005, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

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

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

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

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

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

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

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

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

(6) Data and information pertinent to Site Management of the Controlled

Property must be reported at the frequency and in a manner defined in the SMP;

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

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

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

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

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

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

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

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

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

This property is subject to an Environmental Easement held

by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

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

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

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

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

(i) are in-place;

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

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

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

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

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

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

(7) the information presented is accurate and complete.

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

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

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

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

5. Enforcement

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

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

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

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

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

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

Parties shall address correspondence to:

Site Number: 344046
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

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

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

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

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

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

Remainder of Page Intentionally Left Blank

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

Athene Annuity & Life Assurance Company of New York:

By: ______________________

Print Name: Guy H. Smith III

Title: President Date: February 26, 2016

State of South Carolina)

County of Greenville)

Grantor's Acknowledgment

The foregoing instrument was acknowledged before me this 26th day of February, 2016 by Guy H. Smith III, President of Athene Annuity & Life Assurance Company of New York, a New York corporation, and that he executed the instrument on behalf of the corporation.

Robert T. Coleman III

Notary Public for South Carolina

Print Name: Robert T. Coleman III

My commission expires: 4-14-2021

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

By: ______________________________
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

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

On the 30th day of March, in the year 2016, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2018

SCHEDULE "A" PROPERTY DESCRIPTION

All that tract or parcel of land situate in the Village of Nyack, County of Rockland, State of New York, and being more precisely described as follows:

Commencing at the intersection of the easterly bounds of Gedney Street with the northerly bounds of Main Street, said point being the southwesterly corner of a parcel of land conveyed by Hudson Vista Associates, Inc. to Foot of Main, LLC by deed dated October 24, 2006 and recorded in the Rockland County Clerk's Office on November 6, 2006 as File No. 2006-00058732;

thence continuing North 10 degrees 01 minutes 02 seconds East, along the easterly bounds of Gedney Street, a distance of 174.00 feet to a point, said point being the **Point of Beginning**;

thence North 10 degrees 01 minutes 02 seconds East, along the easterly bounds of Gedney Street, a distance of 321.88 feet to the southwesterly corner of a parcel of land conveyed by Emily Joan Donato to Nyack Boat Club, Inc. by deed dated December 6, 1968 and recorded in the Rockland County Clerk's office on December 9, 1968 in Liber 852 of Deeds at Page 771;

thence along the southerly line of Nyack Boat Club, Inc., the following four courses and distances:

1. South 75 degrees 05 minutes 38 seconds East a distance of 213.58 feet to a point in the Hudson River, said course passing over the high water line of the Hudson River at a distance of 210.21 feet;
2. South 82 degrees 35 minutes 33 seconds East, within the Hudson River, a distance of 204.23feet;
3. South 02 degrees 24 minutes 27 seconds West, within the Hudson River, a distance of 40.00 feet;
4. South 82 degrees 35 minutes 33 seconds East, within the Hudson River, a distance of 148.00 feet;

thence continuing the Hudson River, the following two courses and distances:

1. South 13 degrees 05 minutes 52 seconds West a distance of 85.00 feet to a point;
2. South 07 degrees 11 minutes 15 seconds West a distance of 170.00 feet to a point on the northerly line of Foot of Main, LLC;

thence along the northerly line of Foot of Main, LLC, the following four courses and distances:

1. North 82 degrees 35 minutes 33 seconds West a distance of 400.00 feet to a point, said course passing over the high water line of the Hudson River at a distance of 323.75 feet ;

2. North 72 degrees 52 minutes 23 seconds West a distance of 2.05 feet to a point;

3. South 16 degrees 12 minutes 02 seconds Eat a distance of 34.34 feet to a point;

4. North 72 degrees 52 minutes 23 seconds West a distance of 188.79 feet to the Point of Beginning.

To contain 3.84-acres of land, more or less.

The above-described parcel is intended to be a portion of the same premises conveyed by F. W. D. Properties, Inc. by deed dated May 14, 1980 and recorded in the Rockland County Clerk's Office on May 15, 1980 in Liber 1043 of Deeds at Page 405.

The above mentioned bearings and distances were taken from a map titled "Boundary Survey for TZ VISTA LLC, Section 66.39 Block 1 Lot 1, Section 66.38 Block 2 Lot 14 & 15, Village of NYACK, Rockland County, New York State", dated September 4, 2014, prepared by Maser Consultants P.C., and is distinguished as Project No. 0003038.

TP-584 (4/13)

New York State Department of Taxation and Finance

Combined Real Estate Transfer Tax Return, Credit Line Mortgage Certificate, and Certification of Exemption from the Payment of Estimated Personal Income Tax

Recording office time stamp

See Form TP-584-I, Instructions for Form TP-584, before completing this form. Print or type.

Schedule A — Information relating to conveyance

Grantor/Transferor
☐ Individual
☒ Corporation
☐ Partnership
☐ Estate/Trust
☐ Single member LLC
☐ Other

Name (if individual, last, first, middle initial) (☐ check if more than one grantor): Athene Annuity & Life Assurance Company of New York
Social security number:
Mailing address: 69 Lydecker Street
Social security number:
City: Nyack State: NY ZIP code: 10960
Federal EIN: 13-2570714
Single member's name if grantor is a single member LLC (see instructions):
Single member EIN or SSN:

Grantee/Transferee
☐ Individual
☐ Corporation
☐ Partnership
☐ Estate/Trust
☐ Single member LLC
☒ Other

Name (if individual, last, first, middle initial) (☐ check if more than one grantee): New York State Department of Environmental Conservation
Social security number:
Mailing address: 625 Broadway
Social security number:
City: Albany State: NY ZIP code: 12233
Federal EIN: 14-6013200
Single member's name if grantee is a single member LLC (see instructions):
Single member EIN or SSN:

Location and description of property conveyed

Tax map designation – Section, block & lot (include dots and dashes)	SWIS code (six digits)	Street address	City, town, or village	County
66.39-01-01	392403	55 Gedney Street	Nyack	Rockland

Type of property conveyed (check applicable box)

1 ☐ One- to three-family house
2 ☐ Residential cooperative
3 ☐ Residential condominium
4 ☒ Vacant land
5 ☐ Commercial/Industrial
6 ☐ Apartment building
7 ☐ Office building
8 ☐ Other ______

Date of conveyance: 3 / 30 / 16 (month / day / year)

Percentage of real property conveyed which is residential real property 0 % (see instructions)

Condition of conveyance (check all that apply)

a. ☐ Conveyance of fee interest
b. ☐ Acquisition of a controlling interest (state percentage acquired ______%)
c. ☐ Transfer of a controlling interest (state percentage transferred ______%)
d. ☐ Conveyance to cooperative housing corporation
e. ☐ Conveyance pursuant to or in lieu of foreclosure or enforcement of security interest (attach Form TP-584.1, Schedule E)
f. ☐ Conveyance which consists of a mere change of identity or form of ownership or organization (attach Form TP-584.1, Schedule F)
g. ☐ Conveyance for which credit for tax previously paid will be claimed (attach Form TP-584.1, Schedule G)
h. ☐ Conveyance of cooperative apartment(s)
i. ☐ Syndication
j. ☐ Conveyance of air rights or development rights
k. ☐ Contract assignment
l. ☐ Option assignment or surrender
m. ☐ Leasehold assignment or surrender
n. ☐ Leasehold grant
o. ☒ Conveyance of an easement
p. ☒ Conveyance for which exemption from transfer tax claimed (complete Schedule B, Part III)
q. ☐ Conveyance of property partly within and partly outside the state
r. ☐ Conveyance pursuant to divorce or separation
s. ☐ Other (describe) ______

For recording officer's use	Amount received	Date received	Transaction number
	Schedule B., Part I $ Schedule B., Part II $		

Schedule C — Credit Line Mortgage Certificate (Tax Law, Article 11)

Complete the following only if the interest being transferred is a fee simple interest.
I (we) certify that: *(check the appropriate box)*

1. ☐ The real property being sold or transferred is not subject to an outstanding credit line mortgage.

2. ☐ The real property being sold or transferred is subject to an outstanding credit line mortgage. However, an exemption from the tax is claimed for the following reason:

   ☐ The transfer of real property is a transfer of a fee simple interest to a person or persons who held a fee simple interest in the real property (whether as a joint tenant, a tenant in common or otherwise) immediately before the transfer.

   ☐ The transfer of real property is (A) to a person or persons related by blood, marriage or adoption to the original obligor or to one or more of the original obligors or (B) to a person or entity where 50% or more of the beneficial interest in such real property after the transfer is held by the transferor or such related person or persons (as in the case of a transfer to a trustee for the benefit of a minor or the transfer to a trust for the benefit of the transferor).

   ☐ The transfer of real property is a transfer to a trustee in bankruptcy, a receiver, assignee, or other officer of a court.

   ☐ The maximum principal amount secured by the credit line mortgage is $3,000,000 or more, and the real property being sold or transferred is **not** principally improved nor will it be improved by a one- to six-family owner-occupied residence or dwelling.

   Please note: for purposes of determining whether the maximum principal amount secured is $3,000,000 or more as described above, the amounts secured by two or more credit line mortgages may be aggregated under certain circumstances. See TSB-M-96(6)-R for more information regarding these aggregation requirements.

   ☐ Other *(attach detailed explanation).*

3. ☐ The real property being transferred is presently subject to an outstanding credit line mortgage. However, no tax is due for the following reason:

   ☐ A certificate of discharge of the credit line mortgage is being offered at the time of recording the deed.

   ☐ A check has been drawn payable for transmission to the credit line mortgagee or his agent for the balance due, and a satisfaction of such mortgage will be recorded as soon as it is available.

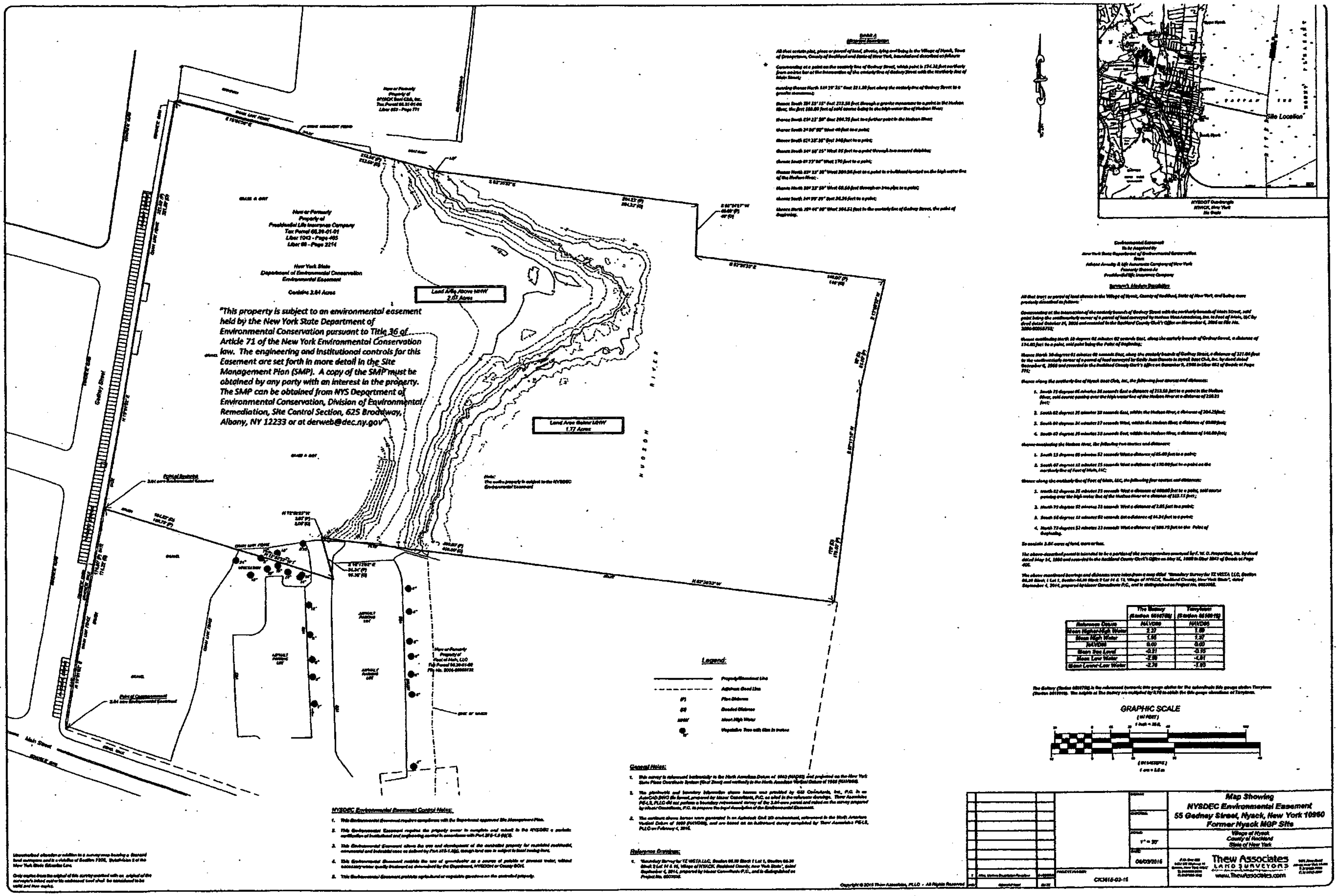
4. ☐ The real property being transferred is subject to an outstanding credit line mortgage recorded in ______________ (insert liber and page or reel or other identification of the mortgage). The maximum principal amount of debt or obligation secured by the mortgage is ______________. No exemption from tax is claimed and the tax of ______________ is being paid herewith. *(Make check payable to county clerk where deed will be recorded or, if the recording is to take place in New York City but not in Richmond County, make check payable to the **NYC Department of Finance.**)*

Signature (both the grantor(s) and grantee(s) must sign)

The undersigned certify that the above information contained in schedules A, B, and C, including any return, certification, schedule, or attachment, is to the best of his/her knowledge, true and complete, and authorize the person(s) submitting such form on their behalf to receive a copy for purposes of recording the deed or other instrument effecting the conveyance.

[signature] Grantor signature Guy H. Smith III	President Title	[signature] Grantee signature Andrew Guglielmi NYSBRC	Attorney Title
Grantor signature	Title	Grantee signature	Title

Reminder: Did you complete all of the required information in Schedules A, B, and C? Are you required to complete Schedule D? If you checked *e*, *f*, or *g* in Schedule A, did you complete Form TP-584.1? Have you attached your check(s) made payable to the county clerk where recording will take place or, if the recording is in the New York City boroughs of Manhattan, Bronx, Brooklyn, or Queens, to the ***NYC Department of Finance***? If no recording is required, send your check(s), made payable to the ***Department of Taxation and Finance,*** directly to the NYS Tax Department, RETT Return Processing, PO Box 5045, Albany NY 12205-5045.


"This property is subject to an environmental easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation law. The engineering and institutional controls for this Easement are set forth in more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@dec.ny.gov"
Land Area Above MHW
Land Area Below MHW
1.77 Acres
HUDSON RIVER
Gedney Street
Main Street
Legend:
General Notes:
Reference Drawings:
NYSDEC Environmental Easement Control Notes:
Site Location
GRAPHIC SCALE
Map Showing
NYSDEC Environmental Easement
55 Gedney Street, Nyack, New York 10960
Former Nyack MGP Site
Village of Nyack
County of Rockland
State of New York
1" = 30'
06/03/2016
Thew Associates
LAND SURVEYORS
www.ThewAssociates.com
CK3615-03-15

APPENDIX E – HEALTH AND SAFETY PLAN AND COMMUNITY AIR MONITORING PLAN

HASP and CAMP will be developed for the long-term site monitoring plan by the party implementing these activities. Included with this SMP are the existing NYSDEC-approved plans.

Geotechnical
Environmental and
Water Resources
Engineering

Health and Safety Plan

Nyack Manufactured Gas Plant Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
GEI Consultants, Inc.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist

Table of Contents

Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
BTEX	Benzene, Toluene, Ethylbenzene, Total Xylenes
CHSO	Corporate Health and Safety Officer
CMS	Chip Measurement System
CNS	Central Nervous System
COC	Compounds of Concern
CRZ	Contamination Reduction Zone
CSO	Combined Sewer Overflow
EPA	United States Environmental Protection Agency
EZ	Exclusion Zone
GEI	GEI Consultants, Inc.
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
LEL	Lower Explosive Limit
MGP	Manufactured Gas Plant
MSDS	Material Safety Data Sheet
NAPL	Non-aqueous Phase Liquid
NFPA	National Fire Protection Association
NYSDEC	New York State Department of Environmental Conservation
O&R	Orange & Rockland Utilities, Inc.
OSHA	Occupational Health and Safety Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated bipenyls
PEL	Permissible Exposure Level
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
SZ	Support Zone
USCG	United States Coast Guard
VOC	Volatile Organic Compounds
WNV	West Nile Virus

1.0 Background Information

1.1 General

Consultant	GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 607.216.8955
Project Name	Pre-Design Investigation Nyack MGP Site Village of Nyack, Rockland County, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the former manufactured gas plant (MGP) located on Orange & Rockland Utilities, Inc. (O&R) property and adjacent areas in the Village of Nyack, New York. Reading of the HASP is required of all on-site GEI personnel and GEI subcontractors. GEI subcontractors are required to develop their own site-specific HASP and may use this as a guide. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. In addition to GEI's HASP, all site personnel and subcontractor staff must have read and adhere to O&R's site-specific EHASP.

1.2 Project Description

The work scope is described in the Pre-Design Investigation (PDI) Work Plan. The activities for the investigation are summarized as follows:

- Subsurface utilities will be located by calling Dig Safely New York and a site meeting held with any companies or municipalities with subsurface utilities present.
- Subsurface soil borings will be advanced in order to obtain additional information regarding the thickness and composition of fill beneath the site; to determine the depth to the water table; to observe and screen subsurface soil in order to identify conditions that may be indicative of impacts by MGP or other residuals; to obtain additional information to map the surface of the bedrock unit; and to obtain geotechnical data for the PDI.
- Sediment sampling will be performed using the vibracore method in adjacent areas of the Hudson River.

- A survey will be performed for all the investigation sample points and the shoreline area.
- A bathymetric survey and magnetometer survey will be performed in the Hudson River area.

1.3 Site Description

The Nyack MGP site is located between Gedney Street and the Hudson River in the Village of Nyack, New York. The site covers a total of approximately 4.02 acres, of which approximately 1.7 acres is submerged land in the Hudson River. The site is located in an urban setting where land surrounding the site is used for residential and commercial purposes. The PDI will be performed in the OU2 Area of the site. OU2 is defined as the terrestrial portion of the site outside of the soils which were subjected to in-situ solidification (ISS), and the adjacent portion of the Hudson River which shows indications of impact by MGP residuals.

2.0 Statement of Safety and Health Policy

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

3.0 Hazard/Risk Analysis

Physical hazards associated with heavy equipment operations are present. The heavy equipment associated with this project will include drilling equipment, manual soil sampling equipment, excavation equipment, and vibra-core sediment sampling equipment mounted on a small boat. Some of the hazards associated with this equipment include crushing of limbs, slipping, tripping, or falling, heavy lifting, and drowning.

The Drilling Contractor will verify that all electric, gas, water, steam, sewer, and other services lines should be shut off, capped, or otherwise controlled, at or outside the work areas before work is started. In each case, any utility company that is involved will be notified in advance by the Drilling Contractor, and its approval or services, if necessary, shall be obtained.

The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

3.1 Personal Safety

Field activities have the potential to take site workers into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- www.crimereports.com
- www.cityrating.com/crimestatistics.asp
- www.crimemapping.com

South Nyack, New York is listed on the City Rating website as having a crime rate (total incidents) of 47 in 2009, of which 8 were violent crimes. The Crime Reports website lists 0 criminal reports for fourth quarter 2011.

To protect yourself, take the following precautions:

- Use the buddy system (teams of a minimum of two persons present)
- Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave
- Call in regularly
- Pay attention to what is going on around you
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely

Site workers must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If site workers encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area of concern, and contact local 911 for assistance. Notify the SSO and Corporate Health and Safety Officer (CHSO) of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on site. Confirmation of cellular phone operation and site worker safety will be confirmed at the start, mid-point, and near the end of each working day.

3.2 Activity Hazard Analysis

The potential hazards for this project have been categorized into site and activity hazards. Site hazards are those hazards associated with site conditions, and activity hazards are associated with GEI on-site activities. The potential hazards and control measures established to reduce the risk of injury or illness are identified in the following tables. Safe operating procedures established for routine hazards and common site conditions are included in the table below, or contained in the GEI Corporate Health and Safety Manual.

3.2.1 Activity Hazard Analysis Table

SITE HAZARDS	
Potential Hazard	**Control Measures**
Construction Safety	▪ Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. Coordinate hand signals with operators. ▪ Stay Alert! Pay attention to equipment backup alarms and swing radii. ▪ Wear a high visibility vest when working near equipment or motor vehicle traffic. ▪ Position yourself in a safe location when filling out logs and talking with the contractor. ▪ Notify the contractor immediately if any problems arise. ▪ Do not stand or sit under suspended loads or near any pressurized equipment lines. ▪ Do not operate cellular telephones in the vicinity of heavy equipment operation.
Physical Injury	▪ Wear steel toe/steel shank safety boots in good condition with non-slip soles. ▪ Maintain good visibility of the work area. ▪ Avoid walking on uneven or debris ridden ground surfaces.
Noise	▪ Wear hearing protection when near loud noises. ▪ Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection.
Heat/Cold Stress	▪ Increase water intake while working. ▪ Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in cool, dry areas. ▪ Watch for signs and symptoms of heat exhaustion/cold stress and fatigue. ▪ In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures. ▪ See Heat Stress/Cold Stress Guidelines in Appendix C.
Vehicular Traffic	▪ Wear traffic safety vest at all times. ▪ Use cones, flags, barricades, and caution tape to define work area. ▪ Use a "spotter" to locate oncoming vehicles. ▪ Use vehicle to block work area. ▪ Engage police detail if needed.
Boating Safety	▪ Use caution when boarding the boat. ▪ Establish a safe area for boarding and de-boarding. ▪ Do not stand in the boat. Avoid sudden movements. ▪ Stay away from the edge of the boat. ▪ Wear a PDF at all times when on the water or working near water where there is a potential for falling in.

Utilities	▪ Check that contractor has cleared underground utilities before any intrusive activities, and that contractor has coordinated with utility locating services, property owner(s) or utility companies. ▪ Utilities are to be considered live or active until documented otherwise. ▪ For overhead utilities within 50 feet, have contractor determine with the utility company the appropriate safe distance. Minimum distance for clearance is based on voltage of the line. ▪ An observer will be established when operating drilling rigs near overhead utilities. ▪ Several subsurface soil borings will be advanced inside of the active O&R electrical substation fenced area. All GEI staff assigned to the site and all GEI subcontractor staff will have completed O&R's substation work training class before mobilization. The GEI Site Manager will document attendance for the training. No GEI or subcontractor staff will enter the substation area without a O&R substation oversight staff present, without exceptions.

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
Entering Construction Site	Heavy equipment, dust, noise.	Hard hat, orange safety vest, steel-toed, steel-shank boots, safety glasses, and nitrile/neoprene gloves.
Drilling	Heavy equipment, dust, noise.	In addition to the PPE listed above for "Entering Construction Site" hearing protection (ear plugs or ear muffs) will be utilized.
Soil Excavation and Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hat, safety glasses, and hearing protection. Maintain eye contact with equipment operator.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and traffic safety vests in accordance with Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Excavation	Maintain proper distance from edge of excavation; be alert for unstable soil conditions/wall collapse. Do not enter excavations.

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek™) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photo-ionization detector and multiple gas meter (that monitors % oxygen, and lower explosive limit), and dust monitor to monitor the work zone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, then upgrade to full face respirator with HEPA/organic vapor cartridge as indicated in Section 4.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with Appendix D.
Subsurface Boring/ Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hat, safety glasses, and hearing protection. Maintain eye contact with equipment operator.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and traffic safety vests in accordance with Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek™) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photo-ionization detector and multiple gas meter (that monitors % oxygen, lower explosive limit, hydrogen sulfide and hydrogen cyanide), and dust monitor to monitor the work zone as

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
		specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, then upgrade to full face respirator with HEPA/organic vapor cartridge as indicated in Section 4.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the GEI CAMP.
Sediment Sampling	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall/ Drowning	Maintain safe and orderly work areas. Wear approved floatation device. Identify and prepare potential tripping hazards on the boat. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
Survey	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
Personal Protective Equipment (PPE) is the *initial level of protection* based on the activity hazards and Site conditions which have been identified. *Upgrades to respiratory protection may be required based on the designated action levels.* General on-site provisions shall include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek®) with boot covers, drinking water and electrolyte fluids, reflective vest, first aid kit, sunscreen, hearing protection and washing facilities.		

If site conditions suggest the existence of a situation more hazardous than anticipated, the site personnel shall evacuate the immediate area. The hazard, the level of precautions, and the Personal Protection Equipment (PPE) shall then be reevaluated with the assistance and approval of the GEI Corporate Health and Safety Officer (Steve Hawkins) and Project Manager.

3.2.2 Handling Drums and Containers

Regulations for handling drums and containers are specified by OSHA 29 CFR 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during the site investigation and remediation activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with all applicable regulations.

3.3 Evaluation of Potential Chemical Hazards

The characteristics of constituents of concern (COC) at the Site are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below.

3.3.1 Volatile Organic Compounds (VOCs)

Volatile organic chemicals (VOCs), such as benzene, toluene, ethyl benzene, and xylene (BTEX) are present as soil and groundwater contaminants and in some cases chemical components in non-aqueous phase liquids (NAPL) such as oil or tar within soils and abandoned pipelines. At high concentrations these compounds generally have a depressant effect on the CNS, may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure to high concentrations may include headache, dizziness, nausea, and skin and eye irritation. The primary route of exposure to VOCs is through inhalation and therefore respiratory protection is the primary control against exposure to VOCs.

3.3.2 Coal Tar and Coal Tar Products

Coal tar products, which are semi-volatile organic compounds (SVOCs) consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphthalene, phenanthrene, phenols, pyrene.

Coal tar products and other SVOCs are present at the Site within impacted soil and groundwater and as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former MGP structures, and abandoned pipelines.

Coal tar products such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Coal tar is considered to be very toxic, if ingested. High levels of exposure to coal tar, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever anemia, liver damage, vomiting convulsions and coma. Poisoning may occur by ingestion of large doses, inhalation or skin absorption.

The major route of entry for the work activities to be conducted at this site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

3.3.3 Heavy Metals

The site soils may contain elevated levels of metals including arsenic, chromium, lead, mercury, and selenium.

Exposure to high concentrations of arsenic can cause dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, and hyperpigmentation of skin. Chronic exposure to arsenic has resulted in lung cancer in humans.

Exposure to high concentrations of lead may cause acute symptoms such as eye irritation, weakness, weight loss, abdominal pain, and anemia. Chronic exposure to lead may result in kidney disease, effects to the reproductive system, blood forming organs, and CNS.

Both lead and arsenic are regulated by specific OSHA standards. They are 29 CFR 1910.1025/1926.52 and 29 CFR 1910.1018/1926.1118, respectively. These standards include specific requirements for air monitoring, signs and labels, training and medical surveillance.

Exposure to high concentrations of chromium can cause acute symptoms such as irritation of the eyes, nose and throat as well as wheezing and coughing. Chronic effects include nosebleeds, nasal congestion, dermatitis, and loss of sight.

Exposure to high concentrations of mercury can cause dizziness, salivation nausea, vomiting, diarrhea, constipation, emotional disturbance, and kidney injury. Chronic exposure to mercury can cause CNS damage.

Exposure to high concentrations of selenium can cause mucous membrane irritation, coughing, sneezing, shortness of breath, chills, headaches, hypotension, and CNS depression. Chronic exposure to selenium could cause bronchial irritation, gastrointestinal distress, excessive fatigue, and skin discoloration.

As with SVOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

3.3.4 Asbestos-Containing Materials

The site soils potentially contain asbestos-containing materials (ACM) in the forms of demolition debris. Chronic exposure to asbestos may cause asbestosis and mesothelioma. The primary route of exposure for asbestos is inhalation during the disturbance and/or removal of asbestos from the pipe insulation and cement pipes.

Asbestos is strictly regulated under OSHA 29 CFR 1910.1001/1926.1101. Employees that may be potentially exposed to ACM must participate in a medical surveillance program, have specific training in the hazards and controls of exposure to asbestos and wear respirators with high efficiency particulate (HEPA) filters. All work must be conducted in demarcated regulated areas to minimize the amount of people within the exposure area. Employers must conduct air sampling and provide signs and labels regarding the presence of asbestos.

3.3.5 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) may be of potential concern based on previous land uses at the site. Exposure to PCBs can occur through unbroken skin without immediate pain or irritation. Acute affects of PCB exposure can include eye, skin, nose, and throat irritation. Chronic effects of PCB exposure can include skin swelling and redness, gastro-intestinal disturbances, and neurological effects such as headache, dizziness, nervousness and numbness of extremities. PCBs are suspected human carcinogens that can cause liver cancer. PCBs can accumulate in fatty tissues and result in health effects after the initial exposure has occurred. The primary route of exposure for PCBs is inhalation, dermal contact, and ingestion.

3.3.6 Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiant. It replaces the oxygen in the blood and thereby suffocates the cells. Ferrocyanides are not considered toxic because the hydrogen cyanide ion is bound too tightly to the iron and cannot therefore replace the oxygen. It takes a great amount of heat and/or acid to release cyanide gas from the ferrocyanide molecule, therefore hydrogen cyanide is not a concern at this site.

3.3.7 Hydrogen Sulfide

Hydrogen sulfide is another common by-product of manufactured gas production. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. These symptoms usually go away in a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Breathing very high levels (>800 ppm) of hydrogen sulfide can cause death within just a few breaths. The primary route of exposure is through inhalation and therefore respiratory protection is the primary control against exposure to hydrogen sulfide.

3.3.8 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when personal protective equipment (PPE) must be upgraded or changed. Action levels for volatile organic compounds and associated contingency plans for the work zone are discussed within Section 8.0 of this Health and Safety Plan.

Exposure to organic vapors shall be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photo-ionization detector (PID).
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover or covering up the impacted material with a tarp to mitigate volatile odors.
- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e. air purifying respirator with organic vapor cartridge) will be employed.

3.3.9 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 4.0 will be worn for all activities where contact with potential contaminated media or materials are expected.

Material Safety Data Sheets (MSDS) (as available) and/or Occupational Health Guidelines for decontamination chemicals, laboratory reagents, and calibration gases that may be used on site are included in Appendix B. Specific chemical hazards information from the MSDS and Occupational Health Guidelines are summarized in Table 1.

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Asbestos	1332-21-4	0.1 f/cc	0.1 f/cc over 8 hr period or 1.0f/cc over 30 min.	Inhalation Ingestion Skin Contact	Asbestosis (chronic exposure); mesothelioma, breathing difficulty, interstitial fibrosis' restricted pulmonary function, finger clubbing; irritate eyes, known human carcinogen	Respiratory system, eyes	White, greenish, blue, or gray-green fibrous solids FP: NA LEL: NA UEL NA VP: 0 mm
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L.005mg/ m^3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, known human carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12^{o} F LEL: 1.2% UEL:7.8% VP: 75 mm
Chromium (Chromic Acid and Chromates)	1333-82-0	0.05 mg/m^3	0.1 mg/m^3	Inhalation Ingestion Skin Contact	Irritates respiratory system, nasal, septum perforation, liver and kidney damage, leucocytosis (increased blood leucocytes), leukopenia (reduced blood leucocytes), moncytosis (increased monocytes), Eosinophilia, eye injury, conjunctivitis, skin ulcer, sensitivity dermatitis, potential carcinogen	Blood, respiratory system, liver, kidney, eyes, skin, lung cancer	FP:NA VP: Very Low LEL: NA UEL: NA

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Ethylbenzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, Central Nervous System	FP: 55^o F LEL: 0.8% UEL:6.7% VP: 7 mm
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, Central Nervous System	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, Central Nervous System, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA LEL: NA UEL: NA VP: 0 mm
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m^3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, central nervous system	Silver-white, heavy odorless liquid FP: NA LEL: NA UEL:NA VP: 0.0012 mm

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Naphthalene	91-20-3		10 ppm (50 mg/m^3) TWA	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	FP: 174 F IP: 8.12 eV, LEL: 0.8% UEL:6.7%, VP: 0.08 mm
PAH's as Coal tar pitch Volatiles (CTPV)	65996-93-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Skin contact Ingestion	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, Central Nervous System, liver, kidneys, skin, bladder,	Black or dark brown amorphous residue.
PCBs	11097-69-1	0.5 mg/m^3 (Skin)	0.5 mg/m^3 (Skin)	Inhalation Skin Absorption Ingestion Skin Contact	Irritate eyes; chloracne; liver damage	Skin, eyes, liver, reproductive system	Colorless liquid or solid with a mild, hydro-carbon odor VP = 0.00006 mm
Phenol	108-95-2	10 ppm (skin)	5 ppm (19 mg/m^3) [skin]	Inhalation Skin Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, anorexia, weight loss, weakness, muscle ache, pain, dark urine, cyanosis, liver and kidney damage, skin burns, dermatitis, tremors, convulsions, twitching	Eyes, skin, respiratory system, liver, kidneys	Colorless to light pink crystalline solid with sweet, acrid odor. FP:175 ^{o}F IP:8.5 LEL:1.8% UEL: 8.6% VP: 0.4 mm
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA LEL: NA UEL: NA VP: 0 mm

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, Central Nervous System, liver, kidneys	FP: 40^{o} F LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, Central Nervous System, GI tract, blood, liver, kidneys	FP: 90^{o} F LEL: 0.9% UEL: 6.7% VP: 9 mm

Abbreviations	
A.L. Action Level	ppm = parts per million
C = ceiling limit, not to be exceeded	STEL = Short-term exposure limit (15 minutes)
FP = Flash point	TWA = Time-weighted average (8 hours)
GI = Gastro-intestinal	UEL = Upper explosive limit
LEL = Lower explosive limit	VP = vapor pressure approximately 68° F in mm Hg (mercury)
mm = millimeter	

3.4 Biological Hazards

The site is located in a commercial area which is surrounded by other commercial properties, residential properties, and some woods and brush-covered areas. Employees working on this project should be aware of the potential biological hazards at this site. Each is discussed in detail below.

3.4.1 Mosquito-Borne Disease – West Nile Virus

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. However, most infections are mild and symptoms include fever, headache and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis and rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

If possible, stay inside between dusk and dark. This is when mosquitoes are most active. When outside between dusk and dark, wear long pants and long-sleeved shirts. Spray exposed skin with an insect repellent, preferably containing DEET.

3.4.2 Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e., anaphylactic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once.

3.4.3 Sun Exposure

Employees are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 15, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should wear safety glasses that offer protection from UVA/UVB rays.

3.5 Physical Hazards and Control

3.5.1 Utility Clearance in the Hudson River

New York requires that a utility notification be performed at least two (2) full work days prior to initiation of any subsurface work. GEI will contact Dig Safely New York (1-800-962-7962) to request a mark-out of natural gas, electric, telephone, cable television, water and sewer lines that may be present in the Project Area of the River prior to sampling of sediments. Work will not begin until the required utility clearances have been performed.

Public utility clearance organizations typically do not mark-out underground utility lines that are located on private property. As such, GEI must exercise due diligence and try to identify the location of any private utilities that may be buried within the Project Sub-Areas of the River GEI will fulfill this requirement in several ways, including:

- Obtaining as-built drawings for the areas being investigated from the property owners
- Visually reviewing each proposed sediment sampling location with the property owner or knowledgeable site representative

Due to the limitations associated with utility mark-outs and the fact that work is being conducted in the River, GEI and/or the marine subcontractors' staff may meet with individual utility owners at each Project Sub-Areas to determine if they have any underground lines located in the River. This information will be reviewed by the Project Team. If it is determined that underground utilities are located in the sediment sampling areas, the sampling locations will be changed to reduce the possibility of encountering underground utilities during the proposed investigation.

3.6 Slip, Trip, and Fall Hazards

3.6.1 Access to Water

Access to the sediment sampling area will be determined prior to mobilization. When accessing these locations, employees should be aware of the potential for slipping, falling, or tripping and the presence of various types of debris, including rocks, glass, construction debris, and general refuse. Site workers will walk around, not over or on top of, debris or trash piles. When carrying equipment, identify a path that is clear of any obstructions. It may be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

Boat Deck

The boat or drilling platform itself presents slip, trip, and fall hazards to the field team due to the accumulation of water on the deck. To the extent possible, accumulated water should be removed from the boat or barge deck to avoid this hazard. If possible, anti-slip matting should be placed on the decks as an additional precaution.

Good Housekeeping

Maintaining a work environment that is free from accumulated debris is the key to preventing slip, trip, and fall hazards at construction sites. Essential elements of good housekeeping on each boat or drilling barge include:

- Orderly placement of materials, tools, and equipment
- Placing trash receptacles at appropriate locations for the disposal of miscellaneous rubbish
- Prompt removal and secure storage of items that are not needed to perform the immediate task at hand
- Awareness on the part of all employees to walk around, not over or on, equipment that may be stored in the work area

3.7 Working on Water

This project presents unique hazards to the sampling team when compared to land-based investigation programs. Therefore, special attention has been given to the topic of marine safety in this HASP, including the scheduling of a pre-mobilization strategy meeting between GEI and the marine subcontractors to develop the specific safety and emergency communications protocols (based on actual site conditions) to address the hazards of working in the River.

Boat and Inspection

Effort has not been made to incorporate all applicable USCG regulations; however, some selected excerpts from USCG regulations have been included to provide general guidance. The boat captains are ultimately responsible for having knowledge of, and complying with, all USCG and any other applicable marine regulations.

Before being placed in service, boats and barges will be inspected by the boat captains in consultation with the SSO and determined to be in safe operating condition. The boat captains also must verify that all required safety gear is aboard before use. A pre-use inspection of the watercraft also must be performed by the boat captains before each daily use. All safety deficiencies will be corrected prior to permitting the boat or barge to leave the dock and resume normal service.

The boat captains must provide written documentation of the initial boat inspection and the daily inspections to the SSO. These inspections will be documented on standard inspection forms used by the boating contractor.

Watercraft determined to be in unsafe condition shall be taken out of service and its use prohibited until unsafe conditions have been corrected.

Boat Registration

All watercraft must meet USCG or state watercraft registration and numbering requirements. The USCG requires that all motorized watercraft be numbered in the state of principal use. A valid certificate showing the numbers issued to the watercraft is required to be on board the watercraft whenever the watercraft is in use. Watercraft registration numbers are required to be painted or permanently attached to each side of the forward half of the watercraft. Watercraft registration must be updated as the governing laws require.

Boat and Barge Capacity

The survey boat or drilling barge will not be loaded beyond the maximum capacity (number of passengers or the total weight of passengers and gear) as specified on the manufactures capacity plate affixed to the vessel. In addition, consideration will be applied to down rate this capacity (at the discretion of the GEI survey lead) so that there is sufficient room, freeboard, and stability to safely perform the intended task given the prevailing weather and river conditions. All equipment shall be properly loaded and secured to prevent shifting and to limit tripping hazards. All personnel will be evenly distributed on-board and will be instructed to remain seated at all times while the vessel or barge is underway or being moved to the drilling areas.

Personal Flotation Devices

All employees working on the water, near the water’s edge, or at any other time where there exists the possibility of falling into the water are required to wear a USCG-approved personal flotation device (PFD). When selecting the appropriate type and style of PFD, the type of activity being conducted and the required mobility of the user must be considered, because some activities may require a PFD which is less restrictive.

GEI employees will be required to wear a USCG-approved Type III PFD or a Type V work vest. Although not as effective as a Type I in turning an unconscious wearer face-up in the water, these vests are generally less bulky and restrictive, and are typically the PFDs of choice in a marine work environment. The use of inflatable PFDs is discouraged due to questionable reliability and maintenance requirements.

Prior to and after each use, each PFD shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

In situations where the water temperature has fallen below 50˚F, a USCG-approved Mustang flotation suit shall be worn in place of the Type III or Type V PFD work vest.

Float Plan

Prior to leaving shore, a plan of the day's activities, including time and place of departure, anticipated return time, and list of employees working on the project, will be filed with the PM. In the event the boat crew does not check in at the designated time stated on the float plan, the PM will be responsible for implementing the emergency procedures outlined in the float plan. A Float Plan Form is presented in this HASP as Appendix E.

Emergency Equipment

All GEI personnel working on boat(s) that are owned/operated by others are to be informed of the locations of all on-board safety equipment including first-aid kit, fire extinguishers, throw-ring, marine radio or other suitable communications equipment as applicable to the specific boat being used. Additionally, all personnel will be instructed as to their individual roles and responsibilities in the event of an on-board emergency (loss of operator, medical emergency, man overboard) prior to the start of any on-water work.

Handling of Fuels

Gasoline must be stored in an approved container or tank. Storage in anything other than an approved container is strictly prohibited. Gasoline is a flammable liquid and should be stored at room temperature, away from potential heat sources such as the sun and away from ignition sources.

Walking in the River

In areas of shallow water, such as along the sides of the River, it may be necessary to walk into the water to perform the probing. If it is necessary to wade into the River, site workers will be required to wear a PFD, hip waders, or knee high boots, depending on the specific conditions at hand. Because of the increased chance of a slip or fall while wading, it is necessary that all site workers exercise additional care and caution while performing such sampling activities. Site workers are cautioned not to wade into water that are more than knee high in depth, or where the employee cannot visibly see the stream bottom. All water work must be conducted via the buddy system. No site worker will be permitted to work on or near the water alone. An appropriate PFD must be worn at all times when working in or near the water's edge.

4.0 Personal Protective Equipment

The PPE specified in Table 2 represents PPE selection required by 29 CFR 1910.132, and is based on the AHA of Section 3. Specific information on the selection rationale activity can be found in the GEI Health and Safety Manual.

The PPE program addresses elements, such as PPE selection based on site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations.

A summary of PPE for each level of protection is as follows:

Table 2
PPE Selection

Safety Equipment	Level A	Level B	Level C	Level D
Tyvek™ suit or work overalls				•
Hard hats with splash shields or safety glasses			•	•
Long pants	•	•	•	•
Steel-toe/shank boots				•
Steel-toe/shank boots with overboots			•	•
Chemical-resistant gloves as appropriate for work being performed and materials handled			•	•
Half- or full-face respirators with appropriate cartridges as approved by the CHSO			•	
Tyvek™ splash-resistant suit			•	
Chemical-resistant clothing		•		
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA	•	•		
Inner and outer chemical-resistant gloves	•	•		
Chemical-resistant safety boots or shoes	•	•		
Two-way radio	•	•		
Hard hat	•	•		
Fully encapsulating chemical-resistant suit	•			
Reflective vest	•	•	•	•

PPE requirements for field activities are as follows.

Activity	Level of Protection	Backup Protection
Mobilization and Demobilization	D	C
Drilling and Sampling	D	C
Excavation and Sampling	D	C
Sediment Sampling	D	C
Survey	D	C
Air Monitoring	D	C

PPE will include hard hats, safety glasses or face shields, long pants, steel toe/steel shank boots, hearing protection, nitrile gloves, and leather or Kevlar gloves. If heavily contaminated soil or groundwater is encountered during intrusive work, Tyvek™ suits and overboots may be utilized. Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the exclusion zone and this HASP will be revised with oversight of the CHSO. GEI personnel will not re-enter the exclusion zone until conditions allow.

OSHA Requirements for Personal Protective Equipment

All PPE used during the course of this field investigation must meet the following OSHA standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1 1968
Respiratory	29 CFR 1910.134	ANSI Z88.1 1980
Head	29 CFR 1910.135	ANSI Z89.1 1969
Foot	29 CFR 1910.136	ANSI Z41.1 1967
Foot (EH)	ASTM F2413-05	

CFR = Code of Federal Regulations
ANSI = American National Standards Institute
ASTM = American Society For Testing and Materials

5.0 Key Project Personnel/Responsibilities and Lines of Authority

5.1 GEI Personnel

- Tim Olean — GEI Project Manager
- Garrett Schmidt — GEI Site Safety Officer and Field Representative
- Steven Hawkins — GEI Corporate Health and Safety Officer
- Bruce Coulombe — Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the GEI Project Manager (PM), the GEI Corporate Health and Safety Officer (CHSO), the GEI Project Site Safety Officer (SSO), other GEI personnel implementing the proposed scope of work.

5.1.1 GEI Project Manager

The GEI Project Manager is responsible for ensuring that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Verifying that the GEI staff selected to work on this program are sufficiently trained for the sampling activities
- Assuring that all personnel to whom this HASP applies, including subcontractor personnel, have received a copy of it
- Providing the CHSO with updated information regarding conditions at the site and the scope of site work
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of all necessary safety procedures
- Supporting the decisions made by the SSO and CHSO
- Maintaining regular communications with the SSO and, if necessary, the CHSO
- Verifying that the subcontractors selected by GEI to work on this program have completed GEI environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work
- Coordinating the activities of all GEI subcontractors and ensuring that they are aware of the pertinent health and safety requirements for this project

5.1.2 GEI Corporate Health and Safety Officer

The GEI CHSO, Steve Hawkins, is the individual responsible for the review, interpretation and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the CHSO. Specific duties of the CHSO include:

1. Writing, approving and amending the HASP for this project
2. Advising the PM and SSO on matters relating to health and safety on this site
3. Recommending appropriate personal protective equipment (PPE) and safety equipment to protect personnel from potential site hazards
4. Conducting accident investigations
5. Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP

5.1.3 GEI Site Safety Officer

All GEI field staff are responsible for implementing the safety requirements specified in this HASP. However, one person will serve as the SSO. For this program, the Field Team Leader will serve as the SSO. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies, including subcontractors, have submitted a completed copy of the HASP receipt and acceptance form
- Conducting the pre-entry briefing prior to beginning work, and subsequent safety meetings as necessary
- Conduct daily Safety Tailboard meeting in accordance with O&R (can be combined with “pre-entry”) briefing for river related work
- Assuring that all personnel to whom this HASP applies have attended and actively participated in a pre-entry briefing and any subsequent safety meetings that are conducted during the implementation of the program
- Maintaining a high level of health and safety consciousness among employees implementing the proposed activities
- Procuring the air monitoring instrumentation required and performing air monitoring for investigative activities
- Procuring and distributing the PPE and safety equipment needed for this project for GEI employees

- Verifying that all PPE and health and safety equipment used by GEI is in good working order
- Verifying that the selected contractors are prepared with the correct PPE and safety equipment and supplies
- Notifying the PM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived
- Monitoring and controlling the safety performance of all personnel within the established restricted areas to ensure that required safety and health procedures are being followed
- Stopping work in the event that an immediate danger situation is perceived
- Conducting accident/incident investigations and preparing accident/incident investigation reports

5.1.4 GEI Field Personnel

All GEI field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work
- Submitting a completed HASP Acceptance Form to the GEI SSO prior to the start of work
- Attending and actively participating in the required pre-entry briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program
- Stopping work in the event that an immediate danger situation is perceived
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO prior to the start of work
- Reporting all accidents, injuries and illnesses, regardless of their severity, to the GEI SSO
- Complying with the requirements of this HASP and the requests of the SSO and boat captain

Lines of Authority will be as follows:

On site – GEI will have responsibility for safety of its employees during the work performed at the Nyack MGP site in, Nyack, New York. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI Project Manager and with the O&R representative.

Boat Captain

GEI will hire marine subcontractors to provide boats, drilling platforms or barges, drilling and coring equipment, survey equipment, boat captains and crews for the sediment sampling task. All boat captains assigned to the project will be responsible for managing all on-water operations conducted in support of these proposed efforts. These responsibilities include:

- Complying with all applicable USCG regulations and requirements
- Serving as primary point of contact for coordinating marine operations with GEI's SSO
- Verifying that the vessels are properly licensed/registered and that the vessels are properly sized and equipped for existing conditions
- Conducting a mandatory all-hands marine safety briefing prior to the start of on-water activities, which will include a review of procedures for abandoning ship and man overboard emergencies
- Support GEI SSO with daily safety tailboard meetings
- Performing a thorough daily inspection of the boats and support equipment prior to departure and submitting inspection documentation to the SSO
- Postponing or suspending marine operations due to weather and water conditions
- Coordinating all on-water emergency response efforts, if necessary

5.2 Subcontractors

GEI may subcontract the following firms or additional firms that will be identified prior to the start of the project to assist in performing work on this project:

Analytical Services	Dr. Steven Hawthorne University of North Dakota Energy & Environmental Research Center (EERC) 15 North 23rd Street - Stop 9018 Grand Forks, ND 58202-9018
	TestAmerica Laboratories 30 Community Drive, Suite 11 South Burlington, VT 05403
Sediment Quality Triad Interpretation	Nick Azzolina David V. Nakles, Ph.D., P.E., D.E.E. 4952 Oakhurst Ave. Gibsonia, PA 15044

Geotechnical and ISS Treatability Testing	GeoTesting Express 1145 Massachusetts Avenue Boxborough, MA 01719
	KEMRON Environmental Services 1359-A Ellsworth Industrial Blvd. Atlanta, GA 30318
Toxicity Testing	AquaTox Research 1201 East Fayette Street Syracuse, NY 13210
Benthic Community Analysis	Aquatec Biological Services 273 Commerce Street Williston, VT 05495
Survey and Vibracore Services	Thew Associates 6431 US Highway 11 Canton, NY 13617

The list of GEI subcontractors will be finalized with an amendment to this HASP prior to site mobilization. GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for protection of their employees but at a minimum must adhere to applicable requirements set forth in this HASP.

5.3 Emergency Contact List

<table>
<tr><th colspan="3">EMERGENCY INFORMATION</th></tr>
<tr><th colspan="2">Important Phone Numbers</th><th>Directions to Hospital</th></tr>
<tr><td>Local Police</td><td>911</td><td rowspan="10">Nyack Hospital
160 North Midland Ave.
Nyack, New York 10960

Start out going south on Gedney St toward 4th Ave. Take the 1st right onto 4th Ave. Take the 1st right onto N Broadway. Take the 1st left onto 5th Ave. Turn left onto N Midland Ave. 160 N MIDLAND AVE is on the right.

Total Travel Estimate: 2 mins / 0.66 miles

See Map in Appendix A

<u>Nearest Occupational Health Clinic</u>

Westchester Medical Center
100 Woods Rd.
Valhalla, New York 10595

(914) 493-7000

Total Travel Estimate: 20 mins / 12.54 miles</td></tr>
<tr><td>Fire Department</td><td>911</td></tr>
<tr><td>Ambulance</td><td>911</td></tr>
<tr><td>State Police or
County Sheriff</td><td>911</td></tr>
<tr><td>Local Hospital:
Nyack Hospital
160 N. Midland Ave.
Nyack, NY 10960</td><td>(845) 348-2000</td></tr>
<tr><td>Project Manager
Tim Olean</td><td>(607) 216-8958</td></tr>
<tr><td>Corporate Health and
Safety Officer
Steve Hawkins</td><td>(860) 368-5348 office
(860) 916-4167 cell</td></tr>
<tr><td>Regional Health and
Safety Officer
Bruce Coulombe</td><td>(607) 216-8959 office
(607) 793-3424 cell</td></tr>
<tr><td>Maribeth McCormick
O&R Client Contact</td><td>(845) 783-5534
914.5557.1361</td></tr>
<tr><td>Utility Clearance
Permit #</td><td>Not Applicable</td></tr>
<tr><td colspan="3">Nearest Telephone Location: On-site cellular</td></tr>
</table>

6.0 Training Program

6.1 HAZWOPER Training

In accordance with 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.3 Site-Specific Training

Prior to commencement of field activities, the GEI CHSO or her representative will ensure all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel that have not received site-specific training will not be allowed on site.

6.4 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by GEI’s field representative to assist GEI personnel in safely conducting work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. Documentation of these briefings will be recorded in the GEI field book or on the GEI Daily Safety Briefing form. The meetings will also be an opportunity to periodically update the workers on monitoring results. In addition, all GEI personnel shall sign the HASP to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the plan.

6.5 First Aid and CPR

The PM will identify individuals certified in first aid and CPR, or identify individuals for such training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association.

7.0 Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. Steven Hawkins is GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at all branch office locations. Comprehensive examinations are given to all GEI field personnel participating in hazardous waste operations on an annual or biennial basis (as determined to be appropriate by the CHSO). The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Steve Hawkins telephone number is:
(860) 368-5348 office
(860) 916-4167 cell

Under the CHSO's supervision, all field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use all levels of respiratory protection, in particular.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

All GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

8.0 Monitoring

Monitoring shall be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on site.

GEI will conduct perimeter air monitoring, and work zone monitoring for on-site workers. GEI will monitor and document daily site conditions and operations and inform field representative of results. If action levels are exceeded GEI's field representative will immediately implement dust suppression activities and notify GEI's Project Manager.

GEI will provide the following equipment for health and safety monitoring of on-site personnel:

- Particulate Meter (PM-10 capable)
- Four-gas meter (O_2, H_2S, CGI, CO)
- Photo-ionization Detector (PID)
- Sound Level Meter if deemed necessary by the CHSO or PM (type to be appropriate to the activities performed)

The perimeter and work zone air monitoring will be conducted during drilling and excavation activities. Table 3 provides a summary of real time air monitoring action levels and contingency plans for work zone activities.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
PID	Breathing Zone	1 ppm	Use Dräger Chip Measurement System (CMS) tube for benzene or Z-nose® to verify if concentration is benzene.
PID	Breathing Zone	0 - 500 ppm	No respiratory protection is required.
		500 - 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist Upgrade to Level C.
		> 100 ppm	Stop work, withdraw from work area; notify PM & CHSO.
Oxygen meter (O_2)	Breathing Zone	< 20.7%	Stop work; withdraw from work area; ventilate area, notify PM & CHSO.
		> 21.1%	Stop work; withdraw from work area; notify PM & CHSO.
Hydrogen Sulfide (H_2S) meter	Breathing Zone	<5 ppm	No respiratory protection is required.
		>5 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, and notify PM & CHSO.
Combustible Gas Indicator (CGI)	Excavation/ Work Zone	< 10 % Lower Explosive Limit (LEL)	Investigate possible causes, allow excavation to ventilate; use caution during procedures.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
		> 10% LEL	Stop work; allow excavation, borehole to ventilate to < 10% LEL; if ventilation does not result in a decrease to < 10% LEL, withdraw from work area; notify PM & CHSO.
Particulate Meter	Excavation/ Work Zone	150 µg/m^3	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

9.0 Site Control Measures

9.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to site contaminants exists, will only be allowed access after proper training and medical documentation.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone. This zone will be clearly delineated by cones, tapes or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the Contractor allowing adequate space for the activity to be completed, field members and emergency equipment.

The Contractor is responsible for constructing, maintaining, and enforcing the zones.

9.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site personnel should be aware of their role as a "buddy" and be able to provide assistance in the event of an emergency. A copy of this plan shall be given to any person acting as a GEI "buddy" for informational purposes.

9.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on site.

9.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. All activities planned for the site are anticipated to occur outside during daylight hours. However, if yard areas are used after dark they will be equipped with illumination that meets or exceeds requirements specified in 29 CFR 1926.56, Illumination.

9.5 Utilities

The location of any utility that could pose a risk to workers must be communicated to all workers during site safety indoctrination. Utilities should be marked or access otherwise restricted to avoid change of accidental contact.

Even when a utility search has been completed, drilling, boring and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. All utilities shall be considered “live” or active until reliable sources demonstrate otherwise.

9.5.1 Overhead Utilities

Overhead transmission and distribution lines are present at the site. Clearances will be adequate for the safe movement of vehicles and for the operation of construction equipment.

Overhead or above-ground electric lines should be considered active until a reliable source has documented them to be otherwise. Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures shall be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded or shielded and a competent electrician has certified that arcing cannot occur between the work location or superstructure.

10.0 Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report shall be made to the GEI Project Manager verbally within 2 hours of the incident. The Project Manager will immediately inform the CHSO, the Director of Human Resources, and the O&R representative of the incident. An Accident Report Form will be completed and submitted to the CHSO and the Director of Human Resources within 24 hours of the incident.

11.0 Decontamination Procedures

A decontamination pad has been established for personnel decontamination and equipment decontamination.

11.1 Personnel Decontamination Station

A personnel decontamination station where workers can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor. It will be equipped with basins for water and detergent, and trash bag(s) or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.)

The following specific decontamination procedure will be used as necessary by GEI personnel or subcontractor personnel wearing PPE from Level D through Level C.

Step 1 Equipment drop (respirator, tools, monitoring equipment, etc.)
Decontaminate as appropriate (per GEI's field representative's instructions).

Step 2 Boot wash/rinse (wash with non-foaming detergent, rinse with fresh water spray). Remove boots. If inner and outer gloves are worn, wash outer gloves, remove and save for later use, or remove and discard outer gloves and place in trash bag/can provided in the decontamination area.

Step 3 Hard hat removal, wash if visibly contaminated (use same wash as in Step 2).

Step 4 If Tyvek™ (or equivalent) suit was worn and is visibly contaminated, remove and place in trash bag/can provided in the decontamination area or decontaminate (wash) and store for reuse.
Contaminated washable coveralls should be removed and bagged for washing.

Step 5 Respirator and/or eye protection removal (as applicable). Wash (per Step 2) to remove visible contamination.

Step 6 Remove outer gloves.

Step 7 Wash potentially exposed skin (use water and soap at indoor sink).

Step 8 Disinfect respirator per manufacturer's recommendations.

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate container) and disposed of in an approved facility. Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with all applicable state and federal regulations.

11.2 Decontamination Equipment Requirements

The following equipment, if required, should be in sufficient supply to implement decontamination procedures for GEI's equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handle soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for ensuring that the above materials, as required for their operation, are in sufficient supply.

12.0 Supplemental Contingency Plan Procedures

12.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their 40-hour HAZWOPER training. All hazardous materials used on the site will be properly labeled, stored, and handled. Material Safety Data sheets (MSDS) will be available to all potentially exposed employees.

12.2 Fire

In the event of a fire, all personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the GEI Project Manager and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

12.3 Medical Support

In case of minor injuries, on site care will be administered with the site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger.

Section 5 of this HASP contains detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. GEI field personnel will carry a cellular telephone.

12.4 Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 mph, heavy rains or snow squalls, thunderstorms, hurricanes, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the GEI Project Manager, the CHSO, and the O&R representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

12.5 Spills or Material Release

If a hazardous waste spill or material release, the SSO or his representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following.

- MSDS, if available, for the material spilled or released
- Source of the release or spillage of hazardous material
- An estimate of the quantity released and the rate at which it is being released
- The direction in which the spill or air release is moving
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result
- Potential for fire and/or explosion resulting from the situation
- Estimates of area under influence of release

If the spill or release is determined to be within the on-site emergency response capabilities, the SSO will ensure implementation of the necessary remedial action. If the release is beyond the capabilities of the site personnel, all personnel will be evacuated from the immediate area and the local fire department will be contacted. The SSO will notify the PM, the CHSO, and the O&R representative.

12.6 Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the site.

Health and Safety Plan Sign-Off

All GEI personnel conducting site activities must read the Health and Safety Plan, be familiar with its requirements, and agree to its implementation.

Once the Health and Safety Plan has been read, complete this sign-off sheet, and return it to the Project Manager.

Site Name:
Nyack Former MGP Site
Village of Nyack, Rockland County, New York
NYSDEC Site #3-44-046

Investigation:
O&R Property
Adjacent Properties

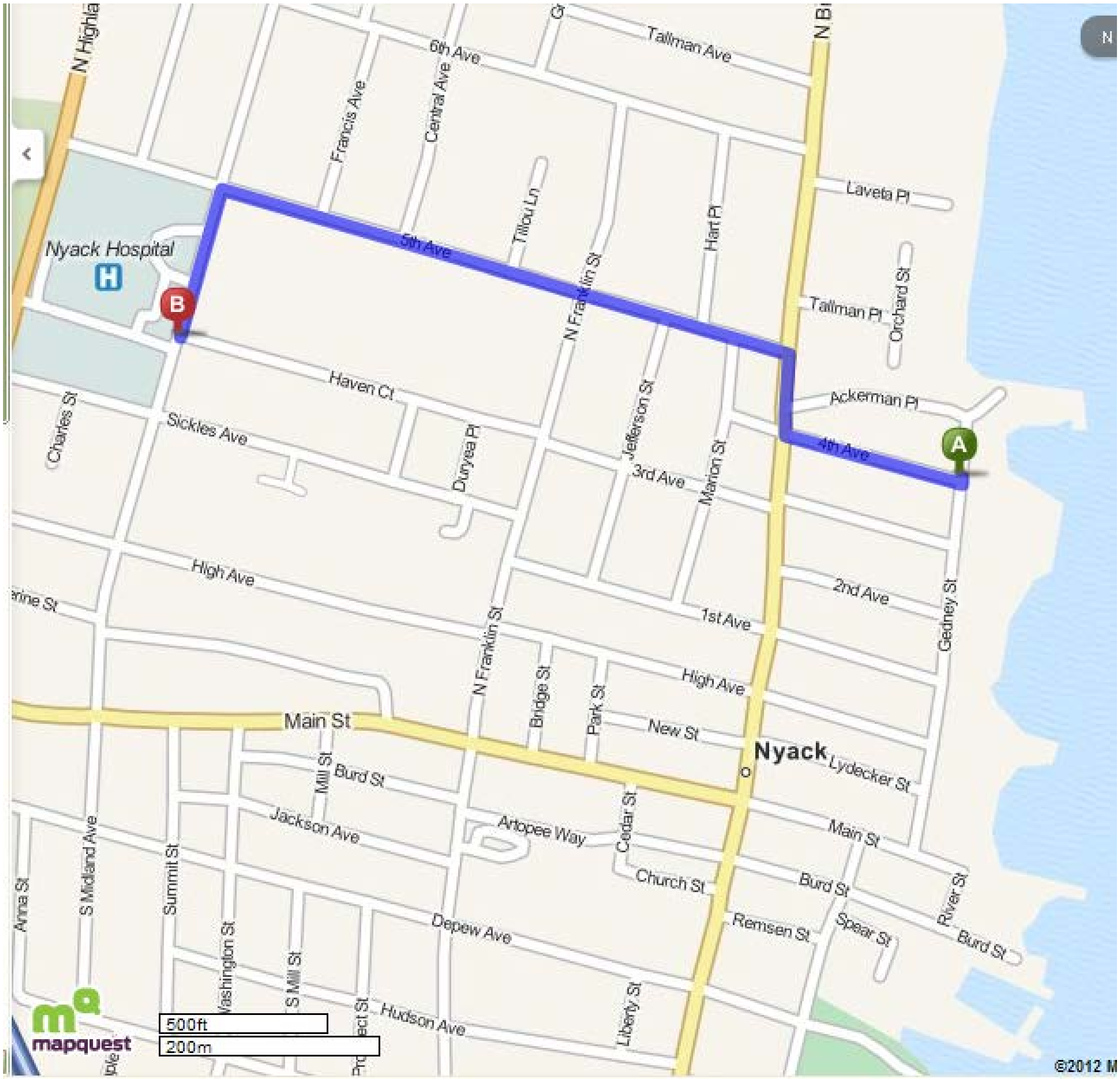
GEI Project No: 121640-*-1001

I have received and read the Health and Safety Plan, been briefed on it, and agree to its implementation.

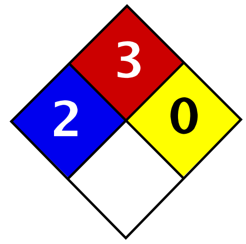
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:

APPENDIX A – HOSPITAL MAP

Gedney Street, Nyack, NY to Nyack Hospital, 160 North Midland Ave Nyack, New York



APPENDIX B – MATERIAL SAFETY DATA SHEETS



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
The substance is toxic to blood, bone marrow, central nervous system (CNS).
The substance may be toxic to liver, Urinary System.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

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

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Slightly flammable to flammable in presence of oxidizing materials.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire.
Reacts on contact with iodine heptafluoride gas.

Dioxygenyl tetrafluoroborate is as very powfFerful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition.
Contact with sodium peroxide with benzene causes ignition.
Benzene ignites in contact with powdered chromic anhydride.
Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powfwerful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

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

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

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

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States]
TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.1 STEL: 1 from NIOSH
TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States]
TWA: 10 (ppm) from OSHA (PEL) [United States]
TWA: 3 (ppm) [United Kingdom (UK)]
TWA: 1.6 (mg/m3) [United Kingdom (UK)]
TWA: 1 (ppm) [Canada]
TWA: 3.2 (mg/m3) [Canada]
TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant.
(Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

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

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone.
Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 930 mg/kg [Rat].
Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
Causes damage to the following organs: blood, bone marrow, central nervous system (CNS).
May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:
Very hazardous in case of inhalation.
Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects.
May affect genetic material (mutagenic).
May cause cancer (tumorigenic, leukemia))
Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system.
Eyes: Causes eye irritation.
Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and

other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system.
Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene
California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene
Connecticut carcinogen reporting list.: Benzene
Connecticut hazardous material survey.: Benzene
Illinois toxic substances disclosure to employee act: Benzene
Illinois chemical safety act: Benzene
New York release reporting list: Benzene
Rhode Island RTK hazardous substances: Benzene
Pennsylvania RTK: Benzene
Minnesota: Benzene
Michigan critical material: Benzene
Massachusetts RTK: Benzene
Massachusetts spill list: Benzene
New Jersey: Benzene
New Jersey spill list: Benzene
Louisiana spill reporting: Benzene
California Director's list of Hazardous Substances: Benzene

TSCA 8(b) inventory: Benzene
SARA 313 toxic chemical notification and release reporting: Benzene
CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R22- Harmful if swallowed.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R45- May cause cancer.
R62- Possible risk of impaired fertility.
S2- Keep out of the reach of children.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S39- Wear eye/face protection.
S46- If swallowed, seek medical advice immediately and show this container or label.
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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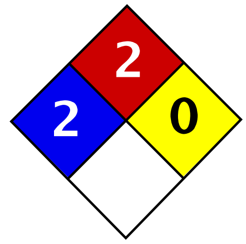

Health	2
Fire	2
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene

Catalog Codes: SLN1789, SLN2401

CAS#: 91-20-3

RTECS: QJ0525000

TSCA: TSCA 8(b) inventory: Naphthalene

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C10H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Naphthalene	91-20-3	100

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

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

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 567°C (1052.6°F)

Flash Points: CLOSED CUP: 88°C (190.4°F). OPEN CUP: 79°C (174.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 5.9%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Flammable solid.
Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Israel: TWA: 10 (ppm)
TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995]
TWA: 52 STEL: 79 (mg/m3) from ACGIH [1995]
Australia: STEL: 15 (ppm)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

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

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:
Partially dispersed in hot water, methanol, n-octanol.
Very slightly dispersed in cold water.
See solubility in methanol, n-octanol.

Solubility:
Partially soluble in methanol, n-octanol.
Very slightly soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Highly reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: May attack some forms of rubber and plastic

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 490 mg/kg [Rat].
Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.

DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of ingestion.
Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Naphthalene, refined : UN1334 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: Naphthalene
Pennsylvania RTK: Naphthalene
Florida: Naphthalene
Minnesota: Naphthalene
Massachusetts RTK: Naphthalene
TSCA 8(b) inventory: Naphthalene
TSCA 8(a) PAIR: Naphthalene
TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87
SARA 313 toxic chemical notification and release reporting: Naphthalene: 1%
CERCLA: Hazardous substances.: Naphthalene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid.
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36- Irritating to eyes.
R40- Possible risks of irreversible effects.
R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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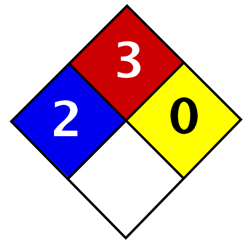

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO_2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide;

concentrated nitric acid, sulfuric acid + nitric acid; N_2O_4; $AgClO_4$; BrF_3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

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

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

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

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States]
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 100 STEL: 150 from NIOSH [United States]
TWA: 375 STEL: 560 (mg/m3) from NIOSH [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Practically insoluble in cold water.
Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide.
Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride.
Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C.
Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 636 mg/kg [Rat].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin.
Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days.
Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite.
Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation.
Chronic Potential Health Effects:
Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis.
Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may

arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene
California prop. 65 (no significant risk level): Toluene: 7 mg/day (value)
California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene
Connecticut hazardous material survey.: Toluene
Illinois toxic substances disclosure to employee act: Toluene
Illinois chemical safety act: Toluene
New York release reporting list: Toluene
Rhode Island RTK hazardous substances: Toluene
Pennsylvania RTK: Toluene
Florida: Toluene
Minnesota: Toluene
Michigan critical material: Toluene
Massachusetts RTK: Toluene
Massachusetts spill list: Toluene
New Jersey: Toluene
New Jersey spill list: Toluene
Louisiana spill reporting: Toluene
California Director's List of Hazardous Substances.: Toluene
TSCA 8(b) inventory: Toluene
TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92
SARA 313 toxic chemical notification and release reporting: Toluene
CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S25- Avoid contact with eyes.
S29- Do not empty into drains.
S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:30 PM

Last Updated: 11/06/2008 12:00 PM

Occupational Health Guideline for Coal Tar Pitch Volatiles

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

Anthracene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Pale green solid with a faint aromatic odor.

Phenanthrene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Pyrene

- Formula: $C_{16}H_{10}$
- Synonyms: None
- Appearance: Bright yellow solid

Carbazole

- Formula: $C_{12}H_{9}N$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Benzo(a)pyrene

- Formula: $C_{20}H_{12}$
- Synonyms: BaP, 3,4-benzopyrene
- Appearance and odor: Colorless solid with a faint aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for coal tar pitch volatiles is 0.2 milligram of coal tar pitch volatiles per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit for coal tar products be reduced to 0.1 mg/m^3 (cyclohexane-extractable fraction) averaged over a work shift of up to 10 hours per day, 40 hours per week, and that coal tar products be regulated as occupational carcinogens. The NIOSH Criteria Document for Coal Tar Products and NIOSH Criteria Document for Coke Oven Emissions should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Coal tar pitch volatiles can affect the body if they are inhaled or if they come in contact with the eyes or skin.

- **Effects of overexposure**

Repeated exposure to coal tar pitch volatiles has been associated with an increased risk of developing bronchitis and cancer of the lungs, skin, bladder, and kidneys. Pregnant women may be especially susceptible to exposure effects associated with coal tar pitch volatiles. Repeated exposure to these materials may also cause sunlight to have a more severe effect on a person's skin. In addition, this type of exposure may cause an allergic skin rash.

- **Reporting signs and symptoms**

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to coal tar pitch volatiles.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to coal tar pitch volatiles at potentially hazardous levels:

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

1. *Initial Medical Examination:*

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the oral cavity, respiratory tract, bladder, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity.

—Urinalysis: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. A urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment, as well as a test for red blood cells.

—Urinary cytology: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology examination.

—Sputum cytology: Coal tar pitch volatiles are associated with an excess of lung cancer. Employees having 10 or more years of exposure or who are 45 years of age or older should have a sputum cytology examination.

—14" x 17" chest roentgenogram: Coal tar pitch volatiles are associated with an excess of lung cancer. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Coal tar pitch volatiles are reported to cause an excess of bronchitis. Periodic surveillance is indicated.

—A complete blood count: Due to the possibility of benzene exposure associated with coal tar pitch volatiles, a complete blood count is considered necessary to search for leukemia and aplastic anemia.

—Skin disease: Coal tar pitch volatiles are defatting agents and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of these agents.

2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated on an annual basis, and semi-annually for employees 45 years of age or older or with 10 or more years' exposure to coal tar pitch volatiles.

- **Summary of toxicology**

Coal tar pitch volatiles (CTPV) are products of the destructive distillation of bituminous coal and contain polynuclear aromatic hydrocarbons (PNA's). These hydrocarbons sublime readily, thereby increasing the amounts of carcinogenic compounds in working areas. Epidemiologic evidence suggests that workers intimately exposed to the products of combustion or distillation of bituminous coal are at increased risk of cancer at many sites. These include cancer of the respiratory tract, kidney, bladder, and skin. In a study of coke oven workers, the level of exposure to CTPV and the length of time exposed were related to the development of cancer. Coke oven workers with the highest risk of cancer were those employed exclusively at topside jobs for 5 or more years, for whom the increased risk of dying from lung cancer was 10-fold; all coke oven workers had a 7-½-fold increase in risk of dying from kidney cancer. Although the causative agent or agents of the cancer in coke oven workers is unidentified, it is suspected that several PNA's in the CTPV generated during the coking process are involved. Certain industrial populations exposed to coal tar products have a demonstrated risk of skin cancer. Substances containing PNA's which may produce skin cancer also produce contact dermatitis; examples are coal tar, pitch, and cutting oils. Although allergic dermatitis is readily induced by PNA's in guinea pigs, it is only rarely reported in humans from occupational contact with PNA's; these have resulted largely from the therapeutic use of coal tar preparations. Components of pitch and coal tar produce cutaneous photosensitization; skin eruptions are usually limited to areas exposed to the sun or ultraviolet light. Most of the phototoxic agents will induce hypermelanosis of the skin; if chronic photodermatitis is severe and prolonged, leukoderma may occur. Some oils containing PNA's have been associated with changes of follicular and sebaceous glands which commonly take the form of acne. There is evidence that exposures to emissions at coke ovens and gas retorts may be associated with an increased occurrence of chronic bronchitis. Coal tar pitch volatiles may be associated with benzene, an agent suspected of causing leukemia and known to cause aplastic anemia.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data—Anthracene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.24
4. Vapor density (air = 1 at boiling point of anthracene): 6.15
5. Melting point: 217 C (423 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

- **Physical data—Phenanthrene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.18
4. Vapor density (air = 1 at boiling point of phenanthrene): 6.15
5. Melting point: 100.5 C (213 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

- **Physical data—Pyrene**

1. Molecular weight: 202.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)

3. Specific gravity (water = 1): 1.28
4. Vapor density (air = 1 at boiling point of pyrene): 6.9
5. Melting point: 150.4 C (303 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Carbazole**
1. Molecular weight: 167.2
2. Boiling point (760 mm Hg): 355 C (671 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of carbazole): 5.8
5. Melting point: 246 C (475 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Benzo(a)pyrene**
1. Molecular weight: 252.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of benzo(a)pyrene): 8.7
5. Melting point: 179 C (354 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Reactivity**
1. Conditions contributing to instability: None hazardous
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: None
4. Special precautions: None

• **Flammability**
1. Flash point: Anthracene: 121 C (250 F) (closed cup); Others: Data not available
2. Autoignition temperature: Anthracene: 540 C (1004 F); Others: Data not available
3. Flammable limits in air, % by volume: Anthracene: Lower: 0.6; Others: Data not available
4. Extinguishant: Foam, dry chemical, and carbon dioxide

• **Warning properties**
Grant states that "coal tar and its various crude fractions appear principally to cause reddening and squamous eczema of the lid margins, with only small erosions of the corneal epithelium and superficial changes in the stroma, which disappear in a month following exposure. Chronic exposure of workmen to tar fumes and dust has been reported to cause conjunctivitis and discoloration of the cornea in the palpebral fissure, either near the limbus or, in extreme cases, across the whole cornea. Occasionally, epithelioma of the lid margin has been attributed to contact with coal tar."

MONITORING AND MEASUREMENT PROCEDURES

• **General**
Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**
Coal tar products may be sampled by collection on a glass fiber filter with subsequent ultrasonic extraction and weighing. An analytical method for coal tar pitch volatiles is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 1, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00267-3).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent skin contact with condensed coal tar pitch volatiles, where skin contact may occur.
• If employees' clothing may have become contaminated with coal tar pitch volatiles, employees should change into uncontaminated clothing before leaving the work premises.
• Clothing contaminated with coal tar pitch volatiles

should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of coal tar pitch volatiles from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the coal tar pitch volatiles, the person performing the operation should be informed of coal tar pitch volatiles's hazardous properties.

- Employees should be provided with and required to use splash-proof safety goggles where condensed coal tar pitch volatiles may contact the eyes.

SANITATION

- Workers subject to skin contact with coal tar pitch volatiles should wash with soap or mild detergent and water any areas of the body which may have contacted coal tar pitch volatiles at the end of each work day.
- Employees who handle coal tar pitch volatiles should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- Areas in which exposure to coal tar pitch volatiles may occur should be identified by signs or other appropriate means, and access to these areas should be limited to authorized persons.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to coal tar pitch volatiles may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from extraction and packaging from coal tar fraction of coking	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a binding agent in manufacture of coal briquettes used for fuel; use as a dielectric in the manufacture of battery electrodes, electric-arc furnace electrodes, and electrodes for alumina reduction	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture of roofing felts and papers and roofing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use for protective coatings for pipes for underground conduits and drainage; use as a coating on concrete as waterproofing and corrosion-resistant material; use in road paving and sealing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture and repair of refractory brick; use in production of foundry cores; use in manufacture of carbon ceramic items	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- **Eye Exposure**

If condensed coal tar pitch volatiles get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with these chemicals.

- **Skin Exposure**

If condensed coal tar pitch volatiles get on the skin, wash the contaminated skin using soap or mild detergent and water. Be sure to wash the hands before eating or smoking and to wash thoroughly at the close of work.

- **Breathing**

If a person breathes in large amounts of coal tar pitch volatiles, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of releases until cleanup has been completed.
- If coal tar pitch volatiles are released in hazardous concentrations, the following steps should be taken:

1. Ventilate area of spill.

2. Collect released material in the most convenient and safe manner for reclamation or for disposal in sealed containers in a secured sanitary landfill.

• Waste disposal method:

Coal tar pitch volatiles may be disposed of in sealed containers in a secured sanitary landfill.

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RESPIRATORY PROTECTION FOR COAL TAR PITCH VOLATILES

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m^3
Particulate and Vapor Concentration	
2 mg/m^3 or less	A chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high-efficiency filter. Any supplied-air respirator. Any self-contained breathing apparatus.
10 mg/m^3 or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high-efficiency filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
200 mg/m^3 or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode. A powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter.
400 mg/m^3 or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 400 mg/m^3 or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors and particulates, including pesticide respirators which meet the requirements of this class. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: ISOBUTYLENE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: ISOBUTYLENE
CHEMICAL NAME: Isobutylene
COMMON NAMES/SYNONYMS: 2-Methylpropene, Isobutene
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Isobutylene FORMULA: C4H8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	Simple Asphyxiant	Simple Asphyxiant	LC_{50} 620 mg/m^3/3H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

This product does not contain oxygen and may cause asphyxia if released in a confined area. Simple hydrocarbons can cause irritation and central nervous system depression at high concentrations. flammable.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

PRODUCT NAME: ISOBUTYLENE

HEALTH EFFECTS:

Exposure Limits No	Irritant Yes	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen No
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Irritation may occur.

SKIN EFFECTS:
None anticipated as product is a gas at room temperature.

INGESTION EFFECTS:
Ingestion is unlikely.

INHALATION EFFECTS:
Product is relatively nontoxic. Simple hydrocarbons can irritate the eyes, mucous membranes and respiratory system at high concentrations.

Inhalation of high concentrations may cause dizziness, disorientation, incoordination, narcosis, nausea or narcotic effects.

This product may displace oxygen if released in a confined space. Maintain oxygen levels above 19.5% at sea level to prevent asphyxiation.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

NFPA HAZARD CODES

Health: 1
Flammability: 4
Reactivity: 0

HMIS HAZARD CODES

Health: 1
Flammability: 4
Reactivity: 0

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures

EYES:
Never introduce oil or ointment into the eyes without medical advice! If pain is present, refer the victim to an ophthalmologist for further treatment and follow up.

SKIN:

Remove contaminated clothing and wash affected area with soap and water. If irritation persists, seek medical attention.

INGESTION:
Not normally required. Seek immediate medical attention.

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted (artificial) respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: -105 °F (-76 °C)	Method: Closed Cup	Autoignition Temperature: 869 °F (465 °C)
LEL(%): 1.8	UEL(%): 9.6	
Hazardous combustion products: Carbon monoxide, Carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Isobutylene is heavier than air and may travel a considerable distance to an ignition source. Isobutylene is a flammable gas! Keep away from open flame and other sources of ignition. Do not allow smoking in storage areas or when handling.

EXTINGUISHING MEDIA:
Water, carbon dioxide, dry chemical.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop the flow of gas with a remote valve. Use water spray to cool fire exposed containers. If fire is extinguished and flow of gas is continued, increase ventilation to prevent a build up of a flammable/ explosive atmosphere. Extinguish sources of ignition.

Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above the liquid level with remote monitors. Limit the number of personnel in proximity to the fire. Evacuate surrounding areas to at least 3000 feet in all directions.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. Increase ventilation to prevent build up of a flammable/explosive atmosphere. Extinguish all sources of ignition! If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location

7. Handling and Storage

Earth bond and ground all lines and equipment associated with the product system. Electrical equipment should be non-sparking and explosion proof.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time.

Post "No Smoking" signs in storage or use areas.

For additional recommendations consult Compressed Gas Association Pamphlet P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Isobuylene FORMULA: C4H8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	Simple Asphyxiant	Simple Asphyxiant	LC_{50} 620 mg/m^3/3H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

ENGINEERING CONTROLS:
Use local exhaust to prevent accumulation. Use general ventilation to prevent build up of flammable concentrations. May use hood with forced ventilation when handling small quantities. If product is handled routinely where the potential for leaks exists, all electrical equipment must be rated for use in potentially flammable atmospheres. Consult the National Electrical Code for details.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Protective gloves made of plastic or rubber.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes, safety shower, eyewash.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure at 70°F	: 39	psia
Vapor density at STP (Air = 1)	: 1.98	
Evaporation point	: Not Available	
Boiling point	: 19.5	°F
	: -6.9	°C
Freezing point	: -220.6	°F
	: -140.3	°C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Insoluble	
Odor threshold	: Not Available	
Odor and appearance	: A colorless gas with an unpleasant odor similar to that of burning coal.	

10. Stability and Reactivity

STABILITY:
Stable

CONDITIONS TO AVOID (STABILITY):
None

INCOMPATIBLE MATERIALS:
Oxidizers

PRODUCT NAME: ISOBUTYLENE

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide

11. Toxicological Information

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Isobutylene	Isobutylene
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1055	UN 1055
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Isoutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

Material Safety Data Sheet: **Simple Green® All-Purpose Cleaner**
Simple Green® Scrubbing Pad
Version No. 1300509A   Date of Issue: January 2009   *ANSI-Z400.1-2003 Format*

Section 1: PRODUCT & COMPANY IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Simple Green® Scrubbing Pad
Additional Name: Simple Green® Concentrated Cleaner/Degreaser/Deodorizer

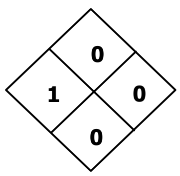
Manufacturer's Product Code Numbers: **Please refer to page 4*

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 ● 562-795-6000   Fax: 562-592-3830
Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Use of Product: An all purpose cleaner and degreaser used diluted in water for direct, spray and dip tank procedures. Scrubbing pad is used with water for manual scrubbing applications. Both are for cleaning water-safe surfaces.

Section 2: HAZARDS IDENTIFICATION

Emergency Overview: CAUTION. Mild eye irritant.
Simple Green@ is a dark green liquid with a sassafras odor. Scrubbing Pad is a green fibrous rectangle.



HMIS Rating:
Health = 1 = slight
Fire = 0
Reactivity, and Special = 0 = minimal

Eye Contact: Mild Eye Irritant.

Skin Contact: No adverse effects expected under typical use conditions. Prolonged exposure may cause dryness. Under this condition, use of gloves or skin moisturizer after washing may be indicated.

Ingestion: May cause stomach or intestinal upset if swallowed (due to detersive properties.)

Inhalation: No adverse effects expected under typical use conditions. Adequate ventilation should be present when using Simple Green® over a prolonged period of time. Open windows or ventilate via fan or other air-moving equipment if necessary.

Carcinogens: No ingredients are listed by OSHA, IARC, or NTP as known or suspected carcinogens.

Medical Conditions: No medical conditions are known to be aggravated by exposure to Simple Green®. Dermal-sensitive users may experience mild but reversible reactions.

UN Number: Not Required   **Dangerous Goods Class:** Non-hazardous

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

The only ingredient of Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<4%) (Butyl Cellosolve; CAS No. 111-76-2) [*1% for Scrubbing Pad*]: the ACGIH TLV-TWA is 20 ppm (97 mg/m^3). Based upon chemical analysis, Simple Green® contains no known EPA priority pollutants, heavy metals or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

All components of Simple Green® are listed on the TSCA Chemical Substance Inventory.
This product does not contain any ingredients covered by the provisions of 29 CFR 1910.1200.

Section 4: FIRST AID MEASURES

Eye Contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin Contact: Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.

Swallowing; Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.

Inhalation: Non-toxic. Exposure to concentrate may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

Section 5: FIRE FIGHTING MEASURES

Simple Green® is stable, not flammable, and will not burn. No special procedures required.

Flash Point/Auto-Ignition: Not flammable.
Flammability Limits: Not flammable.

Extinguishing Media: Not flammable/non-explosive.
Special Fire Fighting Procedures: None required.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with eyes. Do not rub eyes with hands during cleanup. No special precautions for dermal contact are needed. Wash hands thoroughly after cleaning up spill or leak.

Method for cleaning up: Recover usable material by convenient method, residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

Section 7: HANDLING AND STORAGE

No Special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number: Not Required **Dangerous Goods Class:** Non-hazardous

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits: The Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in section IV.) No special precautionary measures required under normal use conditions.

Ventilation: No special ventilation, precautions or respiratory protection is required during normal use. Large-scale use indoors should provide an increased rate of air exchange.

Human Health Effects or Risks From Exposure: Adverse effects on human health are not expected from Simple Green®, based on 20 years of use of Simple Green® without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Eye protection: Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate. Eye protection not generally required. Wash hands after using wipes.

Skin protection: Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact on the skin may lead to temporary, but reversible, irritation. Rinse completely from skin after contact.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION – continued –

General hygiene conditions: There are no known hazards associated with this material when used as recommended. The following general hygiene considerations are recognized as common good industrial hygiene practices:
- Avoid breathing vapor or mist.
- Avoid contact with eyes.
- Wash thoroughly after handling and before eating, drinking, or smoking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Cleaner is a dark green liquid, pad is a fibrous green matrix; both exhibit a sassafras odor.			
Specific Gravity:	1.010 ± 0.010	**Vapor Pressure:**	18 mm Hg @ 20°C; 23.5 mmHg @ 26°C
Evaporation:	>1 (butyl acetate = 1)	**Vapor Density:**	1.3 (air = 1)
Water Solubility:	100%	**Density:**	8.5 lbs/gallon
Boiling Point:	100.6°C (212°F)	**pH:**	9.5 ± 0.3
Ash Content:	At 600°F: 1.86% by weight	**Nutrient Content:** Phosphorus: 0.3% by formula Nitrogen <1.0% by weight (fusion and qualitative test for ammonia) Sulfur: 0.6% by weight (barium chloride precipitation method)	
Freezing Point:	Approx -9 °C (16 °F) *If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.*		
VOC Composite Partial Pressure: 0.006 mmHg @ 20°C			
Volatile Organic Compounds (VOCs): CARB Method 310 3.8% SCAQMD Method 313 2.8%		Cleaner meets CARB & BAAQMD regulations. Cleaner must be diluted 1:1 with water to Meet SCAQMD Rule 1171 & Rule 1122 VOC requirements for solvent cleaning operations. [*Scrubber VOCs = 3.3% prior to dilution w/water*]	

Section 10: STABILITY AND REACTIVITY

Stability: Stable
Materials to Avoid: None known
Hazardous Decomposition Products: None expected

Section 11: TOXICOLOGICAL INFORMATION

Toxicology information is based on chemical profile of ingredients and extrapolation of data from similar formulas.

Acute Toxicity: Oral LD_{50} (rat) >5 g/kg body weight*
Dermal LD_{50} (rabbit) >2 g/kg body weight

**Calculation from OECD series on testing and assessment number 33, Chapter 3.2*

Eye Irritation: Moderate/Mild reversible eye irritation may occur based on relevant laboratory studies. This potential is reduced by immediate rinsing of eyes in case of eye contact.

Dermal Irritation: Mild, reversible skin irritation may occur based on relevant laboratory studies. A 6-hour exposure to human skin under a patch did not produce irritation

Repeat Exposure Via Skin Contact: Based on relevant laboratory studies, no toxic effects are expected to be associated with daily skin exposures (with up to 2 g/kg/day tested for 13 weeks on rabbits). Skin irritation may, however, occur with repeated or prolonged exposures.

Reproductive Effects Assessment: Based on relevant laboratory studies (CD-1 mouse 18-week fertility assessment continuous breeding), no adverse effects on reproduction, fertility, or health of offspring are expected.

Section 12: ECOLOGICAL INFORMATION

Hazard to wild animals & aquatic organisms: Low, based on toxicological profile.

Biodegradability: Readily biodegradable based on biodegradation profile,
PRO/FT CBT-AC 014-7 "Ready Biodegradability: Closed Bottle Test" OECD, and OECD 302B laboratory tests

Environmental Toxicity Information: It is important not to allow the runoff from cleaning into closed systems such as decorative ponds. Always protect closed systems with tarps or dikes if necessary.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with all applicable local, state and federal laws. Dispose of used or unused product, and empty containers in accordance with the local, State, Provincial, and Federal regulations for your location. Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

This product is non-hazardous for transport according to the U.S. Department of Transportation Services
UN Number: Not required Dangerous Goods Class: Non-hazardous

Section 15: REGULATORY INFORMATION

*Reportable components:

All components are listed on:	EINECS and TSCA Inventory		
No components listed under:	Clean Air Act Section 112		
SARA:	This material contains 2-Butoxyethanol, < 4%, (CAS# 111-76-2) which is subject to the reporting requirements of Section 313 of SARA Title III and 49 CFR Part 373.		
RCRA Status:	Not a hazardous waste.	CERCLA Status:	No components listed
TSCA TRI Reporting:	Not required / Not listed	CA PROP. 65 Status:	No components listed

Section 16: OTHER INFORMATION

Questions about the information found on this MSDS should be directed to:
SUNSHINE MAKERS, INC. – TECHNICAL DEPARTMENT
15922 Pacific Coast Hwy. Huntington Harbour, CA 92649

Phone: 800/228-0709 [8am-5pm Pacific time, Mon-Fri] *Fax:* 562/592-3830 *Email:* infoweb@simplegreen.com

CAGE CODE 1Z575
GSA/FSS - CONTRACT NO. GS-07F-0065J
National Stock Numbers & Industrial Part Numbers:

	Part Number	NSN	Size
Simple Green	13012	7930-01-342-5315	24 oz spray (12/case)
	13005	7930-01-306-8369	1 Gallon (6/case)
	13006	7930-01-342-5316	5 Gallon
	13016	7930-01-342-5317	15 Gallon
	13008	7930-01-342-4145	55 Gallon
Scrubbing Pad	Part Number	NSN	Size
	10224	7930-01-346-9148	Each (24/case)

Retail Numbers:

Part Number	Size
13002	16 oz Trigger (12/case)
13005	1 Gallon (6/case)
13013	24 oz Trigger (12/case)
13014	67 oz / 2 L (6/case)
13033	32 oz Trigger (12/case)

* *part number is for both industrial and retail*

****International Part Numbers May Differ.**

DISCLAIMER: The information provided with this MSDS is furnished in good faith and without warranty of any kind. Personnel handling this material must make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of this material and the safety and health of employees and customers. Sunshine Makers, Inc. assumes no additional liability or responsibility resulting from the use of, or reliance on this information.

APPENDIX C – HEAT STRESS/COLD STRESS GUIDELINES

Cold Stress Guidelines

	Symptoms	What to do
Mild Hypothermia	• Body Temp 98-90°F • Shivering • Lack of coordination, stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes of blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90-86°F • Shivering stops • Unable to walk or stand • Confused irrational	• All of the above, plus: • Call 911 • Cover all extremities completely • Place very warm objects, such as hot packs on the victim's head, neck, chest and groin
Severe Hypothermia	• Body temp 86-78°F • Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin • Death	• Call 911 • Treat victim very gently • Do not attempt to re-warm
Frostbite	• Cold, tingling, stinging or aching feeling in the frostbitten area, followed by numbness • Skin color turns red, then purple, then white or very pale skin • Cold to the touch • Blisters in severe cases	• Call 911 • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm, not hot, water
Trench Foot	• Tingling, itching or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm sugary drink

HEAT STRESS GUIDELINES

Form	Signs & Symptoms	Care	Prevention[3]
Heat Rash	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures
Heat Cramps	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals[1] ACCLIMATIZATION[2]
Heat Exhaustion	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION[2] Adequate salt intake with meals [1] only during early part of heat season. Ample water intake, frequently during the day
Heat Stroke	HOT Dry Skin. Sweating has stopped. Mental confusion, dizziness, nausea, severe headache, collapse, delirium, coma.	HEAT STROKE IS A MEDICAL EMERGENCY - Remove from heat. - COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. Call for Emergency Assistance. Observe for signs of shock.	ACCLIMATIZATION[2] Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Footnotes:

1.) American diets are normally high in salt, sufficient to aid acclimatization. However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meals per day may help, so long as this is permitted by your physician. Check with your personal physician.

2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.

3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures. Avoid alcohol. Normally takes 8 to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately five days.

APPENDIX D – GEI UTILITY CLEARANCE AND GEI ACCIDENT REPORTING FORM

ACCIDENT REPORT FORM

Report No. ________

Site: ____ Project No. ____________________

Location: ____

Date of Report: ______________________________ Preparer's Name:___________________________________

Name and Address of Injured: ____

Date of Birth ___________________ Date of Hire: ____________ Title/Classification: ______________________

Division/Department ______________________________ Date of Accident __________ Time: _____________

Accident Category: ___ Motor Vehicle ___ Property Damage ___ Fire

___ Chemical Exposure ___ Near Miss ___ Other

Severity of Injury or Illness: ____ Non-disabling ___ Disabling

____ Medical Treatment ___ Fatality

Amount of Damage: $___________________________ Property Damaged: ______________________________

Estimated Number of Days Away from Job: ____

Nature of Injury or Illness: ____

CLASSIFICATION OF INJURY:

____ Fractures
____ Dislocations
____ Sprains
____ Abrasions
____ Lacerations
____ Punctures
____ Bites
____ Toxic Ingestions

____ Heat Burns
____ Chemical Burns
____ Radiation Burns
____ Bruises
____ Blisters
____ Toxic Respiratory Exposure
____ Toxic Ingestions
____ Dermal Allergy

____ Cold Exposure
____ Frostbite
____ Heat Stroke
____ Heat Exhaustion
____ Concussion
____ Faint/Dizziness
____ Toxic Respiratory

Part of Body Affected: ____

Degree of Disability: ____

Date Medical Care Was Received: ____

Where Medical Care Was Received: ____

Address (if off site): ____

ACCIDENT LOCATION:

Causative agent most directly related to accident (object substance, material, machinery, equipment conditions):

____

____

Was weather a factor? ____

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

____

____

Unsafe act by injured and/or others contributing to the accident (be specific, must be answered):

____

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue):

____

____

Level of personal protection equipment required in Site Safety Plan: ______________________________________

____

Modifications: ____

Was injured using required equipment? ____

If not, how did actual equipment use differ from plan? ______________________________________

____

What can be done to prevent a recurrence of this type of accident (modification of machine; mechanical guards; correct environment training):

____

____

Detailed narrative description (how did accident occur, why; objects, equipment, tools used, circumstance assigned duties) (be specific):

____

____

(Use separate sheet as required)

Witnesses to accident ____

Signature of Preparer ____

Signature of Site Leader _

Utility Clearance Documentation

Client: ____________________

Project: ____________________

Site: ____________________

Drilling Location ID: ____________________

Driller: ____________________

GEI PM: ____________________

GEI Field Team Leader: ____________________

Utility Drawings Reviewed: ____________________

Provided By: ____________________

Reviewed By: ____________________

One Call Utility Clearance Call Date: ____________________

Utility Clearance Received back from (list utilities): ____________________

Completed By (Company): ____________________ Date: __________

GEI Staff Responsible for Oversight: ____________________

Metal Detector Survey (yes/no): ____________________

Drilling Location Cleared by: ____________________

Contractor: ____________________ Date: __________

GEI Staff Responsible for Oversight: ____________________

Physical Test Pit Clearance Required (yes/no): ____________________

Contractor: ____________________ Date: __________

GEI Staff Responsible for Oversight: ____________________

Hand clearing Performed: ____________________ Date: __________

Contractor: ____________________

GEI Staff Responsible for Oversight: ____________________

Notes: ____________________

____

Based upon the best available information, appropriate utility clearance procedures were performed for the invasive work specified. If client ordered/site specific deviations from existing GEI utility clearance procedures exist, they are approved by the client signature below.

Client Signature (Optional): ____________________________ Date: ____________________

GEI, Inc. Representative: ____________________________ Date: ____________________

APPENDIX E – FLOAT PLAN

Daily Float Plan

Name of vessel's operator:	
Telephone Number:	
Name of Vessel:	
Registration No.:	
Description of Vessel: Type: Make: Color of Hull/Trim Most distinguishing identifiable feature:	

Rafts/Dinghies: Number:________ Size:_______ Color:_______

Radio: Type: ____________________ Frequencies Monitored: ________________

Number of persons onboard:

Name:	Age:	Address & Telephone:

Engine Type:___________ H.P.:_______ Normal Fuel Supply (days):_______

Survival equipment on board: (check as appropriate)

- [ ] Life Jackets
- [ ] Flares
- [ ] Smoke Signals
- [ ] Medical Kit
- [ ] EPIRB
- [ ] Paddles
- [ ] Anchor
- [ ] Loran/Gps
- [ ] ________________

Trip:

Date & Time of Departure:	
Departure From:	
Departure To:	

Expected to arrive by:____________ In no case later than:_____________

Daily Float Plan

Name of vessel's operator:	
Telephone Number:	
Name of Vessel:	
Registration No.:	
Description of Vessel: Type: Make: Color of Hull/Trim Most distinguishing identifiable feature:	

Rafts/Dinghies: Number:________ Size:_______ Color:_______

Radio: Type: ___________________ Frequencies Monitored: ________________

Number of persons onboard:

Name:	Age:	Address & Telephone:

Engine Type:___________ H.P.:_______ Normal Fuel Supply (days):_______

Survival equipment on board: (check as appropriate)

- ☐ Life Jackets
- ☐ Flares
- ☐ Smoke Signals
- ☐ Medical Kit
- ☐ EPIRB
- ☐ Paddles
- ☐ Anchor
- ☐ Loran/Gps
- ☐ __________________

Trip:

Date & Time of Departure:	
Departure From:	
Departure To:	

Expected to arrive by:____________ In no case later than:_____________

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Community Air Monitoring Plan

Nyack MGP Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
GEI Consultants, Inc.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist

Table of Contents

Tables

Attachments

Abbreviations and Acronyms

CAMP	Community Air Monitoring Plan
COC	Compounds of Concern
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
MGP	Manufactured Gas Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&R	Orange & Rockland Utilities, Inc.
PAH	Polycyclic Aromatic Hydrocarbons
PDI	Pre-Design Investigation
PID	Photo-ionization Detector
ppm	Parts per Million
SVOC	Semi-Volatile Organic Compounds
VOC	Volatile Organic Compounds
$\mu g/m^3$	Micrograms per cubic meter

1. Introduction

This Community Air Monitoring Plan (CAMP) will be implemented during the Pre-Design Investigation (PDI) of the Orange & Rockland Utilities, Inc. (O&R) Nyack Manufactured Gas Plant (MGP) site, located in Nyack, New York. A CAMP is required by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) at sites where ground-intrusive activities may result in airborne release of compounds of concern (COC). Towards that end, community air monitoring will be performed for total volatile organic vapors (VOCs), and for particulates (dust).

The Nyack MGP site is located between Gedney Street and the Hudson River in Nyack, New York. This CAMP applies to the PDI phase of work for the Nyack MGP site. The PDI field work is scheduled to be performed in the spring of 2012. The PDI field work involves the advancement of subsurface soil borings, and sediment sampling. Community air monitoring will be performed during the drilling of soil borings.

The objectives of this CAMP are to:

- Ensure that the airborne concentrations of COC are minimized to protect the community.
- Provide an early warning system so that potential emissions can be controlled on site at the source.
- Measure and document the concentrations of airborne COC to confirm compliance with the specified limits.

This CAMP is a companion document to GEI's site-specific Health and Safety Plan (HASP). The HASP is a separate document and is directed primarily toward protection of on-site workers within the designated work zones.

2. Air Monitoring Equipment, Methods, and Action Levels

This section provides instructions for performing the CAMP activities. Discussed are the COC to be monitored, the equipment to be used, where sampling is to be performed, and the action limits. For the Nyack MGP site, community air monitoring will be performed for total VOCs and particulates (dust) during the drilling of soil borings.

In addition to the community air monitoring, work/exclusion zone monitoring will be performed during work activities where impacted soil or groundwater may be encountered. The exclusion zone air monitoring requirements, equipment, and action levels are described in the site-specific HASP for this project. Note, however, that the work zone air monitoring and the community air monitoring are conducted as part of the overall site control program. When work zone VOC or particulate readings are found to exceed the downwind CAMP limits, the field staff will check the upwind and downwind air monitoring instruments to assess whether control measures will be required.

2.1 Monitoring Locations

Two community air monitoring locations will be established at the start of each workday – one upwind of the work area, and one downwind of the work area/exclusion zone. The purpose of the upwind station will be to determine the background concentration of VOCs and particulates at the worksite. The downwind monitoring station will be used to assess compliance with the NYSDEC/NYSDOH specified action limits for VOCs and particulates. The upwind VOC and dust measurements will be subtracted from the downwind measurements in order to compare the downwind instrument readings to the CAMP action levels.

The location of the each monitoring station will be noted on the ***Community Air Monitoring Daily Data Sheet*** (Daily Data Sheet) [Attachment A]. The locations of the instruments may be changed during the day to adapt to changing wind directions. Each location will be noted on the Data Sheet, along with the start and stop time at each location. Field personnel will be prepared to move the equipment to multiple locations in the event that there is little wind, if the wind direction changes frequently, or if there is a change to the location of the most sensitive downwind receptor location.

Where the work area is less than 20 feet from the nearest occupied building, the downwind air monitoring station will be positioned at the air intake for the building or at the most sensitive exposure point for the downwind receptors. Background measurements inside the building will be made prior to the start of work. If exceedances of the action levels are measured at the outside wall of the building, additional measurements will be made inside the building using portable meters.

If necessary, precautions to minimize the release of VOCs and particulates will be taken at the work zone, and engineering or work controls used to protect the downwind receptor. These controls for minimizing releases from the work zone are discussed in Section 3.

2.2 Air Monitoring Equipment

The monitoring instruments will be calibrated at the start of each workday, and again during the day if the performance of an instrument is in question. The time and method of calibration will be noted on the Daily Data Sheet. Both the photo-ionization detectors (PIDs) and particulate meters will be mounted on a tripod in a vented protective case, and programmed to record 15-minute averages. A monitoring technician will check the instrumentation at each of these locations regularly during the work-day to check that they are operating properly.

2.2.1 VOC Monitoring Equipment

VOC monitoring will be performed using PIDs (RAE Systems MiniRAE™ or equivalent) equipped with a 10.2 or 10.6 eV bulb. The instruments will be set to record 15-minute running average concentrations. The PIDs will be equipped with an audible alarm to indicate an exceedance of the action level of 5 ppm total VOCs.

2.2.2 Particulate (Dust) Monitoring Equipment

Particulate monitoring will be performed using meters set to measure 10 micron and finer particulates (PM-10). Particulates will be monitored using an MIE DataRAM DR-2000l, TSI DustTrak™, or equivalent. The equipment used will be set to record 15-minute running average concentrations, for comparison to the action levels.

In addition to the instrument readings, fugitive dust migration will be visually assessed during all work activities, and the observations recorded. Per NYSDEC requirements, visible dust migration will not be allowed. If visible dust is observed to be migrating from the work zone, the work will be stopped and dust control measures implemented.

2.3 Monitoring Action Levels and Responses

The action levels and responses for VOCs and particulates are presented in Table 1.

Table 1. Air Monitoring Response Levels and Actions

VOCs	
Response Level	**Actions**
>1 ppm at the wall of an occupied structure or at an air intake	▪ Check the indoor air concentration and compare with background measurements taken previously
>5 ppm above background for 15-minute average	▪ Temporarily halt work activities ▪ Continue monitoring, especially inside of occupied structures ▪ If VOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume
Persistent levels >5 ppm over background but <25 ppm	▪ Halt work activities ▪ Identify source of vapors ▪ Corrective action to abate emissions ▪ Continue monitoring ▪ Resume work activities if VOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average
>25 ppm at the perimeter of the work area	▪ Shut down work

Particulates	
Response Level	**Actions**
>100 μg/m^3 above background for 15-minute average or visual dust observed leaving the site	▪ Apply dust suppression ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 μg/m^3 above upwind levels and no visual dust leaving site
>150 μg/m^3 above background for 15-minute average	▪ Stop work ▪ Re-evaluate activities ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 μg/m^3 above upwind levels and no visual dust leaving site

Sources:

- NYSDOH Community Air Monitoring Plan, December 2009, as published in NYSDEC DER-10, Appendix 1A, 2010.
- Fugitive Dust and Particulate Monitoring, NYSDEC DER-10, Appendix 1B, 2010.
- Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures, NYSDOH.

All data will be downloaded to a computer on a daily basis and saved for review. The data will be provided to the NYSDEC and/or the NYSDOH upon request at any stage of the project.

If VOC or particulate action levels are observed to be exceeded during the work day, the event, the source, and corrective actions taken will be recorded on the Daily Data Sheet and reported to the on-site NYSDEC representative. If an on-site representative is not present, exceedances will be noted in the daily report to the NYSDEC project manager within one business day.

Table 2. Emergency Contacts and Telephone Numbers

Fire, Police, Ambulance		911
NYSDEC Contact	Elizabeth Lukowski – Project Manager	(518) 402-9564 (office)
GEI Contacts	James Edwards – Project Geologist Garrett Schmidt – Field Team Leader	(607) 592-6786 (cell) (607) 793-3463 (cell)
O&R Contact	Maribeth McCormick – Project Manager	(845) 783-5534 (office) (914) 557-1361 (cell)

2.4 Odor Monitoring

The field investigation personnel will record observations of odors generated during the RI field activities. When odors attributable to the exposing of impacted media are generated in the work area during intrusive activities, such as soil borings or excavation of test pits, observations will also be made at the downwind limit of the MGP site. The observations will be made to assess the potential for significant odors reaching on-site receptors or being transmitted off site. The downwind odor monitoring will be performed in conjunction with the PID and dust monitoring program described in this CAMP.

Upon detection of odors at the site perimeter, site controls, starting in the work area, will be implemented. The site controls described in Section 3 will be used to assist with odor mitigation. Note that the goal of the Odor Mitigation Plan is to minimize and to prevent, where practicable, the off-site migration of odors. Due to the short distances between any work area at the site and the on-site receptors property line, site controls will be implemented proactively when odors are detected in the breathing zone at any work area.

There are no action levels specified for odors. In the event that odors persist at the downwind receptors or property line after control measures are carried-out, the odor conditions will be discussed with the O&R and NYSDEC project managers.

3. Control Procedures

This section outlines the procedures to be used to control VOCs, odors, and particulates that may be generated during the PDI field activities. The investigation program will be conducted using two principal PDI techniques that may generate odors: test pit excavations and subsurface soil borings. The remainder of this section is intended to provide site managers, representatives of the NYSDEC and NYSDOH, and the public with information summarizing typical odor control options, and to provide some guidance for their implementation. A description of potential sources of odors and methods to be used for odor control are presented in the following sections.

3.1 Potential Sources of Odors and VOCs

Generally, the residuals encountered at former MGP sites are well defined. They are related to residual coal tar-like materials and petroleum, and principally contain VOCs, polycyclic aromatic hydrocarbons (PAHs), and a number of inorganic constituents, including metal-complexed cyanide compounds, and metals. Constituents of MGP tar or petroleum products can produce odor emissions during investigation activities when they are unearthed during backhoe test pits and soil borings. When this occurs, VOCs and light-end semi-volatile organic compounds (SVOCs) can volatilize into the ambient air. Some MGP residuals can cause distinctive odors that are similar to mothballs, roofing tar, or asphalt driveway sealer. It is important to note that the CAMP will provide for continual monitoring of VOCs and particulates during the field work to monitor for any potential release of constituents which may exceed the exposure limits for downwind receptors.

3.2 General Site Controls

Several general excavation or drilling procedure site controls that will be implemented include:

- Every effort will be made to minimize the amount of time that impacted material is exposed to ambient air at the site.
- Drill cuttings from the hollow-stem auger borings will be containerized as soon as possible during completion of each soil boring.
- Meteorological conditions are also a factor in the generation and migration of odors. Some site activities may be limited to times when specific meteorological conditions prevail, such as when winds are blowing away from a specific receptor.

4. Documentation and Reporting

The attached Daily Data Sheet will be filled-out each day to record all of the details of the CAMP work. The form will be used to record the following information:

- Date and weather, with significant changes noted which may affect the positioning of the meters or recording of the data.
- Calibration results for the instruments.
- Locations of the upwind and downwind monitoring stations, and any changes made to the locations during the day to adjust for changing work locations or wind directions.
- Any significant readings made during the day, such as exceedances which occur and their causes.

Additional information will be noted in the project field book(s), as necessary.

The electronic measurements from the PIDs and dust meters will be downloaded each day, reviewed, and archived. Exceedances of the action levels, if any, and the actions to be taken to mitigate the situations, will be discussed immediately with the on-site representatives, or reported within one business day to the NYSDEC project manager (if on-site NYSDEC oversight is not provided). The results of the daily CAMP monitoring will also be discussed in the daily written report to the NYSDEC project manager. Summaries of all air monitoring data will be provided to the NYSDEC or the NYSDOH upon request.

CAMP odor monitoring results will be recorded in the field log book and/or the Daily Data Sheet, and will also be available for review by the state agencies.

ATTACHMENT A

Community Air Monitoring Daily Data Sheet

Community Air Monitoring Daily Data Sheet

Date:

Site:

Project Number:

Weather:

Monitoring Start Time:

End Time:

Monitoring Station Location	Time (24 hour)	CAMP PID (ppm)	CAMP Particulate (mg/m3)	Wind Direction	Work Zone PID (ppm)	Work Zone Particulate (mg/m3)	Activity	Comments

Notes:

INSTRUMENT INFORMATION **Time** **Span and Agent**

PID Model: **Serial Number:** **Calibration:**

PID Model: **Serial Number:** **Calibration:**

Dust meter model: **Serial Number:** **Calibration:**

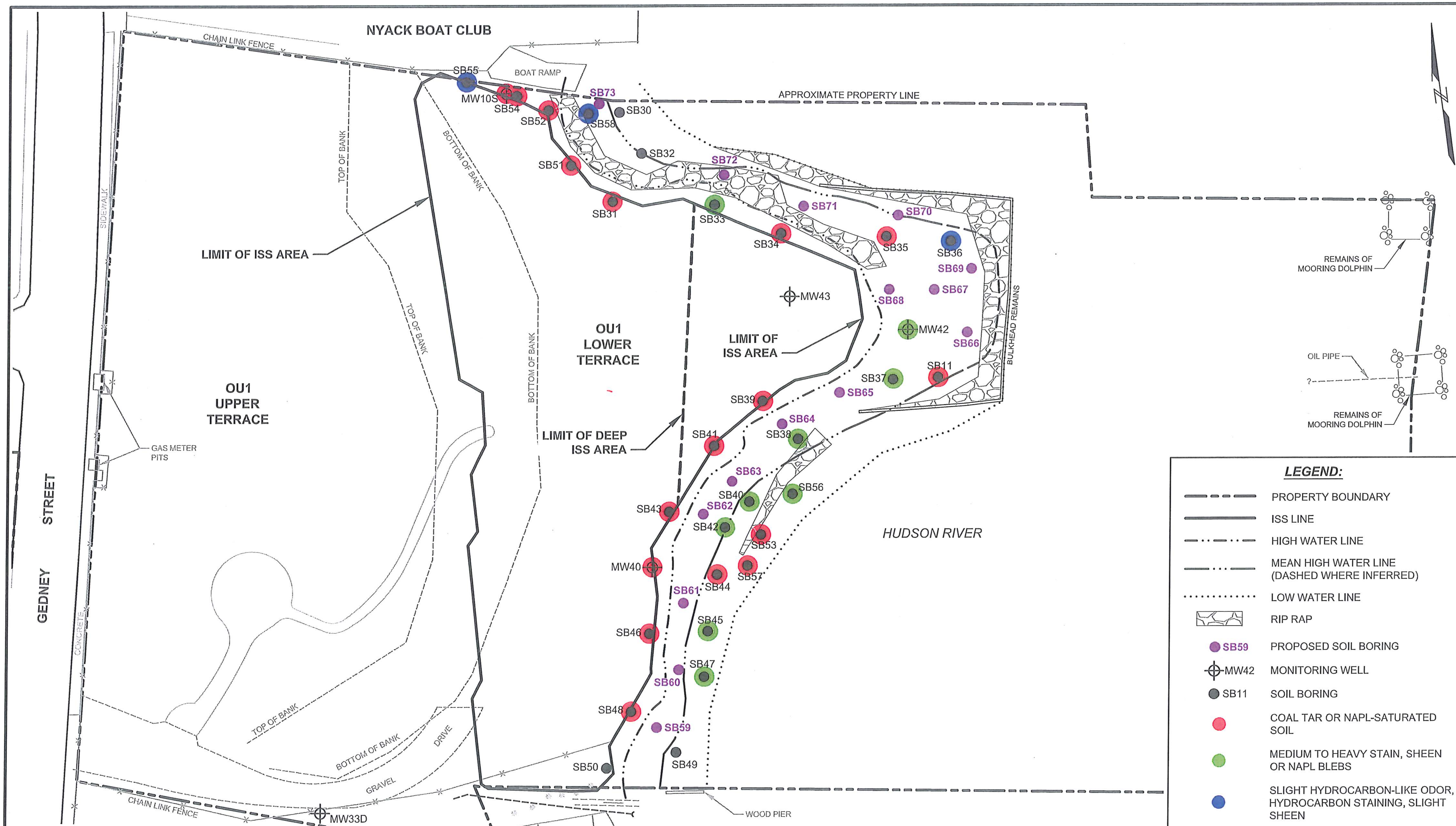
Dust meter model: **Serial Number:** **Calibration:**

Notes for Map on Reverse Side:

Circle Work Area. Show start and end times if there are multiple work areas.

➚ wind direction	**U** Upwind Station	**D** Downwind Station

Monitoring Completed By (print and sign): ______________________________



SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 2: PROPOSED SOIL BORING LOCATIONS* OF THE OU2 PRE-DESIGN INVESTIGATION WORK PLAN, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 2011.

PRE-DESIGN INVESTIGATION WORK PLAN
OPERABLE UNIT 2
NYACK FORMER MGP SITE
NYACK, NEW YORK

ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

GEI Consultants

Project 121640-1001

PREVIOUS AND PROPOSED SOIL BORING LOCATIONS

March 2012

Figure 3

I:\Project\ORANGE & ROCKLAND\Nyack\PDI Work Plan\Drawings\2012-03\Nyack-PDIWP Figures.dwg

APPENDIX F – STORMWATER POLLUTION CONTROL PLAN (ALSO IN APPENDIX A-11)

This Stormwater Pollution Control Plan (SPCP) will be implemented during the temporary disturbance of soil, rock, or ISS material at the Nyack MGP site, located in Nyack, New York. A SPCP is required by the New York State Department of Environmental Conservation (NYSDEC). A detailed SPCP will be prepared if an excavation exceeding 1 acre is planned. Below are the minimal SPCP requirements.

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

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

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

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

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

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

Stormwater management during the remediation of the site was addressed successfully by placement of temporary structures and implementation of the practices provided in the design documents.

Stormwater management during the redevelopment of the site will be accomplished by placement of appropriately sized structures and implementation of practices in accordance with Chapter 9 “Redevelopment Activity” of the New York State Stormwater Management Design Manual, January 2015.

Stormwater management during the temporary disturbance of soil, rock, or ISS material, as addressed in the Nyack Site Management Plan, will be accomplished by placement of silt fence and hay bales and implementation of Specification 01570 Erosion and Sediment Control, attached. Silt fence and hay bale typical details are provided in Figure 17.

APPENDIX G – MONITORING WELL BORING AND CONSTRUCTION LOGS

ThermoRetec Corporation
1001 W. Seneca St., Suite 204
Ithaca, NY 14850-3342
(607) 277-5716 Phone
(607) 277-9057 Fax
www.thermoretec.com

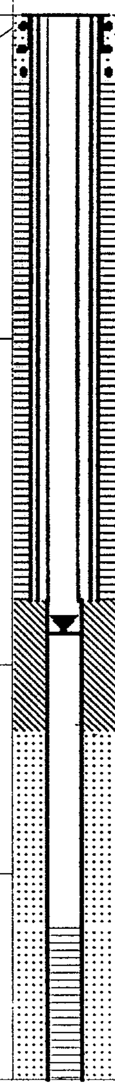
WELL INSTALLATION LOG

ID: MW1D

Project Number: ORAN2-04301	**Drilling Co.:** Maxim Technologies Inc.	**Surface Elevation: (MSL)** 37.70
Client: Orange and Rockland Utilities	**Driller:** Walt Ketter	**Water Level During Drilling:** 9.52
Site Location: Nyack MGP	**Casing ID:** 4" Schedule 40 Steel	**Stickup:** Flush Mount Installation
Start Date: 10/23/99	**Method:** 6 1/4" ID HSA/HQ Rock Core	**MP Elevation: (MSL)** 37.27
Completion Date: 10/24/99	**Logged By:** James Edwards	**Total Depth:** 39
Location: Western Parcel		

Depth (ft)	Sample Depth	Blow Counts\6"	Percent Recovery	PID (ppm)	Run Number	Rock Quality Designation	Description
0–2	0-2	3, 9, 15, 50\0.1	30	4.1	NA	NA	**Asphalt Pavement** **Fill** Gravel; asphalt fragments; brick and mortar fragments.
2–4	2-4	8, 9, 9, 9	45	15.5	NA	NA	Concrete slab - 1.8-2.8' bgs.
4–6	4-6	13, 76, 60\0.1	NA	28.5	NA	NA	Fill: sand mixed with sandstone fragments; hydrocarbon-like odor. **Sandstone Bedrock** Reddish; average hardness; fine grained; broken; thickly bedded;fractures are 0 to 60 degrees; slightly weathered.
6–8	6-8	NA	NA	NA	NA	NA	
8–9	8-9	NA	NA	NA	NA	NA	
9–14	9-14	NA	50	NA	1	7	**Mudstone** Reddish; nodules of grey silt in random pattern; broken; soft; open fractures; 0 to 40 degrees; moist. Open 90 degree fracture w/ reddish silt. **Sandstone** Reddish; average hardness; very fine grained; broken; thickly bedded; nodules of grey silt in random pattern; fractures 0 to 20 degrees; slightly weathered.
14–16							

Well Construction



Remarks: Laboratory Soil Sample
MW1D(4.0-6.0)
MGP Indicators
4" steel Schedule 40 isolation casing
set at 9.0' bgs

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ID: MW1D

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Client: Orange and Rockland Utilities	**Driller:** Walt Ketter	**Water Level During Drilling:** 9.52
Site Location: Nyack MGP	**Casing ID:** 4" Schedule 40 Steel	**Stickup:** Flush Mount Installation
Start Date: 10/23/99	**Method:** 6 1/4" ID HSA/HQ Rock Core	**MP Elevation: (MSL)** 37.70
Completion Date: 10/24/99	**Logged By:** James Edwards	**Total Depth:** 39
Location: Western Parcel		

Depth (ft)	Sample Depth	Blow Counts\6"	Percent Recovery	PID (ppm)	Run Number	Rock Quality Designation	Lithology (symbol)	Description	Well Construction
17–19	14-19	NA	78	NA	2	50		**Sandstone** Reddish; average hardness; very fine grained; broken; thickly bedded; nodules of grey silt in random pattern; fractures 0 to 20 degrees; slightly weathered. Mudstone layer - 0.5' thick; very broken.	
19–24	19-24	NA	100	NA	3	84		0.4' sandstone layer - very broken; soft.	
24–29	24-29	NA	99	NA	4	92		Sandstone; grey and reddish in mottled pattern; slightly broken; fractures 0 to 80 degrees; trace reddish silt in open fracture. Sandstone becomes grey; coarse.	Well built inside 4" open bedrock borehole
29–32			100					Becomes massive.	

Remarks:

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Ithaca, NY 14850-3342
(607) 277-5716 Phone
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Site Location: Nyack MGP	**Casing ID:** 4" Schedule 40 Steel	**Stickup:** Flush Mount Installation
Start Date: 10/23/99	**Method:** 6 1/4" ID HSA/HQ Rock Core	**MP Elevation: (MSL)** 37.70
Completion Date: 10/24/99	**Logged By:** James Edwards	**Total Depth:** 39
Location: Western Parcel		

Depth (ft)	Sample Depth	Blow Counts\6"	Percent Recovery	PID (ppm)	Run Number	Rock Quality Designation	Lithology (symbol)	Description	Well Construction
33	29-34	NA	100	NA	5	100			
34									
35									
36									
	34-39	NA	94	NA	6	80			
37									
								Becomes slightly broken.	
38									
39								Bottom of Borehole	Bottom of sandpack
40									
41									
42									
43									
44									
45									
46									
47									
48									

Remarks:

ENSR | AECOM

1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

Well ID: MW41

Project Name: Nyack OU2 MGP Investigation

Project Number: 05090-022

Date Started/Completed: May 19, 2008

Boring Location: Upper Terrace

Drilling Company: Northstar Drilling Ltd.

Drilling Method: Drive and wash

Sampling Method: HQ core barrel

PVC/Ground Elevation (ft/msl): 25.16 / 34.07

Total Depth: 35.0 ft bgs

Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks	Well Construction
0 to -10	NA	NA				Over-burden		No soil samples were collected at this location. Four (4) inch casing was driven to bedrock and washed out using a rollerbit.	Flush mounted curb box Cement - bentonite grout from 1-17 ft bgs	
-10 to -20	NA	NA				Over-burden			Bentonite seal from 17-18 ft bgs	
-20 to -23	2.2	11.3				Sand-stone		Bedrock was encountered at 20.0 ft bgs. White and reddish-brown SANDSTONE, fine to medium grained, thin to medium bedding, intensely to moderately fractured.	Sand pack from 18-34.5 ft bgs	
-23 to -25	1.8	30.0					🟩	White and reddish-brown SANDSTONE, fine to medium grained, thin to medium bedding, intensely to moderately fractured. Little hydrocarbon-like sheen and little black staining in fractures at 23.5 and 24.5 ft bgs.		

Depth scale: 0, -2, -4, -6, -8, -10, -12, -14, -16, -18, -20, -22, -24

🟥 Coal Tar or Coal Tar NAPL Saturated Soil

🟩 Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No analytical samples were collected at this location

ENSR | AECOM

1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

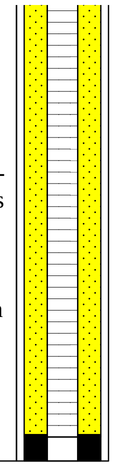
Well ID: MW41

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 19, 2008
Boring Location: Upper Terrace
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Drive and wash
Sampling Method: HQ core barrel
PVC/Ground Elevation (ft/msl): 25.16 / 34.07
Total Depth: 35.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
-26 to -30	4.1	71.1						White and reddish-brown SANDSTONE, fine to medium grained, thin to medium bedding, intensely to moderately fractured. Hydrocarbon-like black staining in fractures at 26.7 and 27.6 ft bgs. Slight hydrocarbon-like sheen in fractures from 26.0-30.0 ft bgs.	2", 0.020 slotted PVC screen from 19.5-34.5 ft bgs
-30 to -35	4.7	68.0						White and reddish-brown SANDSTONE, fine to medium grained, thin to thick bedding, intensely to slightly fractured. Slight hydrocarbon-like sheen in fractures from 26.0-30.0 ft bgs.	Well sump with bentonite seal from 34.5-35 ft bgs.
								Boring terminated at 35.0 ft bgs.	

Well Construction



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No analytical samples were collected at this location

ENSR | AECOM

1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

Well ID: MW43

Project Name: Nyack OU2 MGP Investigation

Project Number: 05090-022

Date Started/Completed: May 22, 2008

Boring Location: ISS Area

Drilling Company: Northstar Drilling Ltd.

Drilling Method: Direct Push

Sampling Method: Macro-core

PVC/Ground Elevation (ft/msl): 5.78 / 6.16

Total Depth: 25.0 ft bgs

Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	USCS	Visual Impacts	Geologic Description	Remarks
0 to -10	NA	NA			ISS		No soil samples were collected at this location. Augered through the In-situ solidified (ISS) material.	Flush mounted curb box; Cement bentonite grout from 0-18 ft bgs
-10 to -20	NA	NA					The thickness of the ISS material ranged from 0-20 ft bgs.	Bentonite seal from 18-19 ft bgs; Sand pack from 19-25 ft bgs
-20 to -22	2.6	1.1			SM		Brown fine to medium SAND, little silt; wet.	2", 0.020 slotted PVC screen from 20-25 ft bgs
-22 to -24		1.3					Boring terminated at 25.0 ft bgs.	
-24 to -25	NA	NA						

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No samples were collected.

ENSR | AECOM

1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

Well ID: MW44

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 20, 2008
Boring Location: Upper Terrace
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Drive and wash
Sampling Method: HQ core barrel
PVC/Ground Elevation (ft/msl): 33.55 / 33.84
Total Depth: 32.5 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	RQD (%)	Sample ID	Sample Interval	USCS	Geologic Description	Remarks
0 to -8.7	NA	NA			Over-burden	No soil samples were collected at this location. Four (4) inch casing was driven to bedrock and washed out using a rollerbit.	Flush mounted curb box Cement bentonite grout from 1-15 ft bgs
-8.7 to -17.5	NA	NA			Over-burden	Bedrock was encountered at 17.5 ft bgs.	Bentonite seal from 15-16 ft bgs
-17.5 to -19	1.5	0.0			Sand-stone	White and reddish-brown SANDSTONE, fine to medium grained, medium bedding, intensely fractured; hydrocarbon-like sheen and black staining in a fracture at 18 ft bgs.	Sand pack from 16-32 ft bgs
-19 to -24	4.8	0.0				White and reddish-brown SANDSTONE, fine to medium grained, medium bedding, intensely fractured; slight hydrocarbon-like sheen in fractures from 19-24 ft bgs, black hydrocarbon-like staining in fractures at 19.5, 19.9, 20.1, and 21.5 ft bgs.	2", 0.020 slotted PVC screen from 17-32 ft bgs
-24 to -25.5						White and reddish-brown SANDSTONE, fine to medium grained, medium bedding, intensely to moderately fractured; hydrocarbon-like sheen in fractures from 24.0-26.0 ft bgs,	

Depth scale: 0, -2, -4, -6, -8, -10, -12, -14, -16, -18, -20, -22, -24

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No analytical samples were collected at this location

ENSR | AECOM
1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

Well ID: MW44

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 20, 2008
Boring Location: Upper Terrace
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Drive and wash
Sampling Method: HQ core barrel
PVC/Ground Elevation (ft/msl): 33.55 / 33.84
Total Depth: 32.5 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	RQD (%)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks	Well Construction
-26 to -28	4.7	68.0						black hydrocarbon-like staining in fractures at 25.0 and 25.5 ft bgs.	Well sump with bentonite seal from 32-32.5 ft bgs	
-30 to -32	3.0	53.3						White and reddish-brown SANDSTONE, fine to medium grained, medium bedding, intensely to moderately fractured; Hydrocarbon-like sheen in fractures from 31.0-32.0 ft bgs. Boring terminated at 32.5 ft bgs.		

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No analytical samples were collected at this location

ENSR | AECOM

1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

Well ID: MW45

Project Name: Nyack OU2 MGP Investigation

Project Number: 05090-022

Date Started/Completed: May 23, 2008

Boring Location: Bottom of the slope

Drilling Company: Northstar Drilling Ltd.

Drilling Method: Drive and wash

Sampling Method: HQ core barrel

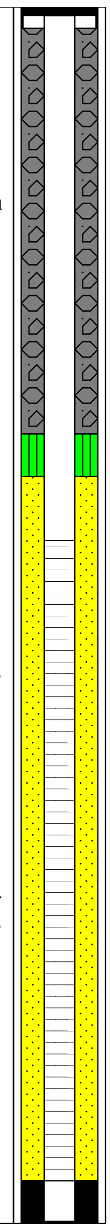
PVC/Ground Elevation (ft/msl): 13.84 / 14.15

Total Depth: 28.5 ft bgs

Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
0 to -13.5	NA	NA				Over-burden		No soil samples were collected at this location. Four (4) inch casing was driven to bedrock and washed out using a rollerbit.	Flush mounted curb box
	NA	NA							Cement bentonite grout from 1-10 ft bgs
								Bedrock encountered at 13.5 ft bgs.	Bentonite seal from 10-11 ft bgs
-13.5 to -18.5	4.8	75.0				Bed-rock		Reddish-brown SANDSTONE, fine to medium grained, thin to medium bedding, intensely to moderately fractured.	Sand pack from 11-27.5 ft bgs
-18.5 to -20.5	1.8	59.0						Reddish-brown SANDSTONE, fine to medium grained, medium bedding, moderately fractured.	2", 0.020 slotted PVC screen from 12.5-27.5 ft bgs
-20.5 to -24	4.1	83.7						Reddish-brown SILTSTONE, fine to medium grained, thin to thick bedding, moderately to slightly fractured.	
-24 to -28.5	3.5	19.0						Reddish-brown SILTSTONE, thin to medium bedding, intensely to moderately to fractured. Sheen in fracture at 27.0 ft bgs. Boring terminated at 28.5 ft bgs.	Well sump with bentonite seal from 27.5-28.5 ft bgs

Well Construction



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No analytical samples were collected at this location

APPENDIX H – GROUNDWATER MONITORING WELL SAMPLING LOG FORM AND SOIL VAPOR SAMPLING DOCUMENTATION FORM

MONITORING WELL SAMPLING RECORD

PID Reading ________ Job Name ________

Job Number ________ By ________ Date ________

Location ________ Measurement Datum ________

Well Number ________

Pre-Development Information Time (start) ________

Water Level ________ Total Depth of Well ________

One Purge Vol ________ Three Well Volume ________

Water Characteristics

Color ________ Clear ____ Cloudy

Odor ____ None ____ Weak ____ Moderate ____ Strong

Any films or immiscible material ____ None

Volume (gal)	Time	pH	Temp (EC)	Spec. Conductance (ΦS/cm)	Turbidity (NTU)	DO Conc. (mg/L)	ORP (mV)	TDS

Total Volume Removed (gal) ________ pH ________

Temperature (EC) ________ Specific Conductance (ΦS/cm) ________

DO Concentration (mg/L) ________ ORP (mV) ________

TDS ________

Post Development Information Time (Finished) ________

Water Level ________ Total Depth of Well ________

Approximate Volume Removed (gal) ________

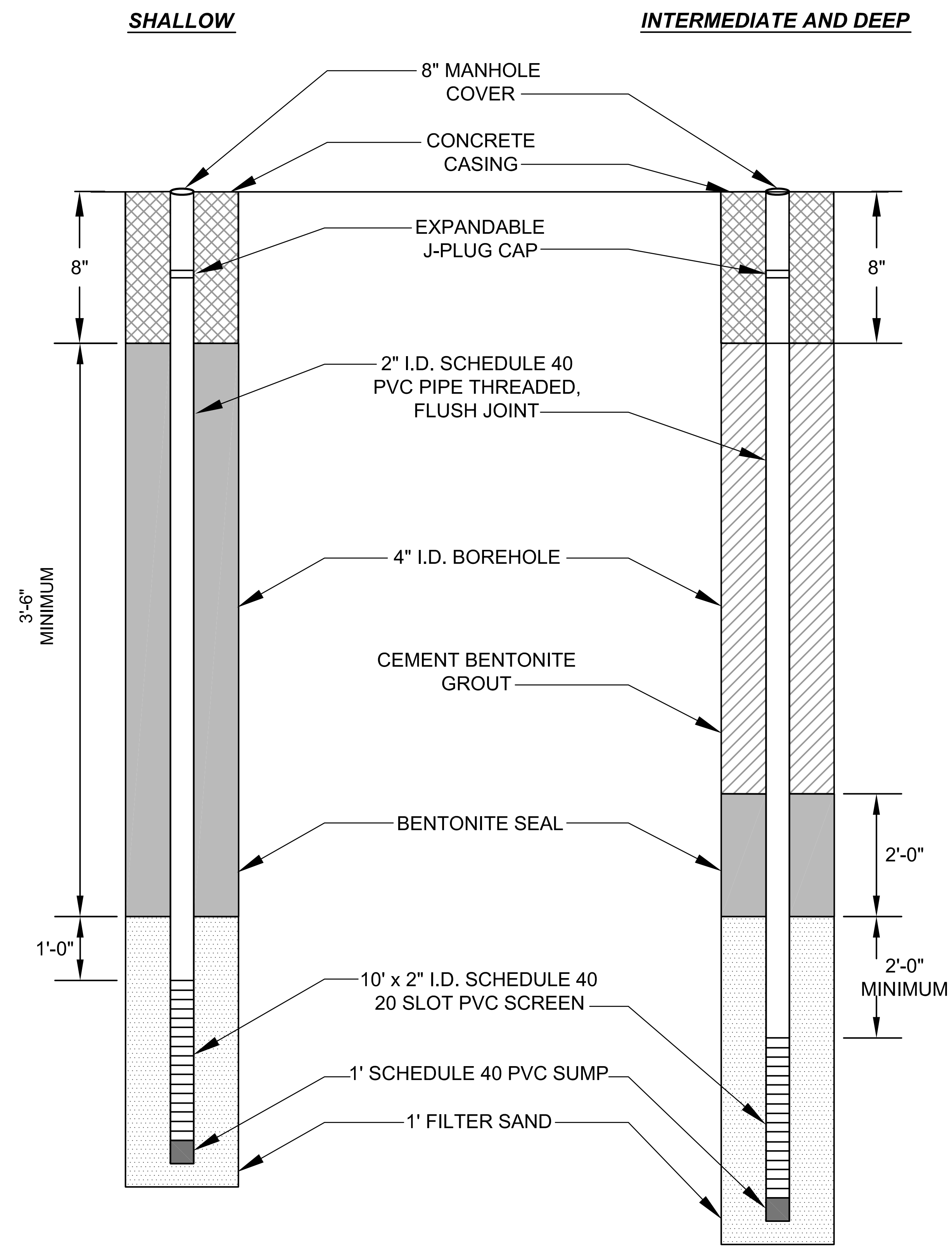
Water Characteristics

Color ________ Clear ____ Cloudy

Odor ____ None ____ Weak ____ Moderate ____ Strong

Any films or immiscible material ____ None ________

Comments:



NOT TO SCALE

GEI Consultants

TYPICAL SHALLOW, INTERMEDIATE AND DEEP GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

June 2008

I:\GEI\SOPs\ Well Detail.dwg \Jun 10, 2008

Figure 1

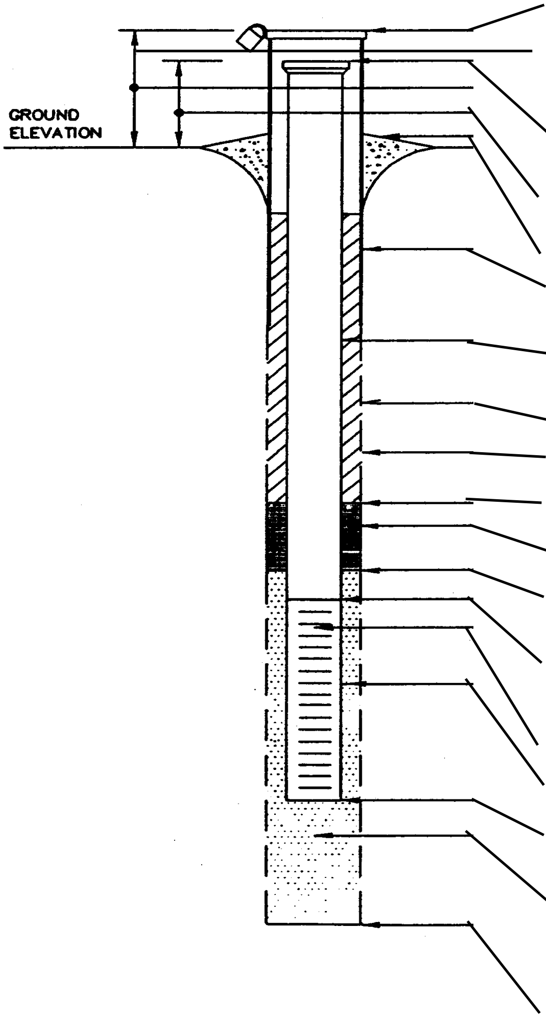
WELL INSTALLATION CHECKLIST

Project Name		Drilling Co.		Boring No.	
Project Number		Drillers		Date Started	
Project Location				Date Completed	
Site Location		Inspector			

Final depth of boring and bore hole diameter	
Depth bottom of sand pack and sand used (e.g. Morie #0)	
Type of casing (e.g. 2-in SCH 40 PVC)	
Depth bottom of screen and screen type (e.g. 10-slot)	
Depth top of screen	
Depth top of sand pack	
Depth top of seal and type of seal (e.g. cement/bentonite grout)	
Type of surface seal	
Well completion (e.g. stickup or flush mount)	

Figure 2
Overburden Monitoring Well Construction Diagram

Project		Driller	
Project No.		Drilling Method	
Date		Development Method	
Elevation		Boring No.	
Field Geologist		Well No.	

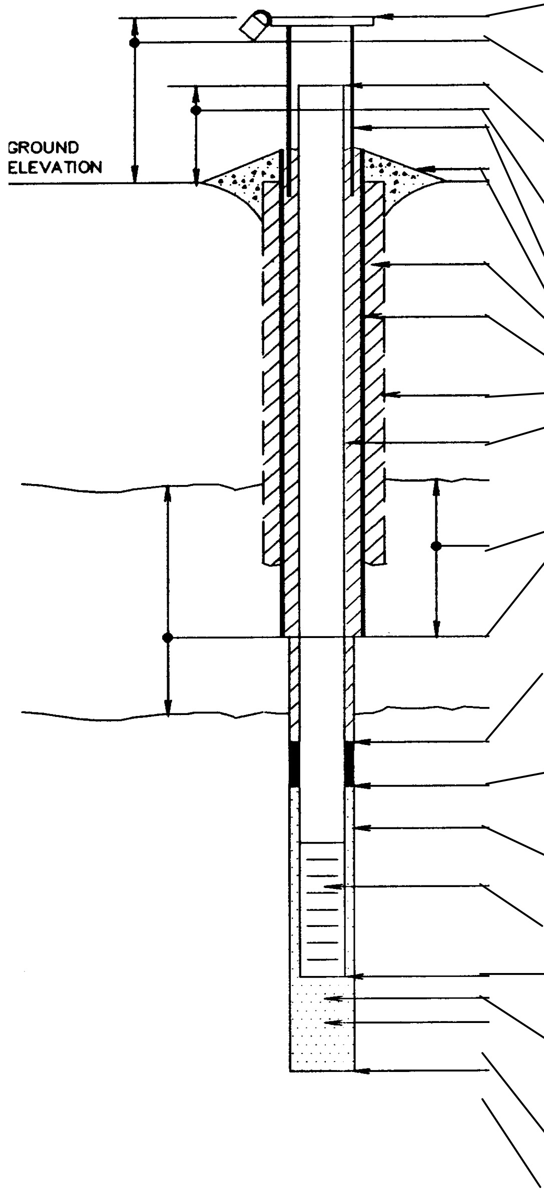


Elevation of Top of Surface Casing	
Stick Up Casing Above Ground Surface	
Elevation of Top of Riser Pipe	
Riser Pipe Above Ground Surface	
Type of Surface Seal	
Surface Casing I.D.	
Type of Surface Casing	
Riser Pipe I.D.	
Type of Riser Pipe	
Borehole Diameter	
Type of Backfill	
Elevation/Depth Top of Seal	
Type of Seal	
Elevation/Depth Top of Sand Pack	
Elevation/Depth Top of Screen	
Type of Screen	
Slot Size and Length	
Type of Sand Pack	
Elevation/Depth Bottom of Screen	
Elevation/Depth Bottom of Sand Pack	
Type of Backfill Below Monitoring Well	
Elevation/Depth of Hole	

NOT TO SCALE

Figure 3
Double Cased Monitoring Well Construction Diagram

Project		Driller	
Project No.		Drilling Method	
Date		Development Method	
Elevation		Boring No.	
Field Geologist		Well No.	



Elevation of Top of Surface Casing	
Stick Up Casing Above Ground Surface	
Elevation of Top of Riser Pipe	
Riser Pipe Above Ground Surface	
Surface Casing I.D.	
Type of Surface Seal	
Type of Surface Casing	
Upper Aquifer Casing I.D.	
Borehole Diameter/Depth	
Riser Pipe I.D.	
Type of Riser Pipe	
Type of Backfill	
Depth Casing is Set In	
Confining Layer	
Approximate Thickness Confining Layer	
Elevation/Depth Top of Seal	
Type of Seal	
Elevation/Depth Top of Sand Pack	
Type of Sand Pack	
Borehole Diameter/Depth	
Type of Screen	
Slot Size and Length	
Elevation/Depth Bottom of Screen	
Elevation/Depth Bottom of Sand Pack	
Type of Backfill Below Monitoring Well	
Elevation/Depth of Hole	

NOT TO SCALE

Soil Vapor Sampling
Documentation Form

Property Location/Address: ______________________________

Property: ______________________________

Sampling Date: ______________________________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Preparer's Name: _________________________________ Date/Time Prepared: ______________

Preparer's Affiliation: _________________________________ Phone No.: __________________

Purpose of Investigation:____

1. OCCUPANT Interviewed: Yes □ No □

Last Name: ______________________________ First Name: _____________________________

Address: ____

County: ________________________

Home Phone: ____________________________ Office Phone: ___________________________

Number of Occupants/persons at this location _______ Age of Occupants__________________

2. OWNER OR LANDLORD (Check if same as occupant __) Interviewed: Yes □ No □

Last Name: ______________________________ First Name: _____________________________

Address: ____

County: ________________________

Home Phone: ____________________________ Office Phone: ___________________________

3. CONTACT NAME (Check if same as Occupant ____, Owner ____)

Last Name: ______________________________ First Name: _____________________________

Address: ____

County: ________________________

Home Phone: ____________________________ Office Phone: ___________________________

4. PROPERTY LOCATION: ____

Relative to Site:

Direction _________ Direction to Nearest Cross Street: __________

Distance _________ Distance to Nearest Cross Street: __________

Surrounding Land Use:

North: _________________ East: _________________

South: _________________ West: _________________

Property Location/Address: ______________________________
Property: ____________________________
Sampling Date: ____________________________

5. PROPERTY BOUNDARIES

Delineate the boundaries of the property (on a separate project map, outline property location, private well location, septic/leachfield location, groundwater flow, compass direction, windrose.)

6. BUILDING CONSTRUCTION

Type of Building (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: __________________

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:________________

If multiple units, how many? ________

If the property is commercial, type?

Business Type(s) _______________________________________

Does it include residences (i.e., multi-use)? Yes □ No □

If yes, how many? ______

Other characteristics:

Number of floors______ Building age______

Is the building insulated? Yes □ No □ How air tight? Tight / Average / Not Tight

Construction Material _____________________________________

7. BASEMENT AND CONSTRUCTION CHARACTERISTICS

Does the building have a basement and/or crawl space, or is it slab-on-grade construction?

____

Describe the construction of the basement/crawl space (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other ________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

c. Basement floor:	concrete	dirt	stone	other ________
d. Basement floor surface:	uncovered	covered	covered with ____________	
e. Concrete floor:	unsealed	sealed	sealed with _____________	
	unpainted	painted	painted with ____________	
f. Foundation walls:	poured	block	stone	other ________
g. Foundation walls:	unsealed	sealed	sealed with _____________	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	

Does your basement have a sump? Yes ☐ No ☐

Is, is there water in the sump? Yes ☐ No ☐

Describe sump conditions:____

____

Have you observed standing water in your basement? Yes ☐ No ☐

If so, what is the frequency of this observation? _____________During rain events? ☐

Have you observed sheen atop the standing water? Yes ☐ No ☐

Basement/Lowest level depth below grade: ________(feet)

Are there any cracks in the floor of your basement? Yes ☐ No ☐

Description: ____

____

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

Description: ____

____

What activities occur in the finished basement?

Description: ____

____

Approximately how many hours per day (or week) do you spend in your basement? __________

8. HEATING, VENTING AND AIR CONDITIONING

Type of heating system(s) used in building: (Circle all that apply – note primary)

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Hot Air Circulation	Hot Water Baseboard	Steam Radiation
Electric Baseboard	Heat Pump	Wood Stove
Space Heaters	Radiant Floor	Outdoor wood boiler

Unvented Kerosene Heater Other _____________________________

The primary type of fuel used is:

Fuel Oil	Natural Gas	Electric
Kerosene	Propane	Solar
Wood	Coal	Other? ___________________

Time of use of each type of heating? ____

Domestic hot water tank fueled by: ____

Boiler/furnace located in: Basement Outdoors Main Floor Other_______________

Air conditioning: Central Air Window units Open Windows None

Are there air distribution ducts present? Yes ☐ No ☐

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____

____

____

____

Type of insulation (e.g. blown, fiber, etc.)? ____

Does building have energy efficient windows (e.g. double paned) Yes ☐ No ☐

Was weather-stripping recently added/upgraded? Yes ☐ No ☐

Particleboard used in construction? Yes ☐ No ☐

9. OCCUPANCY

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Level General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)

Basement ____

1st Floor ____

2nd Floor ____

3rd Floor ____

4th Floor ____

10. BULK PETROLEUM STORAGE

Aboveground storage tank on the property Yes ☐ No ☐

If yes, how old is tank? _______________ Condition? __________________

Last inspected? _______________ Location: ____________________

Describe conduits to building (type, location, and entry portal condition): _________________

____

Underground storage tank on the property. Yes ☐ No ☐

If yes, how old is tank? _______________ Condition? __________________

Last inspected? _______________ Location: ____________________

Describe conduits to building (type, location, and entry portal condition): _________________

____

11. WATER AND SEWAGE

Water Supply:

Public Water Drilled Well Driven Well Dug Well Other ______________

Is there use of groundwater water for irrigation purposes? Yes ☐ No ☐

Sewage Disposal:

Public Sewer Septic Tank Leach Field Dry Well Other ______________

12. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Yes ☐ No ☐

If not, is there a separate garage or carport? Yes ☐ No ☐

b. Does the garage have a separate heating unit? Yes ☐ No ☐ NA ☐

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, car)
Yes ☐ No ☐ NA ☐ Please specify__________________

Is gasoline stored in the garage? Yes ☐ No ☐

Quantity? ________________

d. Has the building ever had a fire? Yes ☐ No ☐

When?_________________

e. Is a kerosene or unvented gas space heater present? Yes ☐ No ☐

Where? ________________

f. Is there a workshop or hobby/craft area? Yes ☐ No ☐

Where & Type? ________________

g. Is there smoking in the building? Yes ☐ No ☐

How frequently? _______________

h. Have cleaning products been used recently? Yes ☐ No ☐

When & Type? ________________

i. Have cosmetic products been used recently? Yes ☐ No ☐

When & Type? ________________

j. Has painting/staining been done in the last 6 months? Yes ☐ No ☐

Where & When? _______________

Is house paint stored inside? Yes ☐ No ☐

Where? _______________

k. Is there new carpet, drapes or other textiles? Yes ☐ No ☐

Where & When? _______________

l. Have air fresheners been used recently? Yes ☐ No ☐

When & Type? ________________

m. Is there a kitchen exhaust fan? Yes ☐ No ☐

If yes, where vented?____________

n. Is there a bathroom exhaust fan? Yes ☐ No ☐

If yes, where vented?____________

o. Is there a clothes dryer? Yes ☐ No ☐

If yes, is it vented outside? Yes ☐ No ☐

p. Has there been a pesticide/chemical fertilizer application? Yes ☐ No ☐

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

When & Type?____

Conducted by Owner or Private Yard Service ___________________________

Is yard waste/trash burned on-site? Yes ☐ No ☐

Do any of the building occupants use solvents at work? Yes ☐ No ☐

(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Yes ☐ No ☐

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, Use dry-cleaning regularly (weekly) No

Use dry-cleaning infrequently (monthly or less) Unknown

Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Yes ☐ No ☐

Date of Installation: ____________

Is the system active or passive? Active ☐ Passive ☐

Are there any recent/past improvements to building? Yes ☐ No ☐

Interior painting? ____

Any landscaping improvements that involved bringing fill on site? Yes ☐ No ☐

Other ____

Approximately when (how long ago) did these improvements occur? ______________

Does anyone living here engage in any of the following activities or hobbies?

a. Art projects (e.g. oil painting, ceramics, pottery, stained glass, metal sculpture)

Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

b. Furniture refinishing Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

c. Model building(e.g. planes,boats,cars) Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

d. Gardening Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

e. Automotive work Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

f. Ammunition reloading Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

Is there a wood burning stove? Yes ☐ No ☐

If so, how frequently is it used?

____

____

Is there a barbeque grill? Yes ☐ No ☐

If so, how frequently is it used? What is the type of fuel?

____

____

Has the building ever had fumigation? Yes ☐ No ☐

If so, when and how frequently? Type?

____

____

13. ODOR SUMMARY

Have the occupants observed any unusual odors? ___________________________________

____

____

____

____

History of odor observation – date of onset, duration, severity, etc.

____

____

____

____

____

____

____

14. PRODUCT INVENTORY

Record the specific products found in building that have the potential to affect indoor air quality on the attached product inventory form.

15. INDOOR SKETCH

Draw a plan view sketch (on grid paper) of the basement, first floor, and any other floor where sampling was conducted in the building as well as any outdoor sample locations. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Product Inventory
Off-Site Property Sampling Documentation
Soil Vapor Intrusion Investigation

Property Address:	**Performed by:**
Date of Inventory:	**Field Instrument Make & Model:**

Location	Product Description	Size (units)	Condition *	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y/N

Notes

* Describe the condition of the product containers as Unopened (UO), Used (U), or Deteriorated (D)

** Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

APPENDIX I – FIELD SAMPLING PLAN

Geotechnical
Environmental and
Water Resources
Engineering

Field Sampling and Analytical Plan

Nyack Former Manufactured Gas Plant Site
Nyack, New York
NYSDEC Site # 3-44-046

Prepared for:
Orange and Rockland Utilities, Inc.
of New York, Inc.
3 Old Chester Road
Goshen, NY, 10924

Prepared by:
GEI Consultants, Inc., P.C.
1 Greenwood Avenue Suite 210
Montclair, NJ 07042
(973) 509-9650

March, 2015

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Abbreviations and Acronyms

CAMP	Community Air Monitoring Plan
COC	Chain-of-Custody
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
HASP	Health and Safety Plan
ID	Inner Diameter
ISS	In-Situ Stabilization
MGP	Manufactured Gas Plant
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPL	Non-aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NIST	National Institute of Standards and Technology
O&R	Orange and Rockland Utilities, Inc.
ORP	Oxidation-Reduction Potential
OU	Operable Unit
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts per Million
QAPP	Quality Assurance Project Plan
RA	Remedial Action
SC	Specific Conductance
SMP	Site Management Plan
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
TCL	Target Compound List
USDOT	U.S. Department of Transportation
VOC	Volatile Organic Compound

1. Introduction

This Field Sampling Plan (FSP) has been prepared to specify procedures that need to be followed during the implementation of post-Remedial Action (RA) groundwater monitoring and excavation activities conducted below the clean cover and demarcation barrier that will be installed at the Nyack former Manufactured Gas Plant (MGP) Site as part of required annual groundwater monitoring activities. The numbers and types of environmental samples to be collected for excavation activities will be described in a project Work Plan that will be submitted to Orange and Rockland Utilities, Inc. (O&R) for New York State Department of Environmental Conservation (NYSDEC) approval prior to the start of work.

1.1 Overview of Field Activities

The following field activities may be performed as part of post-RA groundwater monitoring and excavation activities at the Site:

- Air monitoring
- Subsurface soil sampling
- Excavation and soil sampling
- Soil borings, monitoring well installation, and well development
- Groundwater sampling
- Soil vapor sampling
- Contaminated soil/material load out and transport activities
- Clean cover and demarcation barrier repair
- Site surveying
- Other work as applicable

2. General Field Guidelines

2.1 Site Hazards

Potential on-Site surface hazards, such as sharp objects, overhead power lines, energized areas, and building hazards will be identified prior to initiation of field work. Generally, such hazards will be identified during a site visit prior to the first day of field work.

2.2 Underground Utilities

All underground utilities, including electric lines, gas lines, and communication lines will be identified prior to initiation of drilling and other subsurface work. This will be accomplished as follows:

- All on-Site underground utilities in the vicinity of proposed drilling or excavation locations will be located.
- Dig Safely of New York 800-272-4480 will be contacted to initiate the locating activities. New York State law requires that Dig Safely of New York be notified at least two working days, and not more than 10 working days, before subsurface work is performed.
- Companies and municipalities with subsurface utilities present will locate and mark-out all subsurface utility lines.

2.3 Field Log Books

All field activities will be carefully documented in field log books. Entries will be of sufficient detail that a complete daily record of significant events, observations, and measurements is obtained. The field log book will provide a legal record of the activities conducted at the Site. Accordingly:

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Field Team Leader while field work is in progress.
- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of field work.

- Erroneous entries made while field work is in progress will be corrected by the person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections made after departing the field will be made by the person who made the original entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.

At a minimum, daily field book entries will include the following information:

- Location of field activity;
- Date and time of entry;
- Names and titles of field team members;
- Names and titles of any site visitors and site contacts;
- Weather information, for example: temperature, cloud coverage, wind speed and direction;
- Purpose of field activity;
- A detailed description of the field work conducted;
- Sample media (soil, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) taken;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;
- Preservatives used;
- Analytical parameters;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- Any field measurements made, such as pH, temperature, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s);
- Information pertaining to sample documentation such as:
  - Bottle lot numbers;
  - Dates and method of sample shipments;
  - Chain-of-Custody (COC) Record numbers;

- Overnight carrier Air Bill Number.

3. Field Equipment Decontamination and Management of Excavation Derived Wastes

3.1 Decontamination Area

A temporary decontamination area lined with polyethylene sheeting will be constructed on-Site for steam-cleaning drilling and excavation equipment. Water collected from the steam-cleaning activities will be collected in 55-gallon drums or other container and managed as described in Section 3.3.

3.2 Equipment Decontamination

The following procedures will be used to decontaminate equipment used during drilling and excavation activities.

- All drilling and excavation equipment including the drilling rig, augers, bits, rods, tools, split-spoon samplers and tremie pipe will be cleaned with a high-pressure steam cleaning unit before beginning work.
- Tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided.
- All augers, rods, and tools will be decontaminated between each drilling location according to the above procedures.
- The back of drilling rig, backhoe/excavator bucket and all tools, augers, and rods will be decontaminated at the completion of the work and prior to leaving the site.

3.2.1 Sampling Equipment Decontamination

Suggested Materials:

- Potable water
- Simple Green®
- Reagent-grade methanol or isopropanol
- Distilled water
- Aluminum foil
- Plastic/polyethylene sheeting
- Plastic buckets and brushes

- Personal protective equipment (PPE) in accordance with the Site Management Health and Safety Plan (HASP).

Procedures

- Prior to sampling, all non-dedicated sampling equipment (bowls, spoons, interface probes, etc.) will be either steam cleaned or washed with potable water and Simple Green®. Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, etc.
- The sampling equipment will then be rinsed with potable water followed by a deionized water rinse.
- Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

3.3 Management of Excavation Derived Wastes

3.3.1 Decontamination Fluids

Steam-cleaning and decontamination fluids will be collected in 55-gallon drums or other containers. The containers will be labeled as investigation derived wastewater and temporarily stored on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

3.3.2 Drill Cuttings, Excavated Soil/Fill/ISS Material and Groundwater

Soil excavated from below the clean soil cover barrier may be re-used as on-Site backfill material following provisions in the Site Management Plan (SMP), Appendix A-7. Soil or fill that does not meet the re-use criteria, must be transported off Site for disposal at a permitted facility in accordance with SMP, Appendix A-6.

Site soil or fill that exceeds Restricted Residential Standards and that is transported off Site for disposal must be managed, characterized, and properly disposed of in accordance with NYSDEC regulations and directives.

Any groundwater that is uncounted during excavation work below the clean fill, and that must be removed from the excavation to accommodate this work, will be containerized and characterized for off-Site treatment and disposal in accordance with applicable NYSDEC rules and regulations.

3.3.3 Development and Purge Well Water

All development and purge water will be contained in 55-gallon drums or other container. The containers will be labeled as investigation derived wastewater and temporarily stored on wooden pallets in a plastic-lined containment area pending characterization for off-Site treatment and disposal in accordance with applicable NYSDEC rules and regulations.

3.3.4 Personal Protective Equipment

All PPE will be placed in 55-gallon drums or other container for proper disposal in accordance with applicable NYSDEC rules and regulations.

3.3.5 Dedicated Sampling Equipment

All dedicated groundwater sampling equipment (dedicated disposable polyethylene bailer and dedicated polypropylene line) will be placed in 55-gallon drums or other container for disposal in accordance with applicable NYSDEC rules and regulations.

4. Drilling/Excavation/Soil Sampling Procedures

4.1 Introduction

Drilling and excavation activities that may be conducted at the Site consist of:

- Backhoe/excavator digging;
- Soil borings;
- Monitoring well installations; and
- Other work as applicable.

These procedures are described in the following section. Equipment decontamination procedures are described in Section 3.

4.2 Excavation, Soil Borings, and Soil Sampling

Excavation will be implemented in accordance with Appendix A.

4.3 Monitoring Well Installation and Development

It is not anticipated that monitoring wells will be installed within the area of the clean fill cover, in-situ solidification (ISS) material and demarcation barrier. However, if any monitoring wells are required, the following methods described in Standard Operating Procedures (SOPs), provided in Appendix F of the SMP, will be used for drilling, installing, and developing the monitoring wells. Alternative methods may be used if approved by the NYSDEC.

5. Groundwater Sampling Procedures

5.1 Introduction

Groundwater sampling will be conducted at the Site. Procedures for obtaining samples of various environmental media are described in this section.

5.2 Groundwater Sampling

The following is a step-by-step sampling procedure to be used to collect groundwater samples from the monitoring wells during the annual monitoring. Monitoring frequency may be reduced with NYSDEC approval. Well sampling procedures will be recorded in the field notebook. Sample management is detailed in the Quality Assurance Project Plan (QAPP).

1. Groundwater samples will not be collected until at minimum, two weeks following well development of permanent wells.
2. The monitoring well believed to have the least contaminated groundwater should generally be sampled first and the sampling activity proceed systematically to the well with the most contaminated groundwater. Check the well, the lock, and the locking cap for damage or evidence of tampering.
3. Prior to sampling, a round of groundwater elevation measurements will be collected. The measurements will be made from the surveyed well elevation mark on the top of the inner casing with a decontaminated electric water/product level probe. Depth to well bottom should not be measured at this time (wait until sampling has been completed). The measurements will be made in as short a time frame as practical to minimize temporal fluctuations in hydraulic conditions. The time, date, and measurement to nearest 0.01 foot will be recorded in the field logbook.
4. Place a plastic sheet on the ground to prevent contamination of the bailer rope and/or the tubing associated with the purging (pump) equipment.
5. Each monitoring well will be purged with a centrifugal, submersible, peristaltic, or whale pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist upon consultation with the project manager, and with the prior approval of O&R and NYSDEC.
6. Slowly and gently insert new polyethylene or Teflon-lined tubing to the pump intake (or use dedicated tubing that remains in the well) and to the middle of the saturated screened interval or to the pre-determined sampling depth.
7. The tubing intake should be kept at least two (2) feet above the bottom of the well to prevent disturbance or suspension of any sediment or non-aqueous phase liquid (NAPL) present in the bottom of the well. Record the depth of the pump intake.

8. If possible, position your sampling equipment and tubing so that it is in the shade. The goal is to minimize the effect of sunlight raising the temperature of water being collected.
9. Start the pump on the lowest setting and increase slowly until flow begins. Adjust the pumping rate so that drawdown in the well is minimal (0.3 feet or less, is desirable but not mandatory). Use a pumping rate between 100 to 1,000 milliliters per minute (mL/min) (or approximately 0.1 to 1 quarts per minute). Measure flow rate on the pump or using a graduated container every 3 to 5 minutes and record. The minimum purge volume will be twice the combined volumes of the sampling string (i.e. pump, tubing, and flow-through cell).
10. Temperature, pH, Specific Conductance (SC), turbidity, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP) need to be calibrated on the meter(s). Use calibration methods provided by the manufacturer of the equipment. Note that appropriate calibration for DO requires a water saturated air environment, along with measured temperature and barometric pressure.
11. The water quality parameters of temperature, pH, conductivity, oxygen reduction potential, turbidity, and DO will be measured and recorded, at 3 to 5 minute intervals with a multi-parameter water quality probe. At least, one well volume of water will be removed prior to sampling. When the parameters stabilize over three consecutive readings, sampling may commence.
12. Purging is complete when, after three consecutive measurements, the water quality parameters have stabilized as follows:

    - pH (+/-0.1 standard units)
    - temperature (+/- 3%)
    - SC (+/-3%)
    - turbidity (+/-10% if >5 NTU; if 3 values are <5 NTU, consider the values as stabilized)
    - DO (+/-10% if >0.5 mg/L; if 3 values are <0.5 mg/L, consider the values as stabilized)
    - ORP (+/-10 mV)

    Record results in the field logbook prior to sample collection.

Sample Collection

1. Following purge, the discharge tubing from the flow-through cell will be removed. Do not disturb pump and tubing between stabilization and sample collection.
2. Sample containers will be filled directly from the sampling device in order of decreasing volatility (i.e., volatile organic compounds (VOC) samples are collected first). Fill all containers from the discharge end of the tubing. Collect samples at a flow rate equal to the steady state purge rate.

3. If the well goes dry before the required volumes are removed, the well may be sampled when it recovers sufficiently.
4. After all samples are collected, the water level in the monitoring well will be gauged and the locking cap will be re-installed.
5. Depth to bottom of the well will be measured.
6. Investigation-derived purged groundwater will be contained within United States Department of Transportation (USDOT) 55 gallon drums or other acceptable containers and disposed of by O&R.
7. Investigation derived waste such as PPE will be disposed of according to the Section A-6 of the SMP Appendix A – Excavation Work Plan, dedicated disposable sampling equipment may be stored temporarily in 5-gallon buckets or similar containers.

References

Environmental Standard Operating Procedures Atlantic and New England Region, SOP No. GW-003, Low Flow (Low Stress) Groundwater Sampling, GEI Consultants, July 2011

Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells, published July 30, 1996 by the United States Environmental Protection Agency (EPA).

6. Soil Vapor

6.1 Sub-Slab Soil Vapor Collection

This procedure outlines the steps to collect sub-slab soil vapor samples on as necessary basis, per consultation with NYSDEC. The NYSDEC will be consulted for proposed sample locations, sample depths, and soil vapor monitoring, and frequency.

6.1.1 Documentation of Field Conditions

Document pertinent field conditions prior to installation of any probe locations.

- Weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) will be recorded at the beginning of the sampling event. Substantial changes to these conditions that may occur during the course of sampling will be recorded.
  - The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data will be obtained for the past 24 to 48 hours. The indoor conditions (temperature, heating/cooling system active, windows open/closed, etc.) will be recorded.
- The differential pressure at the building will be measured. The indoor and outdoor barometric pressure will be measured using a high resolution device. Where possible, the sub-slab barometric pressure will be measured at the sampling point.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility will be identified.
- Indoor floor plan sketches will be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (North), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches will be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (North), and paved areas.
- Any pertinent observations will be recorded, such as odors and readings from field instrumentation.

6.1.2 Sub-Slab Soil Vapor Point Installation Specifications

The installation of the temporary sub-slab soil vapor points will be in general accordance with Section 2.7.2 of the NYSDOH *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006 (herein referred to as the NYSDOH guidance document). Each sub-slab soil vapor point will be constructed as follows:

- Drill an approximately 3/8-inch hole through the slab. If necessary, advance the drill bit 2-3 inches into the sub-slab material to create an open cavity.
- Using dedicated inert Teflon or stainless steel tubing of laboratory or food grade quality, insert the inlet of the tubing to the specified depth below the slab. For permanent installation, only stainless steel tubing and fittings will be used.
- For permanent point installations, the annular space surrounding the vapor probe tip will be filled with a porous backfill material (e.g., glass beads or coarse silica sand) to cover 1-inch of the above the tip of the probe.
- Seal the annular space between the hole and the tubing using an inert non-shrinking sealant such as melted 100% beeswax, permagum grout, putty, etc. For permanent installations, cement may be used.
- For permanent points, a protective casing will be set around the top of the point tubing and grouted in place minimize infiltration of water or ambient air, as well as to prevent accidental damage to the permanent point.
- The tubing top will be fitted with a Swagelok and cap to prevent moisture and foreign material from infiltrating the tubing.

6.1.3 Sub-Slab Soil Vapor Sample Collection

Sub-slab soil vapor samples will be collected in accordance with NYSDOH guidance document. Specifically, sub-slab samples from the points will be collected as follows:

- Document pertinent field conditions prior to sampling as described above.
- A suction pump will be used to remove one to three implant volumes from the sub-slab soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples will be collected in an individually laboratory certified clean 6-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (8 hours). The regulator flow rate will not exceed 0.2 liters per minute.

- A helium tracer gas will be used to identify any potential migration or short-circuiting of ambient air during sampling as described below.
- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody (COC) form for each sample.
- Connect the tubing from the sub-slab soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the COC form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples will be analyzed for VOCs and naphthalene via modified EPA modified Method TO-15 and helium via ASTM D-1945, if necessary, by a New York State ELAP-certified laboratory.

- Include the required copies of the COC form in the shipping packaging, as directed by the laboratory. Maintain a copy of the COC for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

All laboratory analytical data will be validated by a data validation professional in accordance with the EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the EPA Region II SOP for the Validation of Organic Data modified to accommodate the EPA Method TO-15 and natural gas analysis by ASTM D-1945.

6.1.4 Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the sub-slab soil vapor probe seal and assess the potential for introduction of indoor air into the sub-slab soil vapor sample. A tracer gas evaluation will be conducted on each temporary sub-slab soil vapor probe to be sampled in the sampling event.

The following tracer gas evaluation procedure uses helium as a tracer gas, which can be measured through laboratory analysis or with a portable detector.

- Retain the tracer gas around the sub-slab sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the sub-slab soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract sub-slab soil vapor at a rate of no more than 0.2 liters per minute. Purge the tubing using the pump. Calculate the volume of air in the tubing and purge one to three tubing volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation will be analyzed for VOCs and naphthalene via modified EPA modified Method TO-15 and helium via ASTM D-1945 by a New York State ELAP-certified laboratory.

- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary:

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred; however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

6.2 Indoor Air Sample Collection

This procedure outlines the steps to collect indoor air samples on as necessary basis, per consultation with NYSDEC. The NYSDEC will be consulted for proposed sample locations, sample depths, and soil vapor monitoring frequency.

The following procedures will be followed for the collection of indoor air samples:

6.2.1 Field Conditions Documentation

Documentation of pertinent field conditions prior to sample collection:

- Weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) will be recorded at the beginning of the sampling event. Substantial changes to these conditions that may occur during the course of sampling will be recorded. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data will be obtained for the past 24 to 48 hours. The indoor conditions (temperature, heating/cooling system active, windows open/closed, etc.) will be recorded.
- The differential pressure at the building will be measured. The indoor and outdoor barometric pressure using a high-resolution device will be measured.

- An attempt will be made to identify uses of volatile chemicals during normal operations of the nearby facilities.
- Indoor floor plan sketches will be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information will be completed.
- Outdoor plot sketches will be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (north).
- Any pertinent observations will be recorded, such as odors and readings from field instrumentation.

6.2.2 Sample Collection

- Samples will be collected in an individually laboratory certified clean 6-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (8-hour). The regulator flow rate will not exceed 0.2 liters per minute.
- Place the canister at the sampling location. The samples will be collected from breathing height (e.g., 3 to 5 feet aboveground); therefore, the canisters will be mounted on a stable platform such that the sample inlet will be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the COC form for each sample.
- Open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling. During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the

laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.

- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the COC form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples will be analyzed for VOCs and naphthalene via modified EPA modified Method TO-15 by a New York State ELAP-certified laboratory.
- Include the required copies of the COC form in the shipping packaging, as directed by the laboratory. Maintain a copy of the COC for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

All laboratory analytical data will be validated by a data validation professional in accordance with the EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the EPA Region II SOP for the Validation of Organic Data modified to accommodate the EPA Method TO-15.

6.3 Ambient Air Sample Collection

Describe procedures to collect ambient air samples. The NYSDEC will be consulted for proposed sample locations, sample depths, and soil vapor monitoring frequency.

The following procedures will be followed for the collection of indoor air samples:

6.3.1 Field Conditions Documentation

Document pertinent field conditions prior to sample collection:

- Record weather information, if available (such as precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for at least the past 12 hours.

- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

6.3.2 Sample Collection

- Samples should be collected in laboratory-certified clean 6-liter SUMMA® canister (or equivalent) using a flow controller calibrated for the anticipated sample duration (8-hour). The regulator flow rate should not exceed 0.2 liters per minute.
- Place the canister at the sampling location. If the sample is collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet should be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.
- Connect the tubing to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- If possible, monitor the vacuum pressure in the canister routinely during sampling. During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, call the laboratory and discuss the sample viability with them. Determine whether another sample will be taken after sharing the laboratory's opinion with the PM.

- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the COC form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the COC form in the shipping packaging, as directed by the laboratory. Maintain a copy of the COC for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

References

Environmental Standard Operating Procedures Atlantic and New England Region, SOP No. SG-002, Soil Vapor Sample Collection, GEI Consultants, July 2011.

Environmental Standard Operating Procedures Atlantic and New England Region, SOP No. SG-003, Sub-slab Soil Vapor Collection, GEI Consultants, July 2011.

Environmental Standard Operating Procedures Atlantic and New England Region, SOP No. SG-004, Ambient Air Sample Collection, GEI Consultants, July 2011.

Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, New York State Department of Health, October 2006.

7. Air Monitoring

7.1 Breathing Zone Air Monitoring During Excavation, Drilling, and Sampling

Air monitoring of the breathing zone will be conducted periodically during all drilling, excavation, and sampling activities conducted below the clean fill cover and demarcation barrier to assure proper health and safety protection for field workers.

- RaeSystems Mini Rae 2000 photoionization detector (PID) or equivalent will be used to monitor for organic vapors in the breathing zone and borehole, and to screen the samples.
- Mini Ram™ PM-10 (or equivalent), particle detector will be used to count inhalable particles of dust during field work.
- Chip Measuring System (CMS) electronic Draeger tubes will be used to monitor for hydrogen cyanide during field work.

The readings will be recorded in the field book and on the boring log during drilling activities. The procedure for air monitoring equipment operation and calibration is included in Section 7 and the SMP Health and Safety Plan (HASP).

7.2 Community Air Monitoring Plan

In accordance with NYSDEC and New York State Department of Health (NYSDOH) requirements, a Community Air Monitoring Plan (CAMP) will be implemented at the Site during drilling and excavation activities conducted below the clean cover and demarcation barrier. The objective of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors, including residences and businesses and on-site workers not involved with drilling and/or excavation activities) from potential airborne contaminant releases as a direct result of drilling and/or excavation activities. Two air-monitoring stations will be set up on Site. VOCs and respirable particulates (PM-10) will be monitored at the downwind perimeter of the immediate work area on a contiguous basis. Wind direction will be determined using a wind sock(s) and/or flagging poles installed on site. Upwind concentrations will also be measured continuously to establish background conditions. VOC vapors will be monitored using a PID. Particulate dust will be monitored using a MiniRAM™ PM-10 particulate meter. Fifteen-minute running average concentrations will be collected from each of the two air monitoring stations during work activities. A summary of air monitoring action levels and restrictions are presented in the SMP HASP.

8. Field Instruments and Calibration

All field analytical equipment will be calibrated immediately prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. All instrument calibrations will be documented in the project field book and in an instrument calibration log. Copies of all of the records and instrument manuals will be maintained by O&R.

The following field instruments may be used during the site development:

- RaeSystems Mini Rae 2000 PID (or equivalent);
- pH Meter;
- Specific Conductivity Meter and Temperature Probe;
- Turbidity Meter; and
- MiniRAM™ PM-10 Particulate Meter.

8.1 Portable Photoionization Analyzer

- The PID will be a RaeSystems Mini Rae 2000 (or equivalent), equipped with a 10.6 eV lamp. The Photovac is capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the Target Compound List (TCL).
- Calibration must be performed at the beginning and end of each day of use with a standard calibration gas having an approximate concentration of 100 parts per million of isobutylene. If the unit experiences abnormal perturbation or erratic readings, additional calibration will be required.
- All calibration data must be recorded in field notebooks and on calibration log sheets to be maintained on site.
- A battery check must be completed at the beginning and end of each working day.

8.2 pH Meter

- Calibration of the pH meter must be performed at the start of each day of use, and after very high or low readings as required by this plan, according to manufacturer's instructions.

- National Institute of Standards and Technology (NIST) - traceable standard buffer solutions which bracket the expected pH range will be used. The standards will be pH of 4.0, 7.0 and 10.0 standard units.
- The use of the pH calibration must be used to set the meter to display the value of the standard being checked.
- The calibration data must be recorded on calibration sheets maintained on site.

8.3 Specific Conductivity Meter and Temperature Probe

- Calibration checks using the conductivity standard must be performed at the start of each day of use, after five to ten readings or after very high or low readings as required by this plan, according to manufacturer's instructions.
- The portable conductivity meter must be calibrated using a reference solution of 200 uohms/cm on a daily basis. Readings must be within five percent to be acceptable.
- The thermometer of the meter must be calibrated against the field thermometer on a weekly basis.

8.4 Turbidity Meter

- The turbidity meter must be checked at the start of each day of use and at the end of the day according to manufacturer's instructions.

8.5 Particulate Meter

- The particulate meter must be calibrated at the start of each day of use in accordance with the manufacturer’s instructions.

9. Field Sample Identification and Custody

9.1 Sample Location Numbering System

- Subsurface soil borings and/or excavations will be numbered consecutively. Individual samples will also be designated with a depth code (see below).
- Monitoring wells will be numbered consecutively.
- Soil vapor samples will be numbered consecutively.

9.2 Sample Identification

Each sample will be given a unique alphanumeric identifier in accordance with the following or similar classification system:

SAMPLE IDENTIFICATION

LL*	NN*	N-N	LL
Sample Type	Sample Number	Depth Code	QC Identifier

	Solid		Water
Sample Type:	MW – Monitoring Well Boring		MW - Monitoring Well
	SB – Soil Boring		
	EX – Excavation		
	Air		
	IA – Indoor Air		
	SA – Sub-slab Air		
	AA – Ambient Air		
Sample Number:	Number referenced to a sample location map.		
Depth Code:	Depth in feet of sample interval (0-0.5, 2-4, 10-12, etc.)		
QC Identifier:	FB - Field Blank	MS - Matrix Spike	
	TB - Trip Blank	MD - Matrix Spike Duplicate	
	WB - Wash or Rinse Blank	MB - Matrix Blank	

* L = Letter
* N = Number

Field duplicate samples will be assigned identifiers that do not allow the laboratory to distinguish them as field duplicates. Each sample container will be labeled prior to packing for shipment. The sample identifier, site name, date, and time of sampling, and analytical parameters will be written on the label in waterproof ink and recorded in the field book.

9.3 Chain-of-Custody

- A Chain-of-Custody (COC) record (Figure 8.1 or similar) will accompany the sample containers during selection and preparation at the laboratory, during shipment to the field, and during return shipment to the laboratory.
- The COC will identify each sample container and the analytical parameters for each, and will list the field personnel that collected the samples, the project name and number, the name of the analytical laboratory that will receive the samples, and the method of sample shipment.
- If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample shipment.
- The COC will be completed by field personnel as samples are collected and packed for shipment.
- Erroneous markings will be crossed-out with a single line and initialed by the author.
- The REMARKS space will be used to indicate if the sample is a matrix spike, matrix spike duplicate (MS/MSD), or matrix duplicate.
- Trip and field blanks will be listed on separate rows.
- After the samples have been collected and sample information has been listed on the COC form, the method of shipment, the shipping cooler identification number(s), and the shipper airbill number will be entered on the COC.
- Finally, a member of the sampling team will write his/her signature, the date, and time on the first RELINQUISHED BY space. Duplicate copies of each COC must be completed.
- One copy of the COC will be retained by sampling personnel. The other copy and the original will be sealed in a plastic bag and taped inside the lid of the shipping cooler.
- Sample shipments will be refrigerated at 4°C, typically by packing with ice, to preserve the samples during shipment.
- After the shipping cooler is closed, custody seals provided by the laboratory will be affixed to the latch and across the front and back of the cooler lid, and signed by the person relinquishing the samples to the shipper.
- The seal will be covered with clear tape, and the cooler lid will be secured by wrapping with packing tape.
- The cooler will be relinquished to the shipper, typically an overnight carrier.
- The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the samples will not be analyzed.

- The samples must be delivered to the laboratory within 48 hours of collection.

9.4 Sample Documentation

The field team leader will retain a copy of the COC, and, in addition, the field team leader will ensure that the following information about each sample is recorded in the field book:

- Sample identifier;
- Identification of sampled media (e.g., soil, sediment, groundwater);
- Sample location with respect to known reference point;
- Physical description of sample location;
- Field measurements, (e.g., pH, temperature, conductivity, and water levels);
- Date and time of collection;
- Sample collection method;
- Volume of groundwater purged before sampling;
- Number of sample containers;
- Analytical parameters;
- Preservatives used; and
- Shipping information:
  - Dates and method of sample shipments;
  - Chain-of-Custody Record numbers;
  - Overnight carrier Air Bill numbers;
  - Sample recipient (e.g., laboratory name).

APPENDIX J – QUALITY ASSURANCE PROJECT PLAN

Geotechnical
Environmental and
Water Resources
Engineering

Quality Assurance Project Plan

Nyack MGP Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
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1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist

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Abbreviations and Acronyms

ASP	Analytical Service Protocols
ASTM	ASTM International (formerly American Society for Testing and Materials)
CAR	Corrective Action Request
CERCLA	Comprehensive Environmental Response, Compensations and Liability Act
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limits
DO	Dissolved Oxygen
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
EIMS	Environmental Information Management System
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FSAP	Field Sampling and Analytical Plan
GS/MS	Gas Chromatography/Mass Spectroscopy
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NIST	National Institute of Standards and Technology
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&R	Orange & Rockland Utilities, Inc.
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PAH34	PAHs defined by EPA for Sediment Toxicity Evaluation
PDI	Pre-Design Investigation
PQL	Practical Quantitation Level
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RD	Remedial Design
RPD	Relative Percent Difference
SA	Spiked Analyte
SIM	Select Ion Monitoring
SR	Sample Result
SSR	Spike sample result
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound

Abbreviations and Acronyms (cont'd.)

TOC	Total Organic Carbon
VOC	Volatile Organic Compound

Quality Assurance Glossary

"Analytical Services Protocol" or "ASP" means the New York State Department of Environmental Conservation's (NYSDEC) compendium of approved United States Environmental Protection Agency (EPA) and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

"Confirmatory sample" means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as "post remediation sample."

"Contract laboratory program" or "CLP" means a program of chemical analytical services developed by the EPA to support Comprehensive Environmental Response, Compensations and Liability Act (CERCLA).

"Data Usability Summary Report (DUSR)" is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

"Effective solubility" means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

"Environmental Laboratory Accreditation Program" or "ELAP" means a program conducted by the New York State Department of Health (NYSDOH), which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

"Intermediate sample" means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

"Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

“Non-targeted compound” means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

“Practical quantitation level” or “PQL” means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

“PAH” means polycyclic aromatic hydrocarbon as defined by EPA Method 8270C.

“Quality assurance” or “QA” means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

“Quality Assurance Project Plan” or “QAPP” means a document, which presents in specific terms the policies, organization, objectives, functional activities, and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

“Quality control” or “QC” means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

“Semi-volatile organic compound” or “SVOC” means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semi-volatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

“Target analyte list” or “TAL” means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/elements.

“Targeted compound” means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a Gas Chromatography/Mass Spectroscopy (GC/MS) analytical method, which has been tentatively, identified using a mass spectral library search. An estimated concentration of the TIC is also determined.

"Unknown compound" means a non-targeted compound, which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

"Volatile organics" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 8260B or those target compounds identified as volatiles in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

1. Project Description

This purpose of this project is to assess the sediment quality for determination of dredging limits at the Orange & Rockland Utilities, Inc. (O&R) former Manufactured Gas Plant (MGP) site in Nyack, New York. This Quality Assurance Project Plan (QAPP) specifies the quality control and quality assurance procedures to ensure the generation of statistically valid data. All procedures are equivalent to those specified in the *United States Environmental Protection Agency's QA/R-5 "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," "Test Methods for Evaluating Solid Waste," EPA SW-846, Third Edition* [EPA, 1986] and its promulgated updates, and New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP). These procedures are to be followed to ensure that data from the Nyack MGP investigation are precise, accurate, representative, comparable, and complete. An ELAP-certified laboratory will be used for the analysis of the samples.

1.1 Introduction

O&R is performing a Pre-Design Investigation (PDI) to obtain the data necessary for completing a Remedial Design (RD) for Operable Unit 2 (OU2) of the Nyack former MGP site. A description of the Nyack MGP site is included in the Pre-Design Investigation (PDI) Work Plan (attached). Additional investigation is required to complete the delineation of MGP-related impacts in the sediment remedial areas.

1.2 Scope of Work

The scope of work for the PDI is described in the project Work Plan (attached). Sediment samples will be collected during the PDI. These samples will be analyzed using EPA SW-846 Methods with NYSDEC ASP Category B laboratory data deliverables.

Data generated for the evaluation of the sediments must be technically sound and legally defensible, and supported by defined and verified limits of confidence. This document specifies the quality control and quality assurance (QA/QC) procedures to ensure the generation of valid data for the evaluation of bioavailability and toxicity of PAHs.

1.3 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements to ensure that data of known and appropriate quality are obtained during sampling and analysis activities. Data developed during the site investigation will be used to fulfill the overall objectives of the program.

1.3.1 Data Quality Levels

There are five analytical levels of data quality which may be used to accomplish these site objectives. They are typically designated as follows:

- Level I - field screening or analysis using portable instruments, calibrated to non-compound specific standards
- Level II - field analysis using portable instruments, calibrated to specific compounds
- Level III - non-Contract Laboratory Program (ASP-CLP) laboratory methods
- Level IV - ASP-CLP Routine Analytical Services methods
- Level V - non-standard analytical methods

To meet the specific objectives of this project, Levels I, IV, and V DQOs will be utilized.

<u>Level I - Field Screening Methods</u>

Level I screening will be performed for health and safety purposes according to procedures provided in the site-specific Health and Safety Plan (HASP) as well as to qualitatively assess the presence of volatile organic compounds (VOCs) in soil at the site. Field data water quality data will also be collected at locations where surface sediment samples are obtained.

<u>Level IV - CLP/ASP Methodologies</u>

Sediment will be analyzed according to the EPA SW-846 Methods following procedures specified in the most recent edition of the NYSDEC ASP [NYSDEC, 2005]. Analytical reports will be prepared in accordance with NYSDEC ASP Category B laboratory data deliverable specifications. This level of data quality will ensure the generation of legally, and technically defensible data for project use.

<u>Level V - Non-Standard Analytical Methods</u>

Samples may be analyzed using non-standard analytical methods should forensic analyses be needed. If these analyses are proposed for the PDI, the analyses to be performed and the methods to be used will be discussed with, and approved by the NYSDEC prior to sample collection.

2. Project Organization

This PDI will be performed for O&R by GEI Consultants, Inc. (GEI), an environmental consultant (the Consultant). GEI will arrange for the sediment sampling and analytical services, and provide on-site field representatives to perform the sediment sampling. The Consultant will also perform the data interpretation and reporting tasks.

Key contacts for this project are as follows:

<u>O&R's Project Manager:</u>

Maribeth McCormick	Orange & Rockland Utilities, Inc. 3 Old Chester Road Goshen, NY 10924 Telephone: (845) 783-5534 Cell: (914) 557-1361

<u>Consultant Project Manager (GEI):</u>

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<u>Consultant Senior Technical Advisor (GEI):</u>

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Laboratory Representative (TestAmerica):

Laboratory to be determined.

3. Quality Assurance/Quality Control Objectives for Measurement of Data

3.1 Introduction

The QA/QC objectives for all quantitative measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in the following subsections. They are formulated to meet the requirements of the NYSDEC ASP and EPA SW-846. The analytical methods and Contract Required Quantitation Limits (CRQLs) are provided in Section 7.

3.2 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value [EPA, 1987]. Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates (MSD). The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	Relative percent difference.
V1, V2	=	The two values to be compared.

|V1 - V2| = The absolute value of the difference between the two values.
(V1 + V2)/2 = The average of the two values.

The DQOs for analytical precision, calculated as the RPD between duplicate analyses, are presented in Table 1.

3.3 Accuracy

Accuracy is a measure of the degree of agreement between a measured value and the true or expected value of the quantity of concern [Taylor, 1987], or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike (MS) compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

%R = Percent recovery.

SSR = Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.
SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.
SA = Spiked analyte: concentration of the analyte spike added to the sample.

The acceptance limits for accuracy for each parameter are presented in Table 1.

3.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program [EPA, 1987]. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices will be performed between samples as outlined in the Field Sampling and Analytical Plan (FSAP). Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow EPA-approved procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate, and chain-of-custody procedures are presented in Sections 4 and 5.

3.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid [EPA, 1987]. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.
V = Number of measurements judged valid.
T = Total number of measurements.

3.6 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another [EPA, 1987]. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project.
- Requiring traceability of all analytical standards and/or source materials to the EPA or National Institute of Standards and Technology (NIST).
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable).
- Using standard reporting units and reporting formats including the reporting of QC data.
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate.
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

4. Sampling Program

4.1 Introduction

The sampling program was developed to provide analytical and field data that can be used to satisfy the project objectives (as outlined in Section 1.2). This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. The sampling procedures are presented in the FSAP.

4.2 Analytical Methods

The laboratory samples for each media and the chemical analyses to be performed, including the QA/QC samples, are included in Table 3. These analyses are summarized below.

4.2.1 Sediment Analyses

The following parameters have been designated for field measurement or laboratory analysis.

- Surface Water Field Tests:
  - pH
  - temperature
  - conductivity
  - salinity
  - dissolved oxygen (DO)
  - turbidity

- Sediment Laboratory Analysis:
  - Total parent and alkylated PAH determinations (PAH34) by EPA Method 8270C
  - Total Organic Carbon (TOC) by the Lloyd Kahn Method
  - Percent solids

The exact number, locations, and rationale for each sample and analytical parameters selected are provided in the Work Plan.

A laboratory, capable of providing reliable data that meets the DQOs stated in the site-specific work plan, shall perform all analyses. The specific analytical procedures and the modifications required are described in Table 3. Where applicable, analyses shall be performed using the following EPA-approved and/or nationally recognized analytical references:

- "Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), EPA Office of Solid Waste and Emergency Response, Third Edition," 1992, and subsequent updates.
- ASTM International (ASTM), "Soil and Rock," Volume 04.08, Philadelphia, PA, 1994.
- "Standard Methods for the Examination of Water and Wastewater," 19th edition, Eaton, A.D. Clesceri, L.S. Greenberg, A. E. American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington D.C., 1995.
- "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates," Second Edition, EPA Office of Research and Development, Duluth, MN, EPA 600/R-99/064, March 2000.
- EPA Contract Laboratory Program Statement of Work (CLP SOW), OLM04.2/4.3 and ILM05.2.
- "Method for Chemical Analysis of Water and Wastes," EPA EPA-600/4-79-020, revised March 1983.

The Project Manager shall ensure that laboratories generating data in support of the PAH evaluation maintain the relevant government regulatory accreditations, certifications, and/or registrations to perform the required analyses.

4.2.2 Forensic Analysis

Samples may be analyzed for forensic purposes to evaluate the potential sources of PAHs in sediments at the site. At locations where forensic analysis may be necessary, EPA Method 8270 analysis will be performed in select ion monitoring (SIM) mode, and the PAH34 analyte list will be expanded to include dibenzothiophenes (parent and alkylated, C0, C1, C2, C3, and C4), carbozoles, and dibenzofuran. These compounds may be used to assess source attribution using diagnostic PAH ratios. The samples will be classified as:

- Background
- Coal tar/MGP related
- Mixed (petrogenic and pyrogenic)

If forensic analyses are needed for this project, the final scope of the sampling and analyses will be determined in consultation with the NYSDEC.

4.3 Sample Container Preparation and Sample Preservation

Sample containers delivered to the field will be new and certified clean by the vendor. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged, and the appropriate chemical preservatives will be added. The types of containers are shown in Table 4.

Samples shall be preserved according to the preservation techniques listed in Table 4. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4° ± 2° C with ice, and delivered to the laboratory within 48 hours of collection under chain-of-custody. Chain-of-custody procedures are described in Section 5.

4.4 Sample Holding Times

The sample holding times for organic and inorganic parameters are listed in Table 4 and are in accordance with the NYSDEC ASP requirements. The NYSDEC ASP holding times must be strictly adhered to by the field and laboratory personnel.

4.5 Field Quality Control Samples

Field QC samples will consist of a series of blanks and duplicates that will be collected to assess field sampling and decontamination performance. Two types of blanks to assess the collection of field samples will be collected and submitted to the laboratory for analyses (trip and equipment blanks). In addition, the precision of the laboratory analytical procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

a. **Trip blanks** - A Trip Blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of one or more 40-ml VOA vials containing EPA Type 2 water, that accompanies all water sample bottles into the field and back to the laboratory. A trip blank will be included in each shipping container of water samples for volatiles analysis. The trip blank will be analyzed for VOCs to assess any contamination from sampling, storage, transport, and internal laboratory procedures.

b. **Equipment blanks** - Equipment blanks are collected to determine the effectiveness of the decontamination procedures for sampling equipment. Equipment blanks are collected by passing EPA Type 2 water provided by the laboratory through decontaminated sampling equipment. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The equipment blank will be analyzed for all of the parameters of interest.

The duplicates will consist of:

a. **Coded field duplicate** - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are duplicate samples. This will eliminate any possible bias that could arise. The coded field duplicates will be taken at a frequency of one duplicate per 20 field samples.

b. **Matrix spike/matrix spike duplicate** - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are listed in Table 1.

5. Sample Tracking and Custody

5.1 Introduction

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the chain-of-custody and transfer of samples will be trained on the purpose of the chain-of-custody and specific procedures prior to implementation.

Evidence of sample traceability and integrity is developed by implementation of, and adherence to, the chain-of-custody procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is presented in Figure 1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession
- Maintained in view after possession is accepted and documented
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody
- In a secured area which is restricted to authorized personnel

5.2 Field Sample Custody

A chain-of-custody record (Figure 2 or equivalent) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the chain-of-custody must be completed for each sample set collected.

The chain-of-custody lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The chain-of-custody also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the chain-of-custody record will be sent with each sample.

The REMARKS space on the chain-of-custody is used to indicate if the sample is an MS/MSD, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and equipment blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper air bill number on the top of the chain-of-custody. Errors will be crossed out with a single line in ink and initialed and dated by the author.

One copy of the chain-of-custody is retained by sampling personnel and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The chain-of-custody seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample(s) will not be analyzed.

5.3 Laboratory Sample Custody

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the chain-of-custody record and record the date and time received.
- Care will be exercised to annotate any labeling or description errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as

broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.

- The samples will be stored in a secured area and, if required, stored at a temperature of 4°± 2° C.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis and final storage for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

6. Calibration Procedures

6.1 Field Instruments

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the FSAP. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader in a notebook. Copies of all the instrument manuals will be maintained on site by the Field Team Leader. Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photo-ionization detector and explosimeter) are provided in the HASP. More frequent calibration may be needed depending on conditions encountered in the field.

6.2 Laboratory Instruments

The laboratory will follow all calibration procedures and schedules as specified in the sections of the EPA SW-846 and NYSDEC ASP and subsequent updates as they apply to the instruments used for the analytical methods listed in Section 7.

7. Analytical Procedures

7.1 Introduction

Samples will be analyzed according to methods approved by the NYSDEC ASP program or EPA SW-846 "*Test Methods for Evaluating Solid Waste,*" November 1986, 3rd edition [EPA, 1986] and subsequent updates. The methods to be used for the laboratory analysis of sediment samples are listed in Table 3. These methods were selected because they attain the DQOs required for the project, and the quantitation limits that are listed in Table 5.

Should an analytical method be required that is outside the scope to the references cited above, the method used will be published by a nationally recognized authority (e.g., EPA, API) and approved for use by the regulatory agency.

The Project Manager shall ensure that laboratories (primary or subcontracted) generating data in support of O&R remediation and investigative projects maintain the relevant state and federal government regulatory accreditations, certifications, and/or registrations to perform the required analyses.

8. Data Reduction, Assessment, and Reporting

8.1 Data Reduction

Data collected during the field investigation will be reduced in accordance with NYSDEC ASP protocols. The procedures for identification and quantification of the analytes will be specified in the NYSDEC ASP or EPA SW-846 *"Test Methods for Evaluating Solid Waste,"* November 1986, 3rd edition and subsequent updates and peer reviewed by laboratory supervising personnel.

8.2 Data Quality Assessment

NYSDEC generally recommends two levels of data review for data collected during site investigations. The basic review is a Data Usability Summary Report (DUSR). Current NYSDEC policy is to require a DUSR for data collected during investigations on most sites. The more rigorous full data validation procedure is called for at sites where the data will be used in litigation. The laboratory deliverables (i.e., NYSDEC ASP Category B) are the same in both cases, and a DUSR can be upgraded to full validation at a later time if necessary. For this investigation, a DUSR will be generated.

Based on the results of data assessment, the validated analytical results reported by the laboratory will be assigned one of the following usability flags by the data validator:

- U The analyte was analyzed for, but was not detected above the level of the reported samples quantitation limit.
- UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.
- J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
- J- (Inorganics) The result is an estimated quantity, likely to be biased low. The associated numerical value is the approximate concentration of the analyte in the sample.
- J+ (Inorganics) The result is an estimated quantity, likely to be biased high. The associated numerical value is the approximate concentration of the analyte in the sample.
- N Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling events.

- NJ Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity.
- R The data are unusable. The sample results are rejected due to serious deficiencies in the ability to meet QC criteria. The presence or absence of the analyte cannot be verified.

Trained and experienced data assessors, who meet NYSDEC approval criteria, will perform the data assessment. Resumes of people performing data assessments and generating DUSRs will be provided to NYSDEC for review and approval.

8.2.1 Data Usability Summary Report

Data for this investigation will be evaluated in accordance with the "*EPA National Functional Guidelines for Organic Data Review*," October 1999 and "*EPA Validation Functional Guidelines for Inorganic Data Review*," October 2004. A DUSR will be generated in accordance with the NYSDEC guidelines.

A DUSR will be prepared which will include a review and an evaluation of all the analytical results. To ensure compliance with the analytical method protocols the following will be reviewed:

- Chain-of-custody forms
- Holding times
- Initial and continuing calibrations
- Blanks
- Laboratory control standards and matrix spikes
- Surrogate recoveries
- Matrix interference checks
- Field and laboratory duplicates
- Sample data

The DUSR will contain a description of the samples and parameters reviewed. Any deficiencies identified during the review will be noted and the effect on the generated data will be discussed. Any re-sampling or re-analysis recommendations will then be made to the investigation's Project Manager. The results of the evaluation will be incorporated into the final investigative report.

8.2.2 Data Validation

The determination to validate data will be made based on the presence of data anomalies, suspect data, or laboratory issues. Unless required to address anomalies, the data will be subject to the DUSR process and will not be subject to full validation. Where necessary, data will be validated in accordance with the "*EPA National Functional Guidelines for Organic Data Review*," October 1999 and "*EPA Validation Functional Guidelines for Inorganic Data Review*," October 2004. If applicable, a data validation report will be prepared and reviewed by the Quality Assurance Officer (QAO) before issuance. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each sample delivery group will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times
- Instrument tuning
- Instrument calibrations
- Blank results
- System monitoring compounds or surrogate recovery compounds (as applicable)
- Internal standard recovery results
- MS and MSD results
- Field duplicate results
- Target compound identification
- Result calculations
- Pesticide cleanup (if applicable)
- Compound quantitation and reported detection limits
- System performance
- Results verification

For each of the inorganic compounds, the following will be assessed:

- Holding times
- Calibrations
- Blank results
- Interference check sample

- Laboratory check samples
- Duplicates
- Matrix spike(s)
- Furnace atomic absorption analysis QC
- ICP serial dilutions
- Results verification and reported detection limits
- Result calculations

8.3 Data Reporting

The data package provided by the laboratory will contain all items discussed above in a "CLP-equivalent" format. Data quality issues will be discussed in a case narrative included with the data report. The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

One copy of the analytical data packages in an electronic disk deliverable format will be provided by the laboratory approximately 30 days after receipt of a complete sample delivery group. The Project Manager will immediately arrange for filing of the package, the data validation, the preparation of the DUSR, and the preparation of the data summary tables. These tables will form the database for the assessment of the extent of the MGP-related impacts at the site.

8.3.1 NYSDEC Data Submittal

The NYSDEC has implemented an Environmental Information Management System (EIMS). The EIMS uses the database software application EQuIS™ from EarthSoft® Inc.

The data submitted to the Division of Environmental Remediation will be in the NYSDEC-approved Electronic Data Deliverable (EDD). New data will be submitted on a continuous basis immediately after data validation occurs but in no event more than 90 days after the data has been submitted to the Consultant. The EDD format will be provided by the NYSDEC.

9. Internal Quality Control Checks and Frequency

9.1 Quality Assurance Batching

Each set of up to 20 samples submitted to the laboratory will be analyzed concurrently with associated calibration standards, method blanks, MS/MSD or laboratory duplicates, and QC check samples (if required by the protocol). Note that the MS/MSD samples will be provided with the field samples and identified by the field personnel.

9.2 Calibration Standards and Surrogates

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the EPA or NIST, or other similar nationally-recognized program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard working solutions are replaced monthly or more frequently, based upon data indicating deterioration. No stock or working standard will be used past the manufacturer's expiration date.

9.3 Organic Blanks and Matrix Spike

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives". The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO^4$. The matrix spike is generated by addition of analyte and surrogate standards to a designated field sample.

9.4 Trip and Field Blanks

Trip blanks and equipment blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and to evaluate the possibility of atmospheric or cross-contamination of the samples.

10. Quality Assurance Performance Audits and System Audits

10.1 Introduction

QA audits may be performed by the project quality assurance group under the direction and approval of the project QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate QA management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 System Audits

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory QC procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

10.3 Performance Audits

The laboratory is required to perform periodic analyses of Performance Evaluation samples to maintain ELAP accreditation and/or state regulatory certifications. Performance Evaluation samples obtained from an EPA-approved vendor or a state agency must be analyzed by the laboratory at least semi-annually.

10.4 Formal Audits

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that QA requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be out of compliance shall be identified at exit interviews conducted with the involved management. Compliance deviation will be logged, and documented through audit findings which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within 15 days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

11. Preventive Maintenance Procedures and Schedules

11.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce downtime, if any. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 Schedules

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

12. Corrective Action

12.1 Introduction

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 Procedure Description

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader, and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined to be deficient
- When equipment or instrumentation is found to be faulty
- When samples and analytical test results are not clearly traceable
- When QA requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/field comparison studies
- As required by EPA SW-846, and subsequent updates, or by the NYSDEC ASP

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with QA requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to QA functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 3 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions were implemented and effective, documented, and approved.

References

EPA, 1986. SW-846 "Test Method for Evaluating Solid Waste," dated November 1986 and subsequent updates. U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7B U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2001. CLP Organics Data Review and Preliminary Review based on CLP/SOW OLM04.2. SOP No. HW-6, Revision 12 dated September 2005. EPA Region II.

EPA, 2005. Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW - ILM05.3. SOP No. HW-2, Revision 13, dated January 1992. EPA Region II.

NYSDEC, 2005. New York State Department of Environmental Conservation, Analytical Services Protocol, July 2005.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan.

Tables

Table 1
Quality Control Limits for Soil Samples
Nyack MGP Site

		Laboratory Accuracy and Precision					
Analytical Parameter	**Analytical Method [(a)]**	**Matrix Spike (MS) Compounds**	**MS/MSD [(b)] % Recovery**	**MS/MSD RPD [(c)]**	**LCS [(d)] % Recovery**	**Surrogate Compounds**	**Surrogate % Recovery**
SVOCs (f)	8270C	Phenol	36-110	25	36-110	Nitrobenzene-d5	35-113
		2-Chlorophenol	38-104	26	38-104	2-Fluorobiphenyl	43-119
		1,4-Dichlorobenzene	34-120	30	34-120	p-Terphenyl-d14	51-125
		N-Nitroso-di-n-propylamine	46-120	20	46-120	Phenol-d5	36-116
		1,2,4-Trichlorobenzene	39-105	24	39-105	2-Fluorophenol	30-107
		4-Chloro-3-methylphenol	49-125	20	49-125	2,4,6-Tribromophenol	46-129
		Acenaphthene	53-119	16	53-119		
		4-Nitrophenol	44-137	25	44-137		
		2,4-Dinitrotoluene	55-125	19	55-125		
		Pentachlorophenol	33-136	27	33-136		
		Pyrene	51-133	25	51-133		
PCBs	8082	PCB 1016	59-154	50	59-154	Decachlorobiphenyl	34-148
		PCB 1260	51-179	50	51-179	Tetrachloro-m-xylene	35-134

(a) Analytical Methods: NYSDEC ASP-CLP Methods with Category B data deliverables, NYSDEC, 2000 and EPA SW-846, 3rd edition, Revision 1, November 1990,

(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) Target Compound List Volatile Organic Compounds
(f) Target Compound List Semi-volatile Organic Compounds
(g) Limits are advisory only
(h) Target Analyte List Inorganics (metals and cyanide)
(i) Matrix spike only
(j) Laboratory duplicate RPD
NA - Not Applicable

Table 2
Summary of Sampling and Analytical Program
Nyack MGP Site

Matrix	Parameter	Analytical Method	Field Samples				QC Blanks		Total
			Field Samples	Field Duplicate	MS/MSD[(a)] (Total)	Sub-Total	Trip Blank	Equip-ment Blank	
Sediment Samples	SVOC/NOAA PAHs	EPA SW 8270C	18	1	1	20	NA	1	21
	TOC	Lloyd Kahn	18	1	1	20	NA	1	21

(a) Matrix spike / matrix spike duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analysis.

* The number of duplicates, MS/MSD, and field QC samples can be reduced if these samples are obtained in conjunction with the sampling of other media during the sampling event.

\+ Rinse blanks not required if dedicated sampling equipment is used.

TBD To be determined

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Table 3
Laboratory Method References
Nyack MGP Site

Parameter	Method	Method Reference(s)	Laboratory[1]
Total PAH34	EPA Method 8270C	SW-846 - EPA Method 8270C Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	TA
Total Organic Carbon (TOC)	Lloyd Kahn	***Determination of Total Organic Carbon in Sediment,*** (Lloyd Kahn Method) July 27, 1988(1988) Lloyd Kahn, Quality Assurance Specialist, U.S. Environmental Protection Agency, Region II Environmental Services Division Monitoring Management Branch Edison, New Jersey 08837	TA
Percent Solids	STL SOP IN623	Method for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised March 1983, CLP SOW, OLM04.2/4.3 and ILM05.2	TA

[1]Laboratories:

TA - TestAmerica Laboratories, Burlington, VT

Table 4
Sample Handling Requirements
Nyack MGP Site

Sample Type	Sample Matrix	Parameter	Quantity	Container Type[1]	Minimum Volume	Preservation[3]	Holding Time from Sample Date	Laboratory[4]
Surface Water	Surface Water	pH, Temperature, Conductivity, Salinity, DO, Turbidity	TBD	Field	Field	Field	15 min.	YSI 6900 or Equivalent
Chemical/ Physical Characterization	Sediment	Total Organic Carbon	TBD	glass	8 oz.	Cool to 4^{o} C	28 days[3]	TA
		Total Sediment PAH34 (parent and alkylated compounds)	TBD				28 days[2]	
		Percent Solids	TBD		2 oz.	Cool to 4^{o} C	28 days[2]	

Notes:
1. All glass jars must have Teflon-lined lids.
2. Test to be initiated within 28 days of sample collection.
3. Samples requiring thermal preservation must be maintained at 2º - 6ºC.
4. TA - TestAmerica Laboratories, Burlington, VT

* Note that all 10 of the reference location samples are included in the 40 samples to be analyzed.

Table 5
Project Quantitation Limits
Sediment SVOC
Nyack MGP Site

Analysis/Compound	Method	Quantitation Limits Sediment (ug/Kg)
Semi-Volatile Organics		
1-Methylnapthalene	8270C	330
1,1'-Biphenyl	8270C	330
2,2'-oxybis(1-chloropropane)	8270C	330
2,3,5-Trimethylnaphthalene	8270C	330
2,4,5-Trichlorophenol	8270C	330
2,4,6-Trichlorophenol	8270C	330
2,4-Dichlorophenol	8270C	330
2,4-Dimethylphenol	8270C	330
2,4-Dinitrophenol	8270C	1600
2,4-Dinitrotoluene	8270C	330
2,6-Dimethylnapthalene	8270C	330
2,6-Dinitrotoluene	8270C	330
2-Chloronaphthalene	8270C	330
2-Chlorophenol	8270C	330
2-Methylnaphthalene	8270C	330
2-Methylphenol	8270C	330
2-Nitrolaniline	8270C	1600
2-Nitrophenol	8270C	330
3,3'-Dichlorobenzidine	8270C	1600
3-Nitroaniline	8270C	1600
4-Bromophenyl-phenyl ether	8270C	330
4-Chloro-3-methylphenol	8270C	330
4-Chloroaniline	8270C	330
4-Chlorophenyl phenyl ether	8270C	330
4-Methylphenol	8270C	330
4-Nitroaniline	8270C	1600
4-Nitrophenol	8270C	1600
4,6-Dinitro-2-methylphenol	8270C	1600
Acenaphthene	8270C	330
Acenaphthylene	8270C	330
Acetophenone	8270C	330
Anthracene	8270C	330
Atrazine	8270C	330
Benzo(a)anthracene	8270C	330
Benzo(a)pyrene	8270C	330
Benzo(b)fluoranthene	8270C	330
Benzo(e)pyrene	8270C	330
Benzo(g,h,i)perylene	8270C	330
Benzo(k)fluoranthene	8270C	330
Benzaldehyde	8270C	330
bis(2-Chloroethoxy) methane	8270C	330
bis(2-Chloroethyl) ether	8270C	330
bis(2-ethylhexyl)phthalate	8270C	330
Butyl benzyl phthalate	8270C	330
C1-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C2-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C3-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C4-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C1-Dibenzothiophene	8270C	330
C2-Dibenzothiophene	8270C	330
C3-Dibenzothiophene	8270C	330
C4-Dibenzothiophene	8270C	330
C1-Fluoranthenes/pyrenes (Note 2)	8270C	330
C1-Fluorenes (Note 2)	8270C	330
C2-Fluorenes (Note 2)	8270C	330
C3-Fluorenes (Note 2)	8270C	330
C2-Naphthalenes (Note 2)	8270C	330
C3-Naphthalenes (Note 2)	8270C	330
C4-Naphthalenes (Note 2)	8270C	330
C1-Phenanthrenes/anthracenes (Note 2)	8270C	330
C2-Phenanthrenes/anthracenes (Note 2)	8270C	330
C3-Phenanthrenes/anthracenes (Note 2)	8270C	330
C4-Phenanthrenes/anthracenes (Note 2)	8270C	330
Caprolactum	8270C	330
Carbazole	8270C	330
Chrysene	8270C	330
Dibenzothiophene	8270C	330
Di-n-butyl phthalate	8270C	330
Di-n-octyl phthalate	8270C	330
Dibenz(a,h)anthracene	8270C	330
Dibenzofuran	8270C	330
Diethyl phthalate	8270C	330
Dimethyl phthalate	8270C	330
Fluoranthene	8270C	330
Fluorene	8270C	330
Hexachlorobenzene	8270C	330
Hexachlorobutadiene	8270C	330
Hexachlorocyclopentadiene	8270C	1600
Hexachloroethane	8270C	330
Indeno(1,2,3-cd)pyrene	8270C	330
Isophorone	8270C	330
N-Nitroso-n-propylamine	8270C	330
N-nitrosodiphenylamine	8270C	330
Naphthalene	8270C	330
Nitrobenzene	8270C	330
Pentachlorophenol	8270C	1600
Phenanthrene	8270C	330
Phenol	8270C	330
Pyrene	8270C	330

Analysis will be by Method 8270C - Full Scan.
Note 1: RLs and MDLs are subject to change due to % moisture, matrix interference, and dilution factors
Note 2: All Alkylated PAH results will be estimates due to lack of sufficient analytical standards availiability

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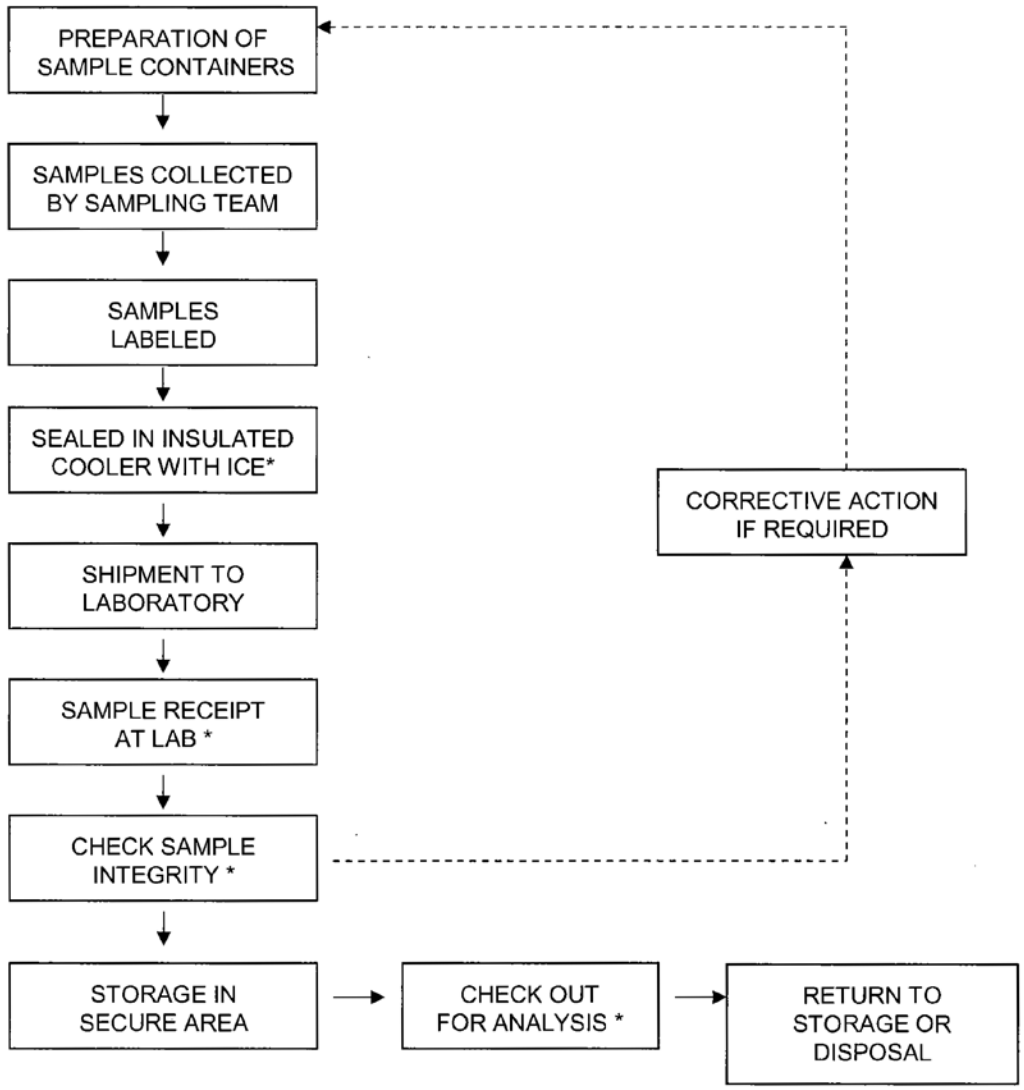
Figures

FIGURE 1

SAMPLE CUSTODY



* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Chain-of-Custody Record FIGURE 2

Laboratory:

Laboratory Job # (Lab use only)

GEI Consultants

1301 Trumansburg Road, Suite N
Ithaca, New York
TEL: 607-216-8955

Project Information

Project Name: | **Project Location:**

Project Number: | **Project Manager:**

Page ____ of ____

Send Report to:

Send Faxed Results to:

Send EDD to:

Preservative

Analysis

Sample Handling

Sample Field Filtered

YES NO NA

Sampled Shipped With Ice

YES NO

MCP PRESUMPTIVE CERTAINTY REQUIRED -- YES NO

If Yes, Are MCP Analytical Methods Required? YES NO

If Yes, Are Drinking Water Samples Submitted? YES NO

If Yes, Have You Met Minimum Field QC Requirements? YES NO

Lab Sample Number	GEI Sample ID	Collection Date	Collection Time	Matrix	No. of Bottles	Sampler(s) Initials								Sample Specific Remarks

Turnaround Time (Business days):

Normal _____ **Other**______

10 Day______ **7 Day**______

5 Day_______ **3 Day**______

Before submitting rush turnaround samples, you **must** notify the laboratory to confirm that the TAT can be

MCP Level Needed: GEI requires the most stringent Method 1 MCP standard be met for all analytes whenever possible.

Additional Requirements/Comments/Remarks:

Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)

14 MCP Metals = Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium (total), Lead, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc.

FIGURE 3 Corrective Action Request

CORRECTIVE ACTION REQUEST
Number: ___________________________ Date: _____________
TO: ____   You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _______________
CONDITION:
REFERENCE DOCUMENTS:
RECOMMENDED CORRECTIVE ACTIONS:
___________ ______ ___________ _________ ____________ _________   Originator Date Approval Date Approval Date
RESPONSE
CAUSE OF CONDITION
CORRECTIVE ACTION   (A) RESOLUTION   (B) PREVENTION   (C) AFFECTED DOCUMENTS
C.A. FOLLOWUP: CORRECTIVE ACTION VERIFIED BY: _____________________________ DATE:______________

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APPENDIX K – SITE-WIDE INSPECTION FORM

SITE INSPECTION FORM

Nyack Former Manufactured Gas Plant Site

SITE INSPECTION DATE: ____________________ **TIME OF ARRIVAL**: ____________________

DEPARTURE: ____________________

WEATHER: ____

____

Orange and Rockland Representative(s): ____

INSPECTION TYPE: **Annual Inspection or Emergency Inspection**

(if emergency indicate event that required an inspection): ____________________

____

____

____

Are the Institutional Controls in place, performing properly, and remain effective?

Site Signage in Place? Yes / No

____

____

Does the Site comply with NYSDEC-approved Site Management Plan? Yes / No

____

____

Has ownership of the property changed since the last inspection? Yes / No

(Verify with Real Estate and Survey Departments)

____

____

____

Are there any changes to intended site use (restricted Residential, Commercial Yes / No

Or Industrial which would affect the SMP or institutional controls?

____

____

Is site used for agricultural purpose or vegetable gardens? Yes / No

____

____

Is groundwater used as source of potable or process water onsite Yes / No

____

If yes to the above – does water go through the necessary water quality treatment? Yes/No

SITE INSPECTION FORM

Nyack Former Manufactured Gas Plant Site

Is solidified material visible? Yes / No

Is there any evidence of the damage to solidified soil from frost and wave Erosion? Yes / No

Are the Engineering Controls in place, performing properly, and remain effective?

Surface Cover Intact (i.e. no evidence of erosion, excavations)? Yes / No

GENERAL SITE OBSERVATIONS:

Have there been any changes to the property since the last inspection?

(i.e. new equipment, residential buildings or facilities, changes in site topography, erosion, etc.)

NOTE:

Inspections should be made a minimum once a year and within 5 days of an emergency, such as a natural disaster or an unforeseen failure or damage to the building occurs. Inspections will be conducted by Orange and Rockland (or their agent) and results reported to NYSDEC.

COMPLETED BY:	**REVIEWED BY:**
SIGNATURE:	**SIGNATURE**

APPENDIX L – RECORD OF DECISIONS FOR OU1 AND OU2

Department of Environmental Conservation

Division of Environmental Remediation

Record of Decision
Nyack Gas Plant Site
Operable Unit No.1
Former Plant Site

Nyack (V), Rockland County, New York

Site Number 3-44-046

March 2004

New York State Department of Environmental Conservation
GEORGE E. PATAKI, *Governor*
ERIN M. CROTTY, *Commissioner*

DECLARATION STATEMENT - RECORD OF DECISION

Nyack Gas Plant Site
Operable Unit No. 1 Former Plant Site
Nyack (V), Rockland County, New York
Site No. 3-44-046

Statement of Purpose and Basis

The Record of Decision (ROD) presents the selected remedy for Operable Unit 1 of the Nyack Gas Plant site. The selected remedial program was chosen in accordance with the New York State Environmental Conservation Law and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for Operable Unit 1 of the Nyack Gas Plant site, and the public's input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Assessment of the Site

Actual or threatened releases of hazardous waste constituents from this site, if not addressed by implementing the response action selected in this ROD, presents a current or potential significant threat to public health and/or the environment.

Description of Selected Remedy

Based on the results of the Remedial Investigation and Feasibility Study (RI/FS) for the Nyack Gas Plant site and the criteria identified for evaluation of alternatives, the NYSDEC has selected a remedy using excavation, in-situ solidification, NAPL recovery, chemical oxidation and institutional controls. The components of the remedy are as follows:

- Impacted soils and subsurface structures in the upper terrace will be excavated to bedrock and transported to an off-site permitted treatment/disposal facility;

- Remaining manufactured gas plant (MGP) subsurface structures and other obstructions in the lower terrace will be excavated. Gross contamination in and immediately adjacent to subsurface structures will be excavated to the extent practicable;

- Flowable coal tar in the overburden in the lower terrace remaining after excavation will be extracted by recovery wells;

- Impacted soils in the lower terrace will be augured and mixed with cement. This process, in-situ solidification, will produce a stable, low permeability monolithic mass;

- Flowable coal tar will be removed from the shallow bedrock by recovery wells and/or trenches. Remaining contamination will be treated using in-situ chemical oxidation;

- In-situ chemical oxidation will be used to treat MGP contamination on the adjoining Hudson Vista Associates property;

- Final grading will include placement of a minimum of two feet of clean soil, asphalt paving, or other appropriate cover;

- A site management plan will be developed to: (a) address residual contaminated soils that may be excavated from the site during future redevelopment, (b) ensure that appropriate barriers (soil, paving or buildings) remain in place between the ground surface and residual contaminated soils, (c) evaluate the potential for vapor intrusion for any buildings developed on the site, and (d) identify use restrictions for development of groundwater;

- The property owner will provide an annual certification that the institutional and engineering controls remain in place and effective;

- An institutional control will be imposed in the form of an environmental easement that will: (a) require compliance with the approved site management plan, (b) restrict use of groundwater, and (c) require the property owner to complete and submit to the NYSDEC an annual certification.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy selected for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

MAR 31 2004

Date

Dale A. Desnoyers, Director
Division of Environmental Remediation

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RECORD OF DECISION

Nyack Gas Plant Site
Operable Unit No. 1 - Former Plant Site
Nyack (V), Rockland County, New York
Site No. 3-44-046
March 2004

SECTION 1: SUMMARY OF THE RECORD OF DECISION

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), has selected this remedy for the Nyack Gas Plant, Operable Unit No. 1 (OU1) - Former Plant Site. The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this remedy. As more fully described in Sections 3 and 5 of this document, operations at the former manufactured gas plant (MGP) have resulted in the disposal of hazardous wastes, including coal carbonization and water gas tars. These coal tars contain chemicals including polycyclic aromatic hydrocarbons (PAHs) and benzene, toluene, ethylbenzene, and xylene (BTEX). These wastes have contaminated the soils, groundwater and soil gas at the site, and have resulted in:

- a threat to human health associated with potential exposure to groundwater, surface soil, subsurface soil and soil gas vapors; and

- an environmental threat associated with the impacts of contaminants to groundwater, surface soil, and subsurface soils.

To eliminate or mitigate these threats, the NYSDEC has selected the following remedy:

- Impacted soils and subsurface structures in the upper terrace will be excavated to bedrock and transported to an off-site permitted treatment/disposal facility;

- Remaining MGP subsurface structures and other obstructions in the lower terrace will be excavated. Gross contamination in and immediately adjacent to subsurface structures will be excavated to the extent practicable;

- Flowable coal tar in the overburden in the lower terrace remaining after excavation will be extracted by recovery wells;

- Impacted soils in the lower terrace will be augured and mixed with cement. This process, in-situ solidification, will produce a stable, low permeability monolithic mass.

- Flowable coal tar will be removed from the shallow bedrock by recovery wells and/or trenches. Remaining contamination will be treated using in-situ chemical oxidation;

- In-situ chemical oxidation will be used to treat MGP contamination on the adjoining Hudson Vista Associates property;

- Final grading will include placement of a minimum of two feet of clean soil, asphalt paving, or other appropriate cover;

- A site management plan will be developed to: (a) address residual contaminated soils that may be excavated from the site during future redevelopment, (b) ensure that appropriate barriers (soil, paving or buildings) remain in place between the ground surface and residual contaminated soils (c) evaluate the potential for vapor intrusion for any buildings developed on the site, and (d) identify use restrictions for development of groundwater;

- The property owner will provide an annual certification that the institutional and engineering controls are in place and remain effective;

- An institutional control will be imposed in the form of an environmental easement that will: (a) require compliance with the approved site management plan, (b) restrict use of groundwater, and (c) require the property owner to complete and submit to the NYSDEC an annual certification.

The selected remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Nyack Gas Plant site is located on Gedney Street in the Village of Nyack in the Town of Orangetown, Rockland County, NY. The site covers a total land area of approximately 4 acres.

The plant site is divided into a number of areas. The western parcel is on the west side of Gedney Street between Lydecker Street and High Avenue and is currently used as a paved parking lot. The eastern parcel (i.e., former plant area) is across Gedney Street from the western parcel, extending from Gedney Street to the Hudson River. The former plant area, which is currently vacant, is divided into the upper terrace, along Gedney Street, and the lower terrace, along the Hudson River. Pedestrian and vehicle access to the Eastern Parcel is restricted by a low chain link fence. Also referenced in this document is an area of off-site contamination directly south of the lower terrace, which is referred to as the "Hudson Vista Associates Property." The site is in an urban setting, with adjacent properties used for a mix of commercial and residential purposes. The site location is shown on Figure 1.

Operable Unit No. 1 (OU1), which is the subject of this ROD, consists of the MGP related wastes on the former MGP site located on the west bank of the Hudson River (i.e., the eastern and western parcels, excluding the sediments in the Hudson River), and the adjacent Hudson Vista Associates property. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

The remaining operable unit (i.e., Operable Unit No. 2) for this site will address sediments in the Hudson River which have been impacted by MGP related wastes. The investigation of this area is currently under review by the NYSDEC.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

An MGP operated at this site from 1852 until 1965. The location of historic MGP structures is show on Figure 2. It is believed that gas was made from the coal carbonization process from 1852 until 1887. From 1887 until 1889 the plant used oil instead of coal, and from 1890 until 1938 the plant used both coal and oil as feedstock for the carburetted water gas (CWG) process. From 1938 until 1965, the site was used as an oil gas facility only during times of peak demand, a practice known as “peak shaving.”

The coal carbonization process heated coal in retorts or beehive ovens, carbonizing the coal in the absence of air. The carburetted water gas process involved the passage of steam through burning coal. This formed a gaseous mixture (water gas or blue gas) which was then passed through a super heater which had an oil spray. The oil spray would generate additional gas, enhancing the heat and light capacity of the overall gas mixture. In each process, the gas produced was purified prior to distribution. Coal tar was formed as a condensate as the gas cooled, and was a by-product of the gas production.

3.2: Remedial History

There were no previous environmental investigations of this site prior to the start of the RI/FS process. The properties to the south and west of this site were previously investigated for unrelated reasons. All buildings on the site were razed by 1974. Very little information is available regarding the site from 1974 until the remedial investigation commenced in 1999.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The NYSDEC and Orange and Rockland Utilities Inc. (O&R) entered into a Consent Order on January 8,1996. The Order obligates O&R to investigate the former MGP sites in their service area. This order was superceded by an second order dated March 11, 1999, which further clarified the obligation to investigate, and as necessary, remediate the Nyack Gas Plant Site.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The RI was conducted between October 1999 and January 2002**.** The field activities and findings of the investigation are described in the RI report.

The following activities were conducted during the RI:

- Research of historical information;
- Collection of nine surface soil samples;
- Excavation of 21 test pits;
- Installation of 31 soil borings and 14 monitoring wells for analysis of soils and groundwater as well as physical properties of soil and hydrogeologic conditions;
- Sampling of 14 new and existing monitoring wells; and
- Collection of six soil gas samples.

To determine whether the surface soil, subsurface soil and groundwater contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater SCGs are based on NYSDEC “Ambient Water Quality Standards and Guidance Values” and Part 5 of the New York State Sanitary Code; and
- Soil SCGs are based on the NYSDEC “Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels."

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized below. More complete information can be found in the RI report.

5.1.1: Site Geology and Hydrogeology

The site is covered with a varying thickness of fill. The jetty area which protrudes into the Hudson River has the thickest layer of fill (13 feet). A second significant area of fill is the slope between the upper and lower terraces, which was apparently placed after plant operations had ended. A layer of native silty sand generally underlies the fill material. A layer of glacial till was noted in one boring on the upper terrace. Underlying the silty sand is sandstone bedrock.

The bedrock is a productive aquifer with the groundwater flowing upward through the bedrock. The overburden in the upper terrace is entirely above groundwater. In the lower terrace, groundwater is found in the overburden, and is seen to fluctuate with the tide, indicating some hydraulic communication between the river and the groundwater.

5.1.2: Nature of Contamination

As described in the RI report, many soil and groundwater samples were collected to characterize the nature and extent of contamination. As summarized in Table 1, the main categories of contaminants which exceed their SCGs are volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs).

Specific volatile organic compounds of concern are benzene, toluene, ethylbenzene and xylenes. These are referred to collectively as BTEX in this document.

The specific semivolatile organic compounds of concern in soil and groundwater are the following polycyclic aromatic hydrocarbons (PAHs):

acenaphthene	acenaphthylene
anthracene	*benzo(a)anthracene*
benzo(a)pyrene	*benzo(b)fluoranthene*
benzo(g,h,i)perylene	*benzo(k)fluoranthene*
dibenzo(a,h)anthracene	*chrysene*
fluoranthene	fluorene
indeno(1,2,3-cd) pyrene	2-methylnaphthalene
naphthalene	phenanthrene
pyrene	

PAH concentrations referred to in this plan are the summation of the individual PAHs listed above (i.e., total PAHs or tPAHs). The italicized PAHs are probable human carcinogens. The summation of the italicized PAHs are referred to in this document as cPAHs.

As reported in Section 5.1.3, coal tars are present at this site in the form of a dense oily liquid which does not readily dissolve in water. Materials such as this are typically found at MGP sites, and are referred to as non-aqueous phase liquids or NAPL. Since this NAPL is more dense than water, it is also referred to as a dense NAPL or DNAPL. Analysis of the NAPL reveals that it contains BTEX and PAHs several orders of magnitude greater than the SCGs for these compounds. The NAPL was found to saturate the unconsolidated deposits and/or exist in scattered, discontinuous globules. Any of these conditions could coincide with high BTEX and PAH concentrations in soil, groundwater and soil gas.

5.1.3: Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

Chemical concentrations are reported in parts per billion (ppb) for water, parts per million (ppm) for soil and micrograms per cubic meter ($\mu g/m^3$) for soil gas samples. For comparison purposes, where applicable, SCGs are provided for each medium.

Table 1 summarizes the degree of contamination for the contaminants of concern in surface and subsurface soil, groundwater and soil gas and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Waste Materials

Coal tar was found in the subsurface in both the upper and lower terrace areas. The sources of the coal tar wastes appear to be the former MGP structures. Coal tar deposits have not migrated a significant distance horizontally from these sources (approximately 20 feet, maximum). Coal tar has migrated vertically into the bedrock underlying the site to a depth of over 40 feet below ground surface.

Surface Soil

Surface soil samples (0-6 inches) contained elevated levels of PAHs. Total PAH levels ranged from 6 ppm to 836 ppm. Total cPAHs were detected at levels of 3 to 158 ppm. No BTEX were detected in the surface soil. Cyanide levels ranged from non-detect to 14 ppm. Cyanide detections were co-located with areas of elevated PAHs. One sample showed lead to be present at a level of 1,200 ppm, which is above the typical background level, but within the range which would be expected in an urban environment.

Subsurface Soil

Subsurface soil in direct contact with and in the vicinity of MGP structures or related coal tar deposits has been impacted by PAHs, BTEX, and cyanide. Total PAHs levels in subsurface soils ranged from non-detect to 19,388 ppm, with total cPAH values of non-detect to 1,936 ppm. BTEX levels in subsurface soils ranged from non-detect to 2,860 ppm. Cyanide levels ranged from non-detect to 56 ppm. All samples with elevated BTEX and cyanide levels also had elevated total PAHs, so total PAH levels are used to delineate subsurface soil impacts. The extent of PAH and visible coal tar contamination are shown on Figure 3.

Groundwater

Groundwater in the vicinity of the coal tar and the contaminated subsurface soil has also been impacted by PAHs and BTEX. BTEX levels in groundwater ranged from non-detect to 199,500 ppb. These results are two to three orders of magnitude above SCGs. Total PAH levels in groundwater ranged from non-detect to 11,450 ppb. Carcinogenic PAHs were detected in only one sample, at a level of 717 ppb. Total cyanide levels ranged from non-detect to 495 ppm. All wells with elevated levels of PAHs and cyanide also had elevated levels of BTEX, so BTEX levels are used to delineate groundwater impacts. The extent of groundwater BTEX contamination is shown on Figure 4.

Soil Gas

Soil gas on-site did have BTEX at levels above typical background. Benzene levels ranged from non-detect to 61 Fg/m^3 (micrograms per cubic meter), toluene from 4 to 68 Fg/m^3, ethylbenzene from non-detect to 23 Fg/m^3, and xylene from 13 to 130 Fg/m^3. These chemicals appear to be from a combination of sources, some site related and some not related to the MGP.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

There were no IRMs performed at this site during the RI/FS.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 6.1.3 of the RI report.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.
The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

Pathways which are known to or may exist at the site include:

- Dermal contact with and incidental ingestion of contaminated surface soil in the Eastern Parcel by trespassers and site workers;

- Dermal contact, inhalation or incidental ingestion with contaminated subsurface soils in the Eastern Parcel by construction and utility workers; and

- Potential for inhalation of volatile organic compounds in the form of vapors from the intrusion of contaminated soil gas into buildings constructed on the Eastern Parcel in the future.

The analyses of soil samples collected from the Western Parcel did not indicate the presence of any significant subsurface contamination that would represent an exposure concern. In addition, the parcel is paved and landscaped further diminishing the potential for contact with any residual MGP-related soil contamination. The analyses of surface soil samples from the Eastern Parcel indicates the presence of PAHs and lead at levels which could present an exposure concern. However, a chain link fence is installed around the perimeter of the parcel so as to control access by trespassers. Authorized access to the parcel is provided to site workers, and the potential for their exposure is minimal based on the vegetated cover present.

The presence of MGP-related contamination at depth presents an exposure concern to construction and utility workers who may excavate into contaminated soils on the Eastern Parcel. The potential exposures to these workers may be minimized by the use of personal protective equipment in areas known to be impacted by MGP contamination.

The presence of any MGP-related contamination remaining at depth following remediation of the Eastern Parcel presents a potential exposure concern should buildings be constructed at a future date. Of concern is the potential for the intrusion of contaminated soil gas into the basements or foundations of newly constructed buildings resulting in discernable impacts to indoor air quality.

5.4: <u>Summary of Environmental Impacts</u>

This section summarizes the existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors. The following environmental exposure pathways and ecological risks have been identified:

- NAPL has impacted the groundwater resource in the shallow and bedrock aquifers at the site, and contamination is migrating off-site as NAPL and as dissolved phase;

- The potential for direct contact by fauna and flora with NAPL and contaminated subsurface soils; and

- MGP contamination has migrated into the Hudson River. Impacts from this contamination will be addressed in Operable Unit 2.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- the presence of NAPL and MGP-related contaminants as the sources of soil, groundwater and soil gas contamination;
- migration of NAPL and MGP-related contaminants that would result in soil, groundwater or soil gas contamination;
- the release of contaminants from NAPL in on-site soil into groundwater that result in exceedances of groundwater quality standards;
- the potential for ingestion of groundwater with contaminant levels exceeding drinking water standards;
- the potential for ingestion/direct contact with contaminated soil;
- impacts to biota from ingestion/direct contact with soil; and
- the release of contaminants from subsurface soil under buildings into indoor air through soil gas migration and intrusion.

Further, the remediation goals for the site include attaining to the extent practicable:

- recommended soil cleanup objectives in TAGM 4046; and
- ambient groundwater quality standards.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Nyack Gas Plant Site, were identified, screened and evaluated in the FS report which is available at the document repositories identified in Section 1.

A summary of the remedial alternatives that were considered for this site are discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated subsurface soils, groundwater and soil gas at the site.

Alternative 1: No Action

Present Worth: *$1,070,000*
Capital Cost: *$0*
Annual OM&M:
(Years 1-30): *$60,000*

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Alternatives S-1 through GW-4

No single technology would be effective in addressing both soil and groundwater impacts at this site, so the remedy for this site will require a combination of a number of different technologies. In analyzing the remaining remedial alternatives, solutions to the groundwater and soil contamination are evaluated separately.

None of the remedial alternatives evaluated would be capable of addressing contamination in the bedrock underlying the Eastern Parcel completely enough to provide unrestricted use of that property. Even with the most aggressive treatment, restrictions would still be required to address groundwater contamination and the potential for re-contamination of subsurface soil from the bedrock. As such, the soil alternatives (S-1 through S-5) do not include any remedies which would remediate the site to unrestricted criteria. In the following soil alternatives, impacted soil are defined as those containing PAHs at levels above the TAGM 4046 objective of 500 ppm total PAHs. Since residential development of this site is contemplated following remediation, and since all remedial alternatives would leave soil behind with individual PAHs above TAGM 4046 levels, all remedial alternatives include institutional and engineering controls to prevent human exposure to these soils.

As previously indicated, other contaminants of concern in soils are co-located with areas of elevated PAHs, so total PAHs are used to delineate impacted soils. Similarly, other contaminants of concern in groundwater are co-located with areas of elevated BTEX, so BTEX are used to delineate groundwater impacts.

Chemical Oxidation of Offsite Area

A small area to the south of the lower terrace, on the Hudson Vista Associates property, is impacted by both MGP wastes and petroleum sources apparently unrelated to this site. The MGP impacts are generally concentrated in the three feet of soil overlying bedrock, approximately ten feet below ground surface. Orange and Rockland has proposed to address this contamination by in-situ chemical oxidation (oxidation). The goal of oxidation would be to oxidize the residual coal tar soils to reduce leaching of coal tar related chemicals to groundwater. The specific performance standard for the oxidation of the Hudson Vista Associates property would be determined during treatability testing. If treatability testing does not demonstrate that oxidation would be effective in eliminating these impacts as a continuing source of contamination, this area would be addressed by the technology selected to address on-site soil contamination on the lower terrace.

Alternative S-1:In-situ Solidification of Upper and Lower Terraces

Present Worth: *$8,072,000*
Capital Cost: *$8,072,000*
Annual OM&M:
(Years 1-30): *$0*

Alternative S-1 would occur in three phases. In the preparation phase, major obstructions such as rip rap, concrete debris and remaining MGP substructures including piping would be removed by conventional excavation. This excavation would also remove gross contamination in and immediately adjacent to subsurface structures and piping to the extent practicable. Where excavation is not practicable, principally in the lower terrace, flowable DNAPL would be extracted by recovery wells. The excavation would be conducted in a manner which controls the emission of dust, odors, and VOCs.

In the second phase, impacted soils in the Upper and lower terrace would be augered and mixed with pozzolanic agents (typically Portland cement). This process would produce overlapping columns of solidified soil, resulting in a low permeability monolith. The result would eliminate the mobility of the contamination and greatly reduce or eliminate the contamination as a continuing source of groundwater contamination. Approximately 19,000 cubic yards of soils would be solidified.

In the third phase, site restoration would occur, with final slope stabilization and grading, and placement of appropriate cover to prevent exposure of the stabilized soil at the ground surface (two feet of seeded, clean soil; asphalt paving; or structure). An environmental easement would be placed on the property which would: 1)describe the location and characteristics of the solidified material, 2)restrict groundwater usage, 3)require that any future on-site building construction address the potential for soil gas intrusion and implement any necessary engineering controls, 4)require a soil management plan to control subsurface exploration or excavation, and 5)require annual certification that the institutional and engineering controls remain in place and are effective in controlling exposures.

Alternative S-2:In-situ Solidification of Lower Terrace / Excavation and Ex-situ Solidification of Upper Terrace

Present Worth: *$8,282,000*
Capital Cost: *$8,282,000*
Annual OM&M:
(Years 1-30): *$0*

This remedial action would occur in four phases. The preparation phase would be identical to that of Alternative S-1 and would involve removal of flowable DNAPL and impacted subsurface structures.

In the second phase, in-situ solidification (ISS) would be conducted as in Alternative S-1, but in the lower terrace only.

In the third phase, impacted soils in the upper terrace would be excavated to bedrock and mixed with pozzolanic agents in a temporary processing facility located on site. This ex-situ solidification (ESS) process would produce a concrete-like thick slurry, which would be placed into forms within the lower terrace. Excavation and ESS activities would occur in a manner which would control emissions of odors, dust, and VOCs. Initial estimates indicate that not all of the volume could be accommodated in the lower terrace, and a few feet of material would need to be placed in the upper terrace area as well. This additional material represents 4,000 to 8,000 cubic yards of soil that would otherwise require off-site transport and disposal.

In the fourth phase, site restoration would occur, with final slope stabilization, grading, and placement and seeding of two feet of clean soil or other appropriate surfacing material. An environmental easement would be placed on the property which would: 1)describe the location and characteristics of the solidified material, 2)restrict groundwater usage, 3)require that any future on-site building construction address the potential for soil gas intrusion and implement any necessary engineering controls, 4)require a soil management plan to control subsurface exploration or excavation, and 5)require annual certification that the institutional and engineering controls remain in place and are effective in controlling exposures.

It is estimated that approximately 8,000 cubic yards of impacted soil would be ex-situ solidified and 11,000 cubic yards of soil would be solidified by ISS techniques during this remedial alternative.

Alternative S-3:**In-situ Solidification of Lower Terrace / Excavation and Off-site Transport of Upper Terrace**

Present Worth: *$8,426,000*
Capital Cost: *$8,426,000*
Annual OM&M:
(Years 1-30): *$0*

This remedial action would occur in four phases. The preparation phase for the lower terrace would be the same as that of Alternatives S-1 and S-2. Additional construction would be performed to facilitate loading and off-site transport of excavated soil.

In the second phase, impacted soils and subsurface structures in the upper terrace would be excavated to bedrock and transported to an off-site permitted treatment/disposal facility. The excavation would occur in a manner which would control emissions of odors, dust, and VOCs.

In the third phase, ISS would be conducted as in Alternatives S-1 and S-2, but in the lower terrace only.

In the fourth phase, site restoration would occur, with final slope stabilization, grading, and placement and seeding of two feet of clean soil or other appropriate cover materials such as asphalt pavement. An environmental easement would be placed on the property which would: 1)describe the location and characteristics of the solidified material, 2)restrict groundwater usage, 3)require any future on-site building construction to address the potential for soil gas intrusion and implement any necessary engineering controls, 4)require a soil management plan to control subsurface exploration or excavation, and 5)require annual certification that the institutional and engineering controls remain in place and are effective in controlling exposures.

Approximately 8,000 cubic yards of impacted material would be excavated and transported off site from the upper terrace while approximately 11,000 cubic yards would be mixed using ISS techniques in the lower terrace.

Alternative S-4:**Partial Excavation of Lower Terrace, In Situ Chemical Oxidation of Soil, and Excavation of Upper Terrace with Off-site Transport**

Present Worth: *$6,936,000*
Capital Cost: *$6,936,000*
Annual OM&M:
(Years 1-30): *$0*

This remedial action would occur in five phases. The preparation phase would prepare the site to accommodate loading of excavated soil and importing of clean fill. DNAPL recovery wells would be installed in the northern portion of the lower terrace to collect any flowable DNAPL present where excavation would not be performed.

In the second phase, impacted, unsaturated soils and impacted structures would be excavated from the upper terrace. Partial excavation of the lower terrace would first involve removal of the small quantity of unsaturated soils exceeding the RAO action levels. The primary remedial action for the lower terrace would be the removal of grossly impacted saturated soils located at the former drainage pits. This excavation is currently estimated to be a 130-foot by 70-foot area of grossly impacted soil. Grossly impacted soil consists of soil which has at least a six-inch thick lens of waste material distributed throughout. The excavation activities in the upper and lower terrace would occur in a manner that would control emissions of odors, dust, and VOCs. Impacted materials would be transported to an off-site permitted treatment/disposal facility.

In the third phase, the upper terrace and lower terrace excavation areas would be backfilled to the extent required to accommodate possible future site development.

In the fourth phase, in situ chemical oxidation would be used to treat impacted saturated soil in the south and north areas of the lower terrace. During chemical oxidation, contaminants are converted to less toxic compounds that are more stable, less mobile, and/or inert through the action of oxidizing agents. To implement the oxidation process, an aqueous solution of the oxidizing agent would be placed in contact with the saturated, impacted soils, usually by a grid of temporary injection points. The process would be repeated several times until the remedial goals are achieved. The process would be monitored before and after treatment. Long-term trends in groundwater quality would also be monitored.

The northern area consists of a 150-foot x 40-foot zone along the toe of the bank, between the excavation area and the northern property line, while the southern area is comprised of a 35-foot x 70-foot area on the southern part of the lower terrace including an area within the Hudson Vista property. These soils, while not constituting gross contamination, contain impacts above 500 ppm total PAHs and cPAHs above 1 ppm as benzo(a)pyrene, and could possibly be a source of continuing impact to groundwater quality in the long term, and therefore should be addressed by remedial action. These soils appear to be amenable to oxidation technology because they are sands and gravels with sheens and small pinhead globules of NAPL that could be contacted by a grid of oxidation injection points. The performance standard to be used for the chemical oxidation would be determined in a bench-scale treatability study conducted during the pre-design investigation.

In the fifth phase, site restoration would occur, with final slope stabilization, grading, placement and seeding of 2 feet of clean soil or other appropriate surfacing material. An environmental easement would be placed on the property which would: 1)describe the location and characteristics of the remaining residual contamination, 2)restrict groundwater usage, 3)require that any future on-site building construction address the potential for soil gas intrusion and implement any necessary engineering controls, 4)require a soil management plan to control subsurface exploration or excavation, and 5)require annual certification that the institutional and engineering controls remain in place and are effective in controlling exposures.

In this alternative, approximately 14,000 cubic yards of impacted soil would be excavated and transported off site for treatment/disposal.

Alternative S-5:**Excavation with Off-site Transport of All Soils**

Present Worth: *$10,095,000*
Capital Cost: *$10,095,000*
Annual OM&M:
(Years 1-30): *$0*

This remedial action would occur in four phases, the first being preparation of the site for excavation and transport, including shoring and dewatering systems in the lower terrace, and accommodations for loading of excavated soil and unloading backfill.

In the second phase, all impacted soils in the upper terrace and lower terrace would be excavated. Excavation of deep saturated soils immediately adjacent to the Hudson River in the lower terrace would require a substantial dewatering system, a water treatment system, and discharge to the Hudson River. A large shoring structure consisting of steel sheeting, pilings, and bracing would be required. All excavation activities would occur in a manner which would control emissions of odors, dust, and VOCs.

In the third phase, the upper terrace would be backfilled to the extent required to accommodate site development. The lower terrace would be backfilled to its original grade. Large quantities of backfill material would be required for the lower terrace.

In the fourth phase, site restoration would occur, with final slope stabilization, grading, addition of two feet of clean soil, and seeding or other appropriate surfacing. An environmental easement would be placed on the property which would: 1)describe the location and characteristics of the remaining residual contamination, 2)restrict groundwater usage, 3)require that any future on-site building construction address the potential for soil gas intrusion and implement any necessary engineering controls, 4)require a soil management plan to control subsurface exploration or excavation, and 5)require annual certification that the institutional controls remain in place and are effective in controlling exposures.

In this alternative, approximately 19,000 cubic yards of impacted soil would be excavated and transported off site for treatment/disposal.

Alternative GW-1: In-situ Biotreatment and NAPL Recovery

Present Worth: *$4,822,000*
Capital Cost: *$2,776,000*
Annual OM&M:
(Years 1-10): *$180,000*
(Years 10-30): *$60,000*

In-situ biotreament enhances the biodegradation of organic contaminants in the subsurface by microorganisms by providing additional oxygen and/or nutrients. Common methods of adding oxygen include placement of oxygen releasing compounds (ORC), injection of low concentration hydrogen peroxide, or air sparging. Addition of nutrients would also be considered to support the biodegradation process. The system would be expected to operate for many years until the groundwater quality would meet the remedial action objectives.

Cost estimates for this alternative are based on the system being active for a period of 10 years and then monitored for an additional 20 years.

Alternative GW-2: Groundwater/NAPL Recovery and Treatment

Present Worth: $6,067,000
Capital Cost: $4,389,000
Annual OM&M:
(Years 1-10): $135,000
(Years 1-30): $60,000

In this alternative, groundwater and NAPL would be recovered from a system of downgradient wells or trenches located in the shoreline area of the lower terrace. A barrier wall would be required to provide hydraulic control so that the system would not be recovering clean river water. Above-ground treatment of the water would be conducted using granular activated carbon (GAC) or other appropriate treatment technologies. The system would be expected to operate for many years until groundwater quality meets the remedial action objectives. Elements of the in-situ biological treatment could be added to further increase the system's effectiveness.

Alternative GW-3: Rapid NAPL Recovery Followed by Bedrock Isolation

Present Worth: $6,939,000
Capital Cost: $5,876,000
Annual OM&M:
(Years 1-30): $60,000

This remedial action would be conducted in three phases. In the first phase, the site would be prepared by conducting initial NAPL recovery and clearing obstructions to the drilling activities. These activities would overlap substantially with many of the site preparation activities described in the soil alternatives.

In the second phase, the grouting of the fractured bedrock matrix would proceed in a designed, controlled procedure. A series of borings would be completed, typically ten borings in a staggered pattern of five-foot spacings, each followed immediately by pumping out the contents of the borings to remove grossly impacted groundwater/NAPL. Controlled pressure grouting would proceed in an outward to inward sequence. The spacings of the borings and characteristics of the grout would be adjusted in response to grout pressure and volume data collected during the initial portion of the program, to ensure that the bedrock matrix has been substantially grouted.

In the third phase, the site would be restored in conjunction with the soil remedial actions.

Alternative GW-4: NAPL Recovery and Chemical Oxidation

Present Worth: *$4,178,000*
Capital Cost: *$2,936,000*
Annual OM&M:
(Years 1-30): *$70,000*

Wells and/or trenches would be used to recover flowable NAPL in the bedrock to the extent practicable. The extent of bedrock contamination would be verified during pre-design investigation, and the construction and distribution of recovery wells and/trenches would be determined during the remedial design. NAPL removal actions would continue until the volume of NAPL recovered is no longer significant.

After the NAPL is removed, the chemical oxidation of MGP contaminants would be implemented using active means, including strategic placement of oxidizing agents or other methods of introducing oxidants to the groundwater. The chemical oxidation process would proceed over a period of several months of intensive oxidant addition. Due to the difficulty of measuring before and after conditions in the hidden fractures of the bedrock, no other performance standard would be applicable for this action in the upper terrace.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York State. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed “threshold criteria” and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative’s ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the NYSDEC has determined to be applicable on a case-specific basis.

The next five “primary balancing criteria” are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectivness. Capital costs and operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP have been evaluated. The responsiveness summary (Appendix A) represents the public comments received and the manner in which the NYSDEC addressed the concerns raised. In general, the public comments received were supportive of the selected remedy.

SECTION 8: SUMMARY OF THE SELECTED REMEDY

Based on the Administrative Record (Appendix B) and the discussion presented below, the NYSDEC has selected Soil Alternative S-3, Excavation of upper terrace with In-Situ Solidification of the lower terrace for addressing the impacts in soil, and Alternative GW-4, Chemical Oxidation and NAPL Recovery to address groundwater/NAPL impacts as the remedy for this site. The areal extent of the groundwater treatment system is shown on Figure 4 and the areal extent of the soil remedy is shown on Figure 5. The elements of the selected remedy are described at the end of this section.

The selected remedy is based on the results of the RI and the evaluation of alternatives presented in the FS. In selecting the remedy for this site, each of the distinct site areas were evaluated separately to select the optimum solution for each area. While this approach increases the complexity of the remedy selection process, it is warranted in this instance due to the distinct characteristics in each of the evaluated areas.

In the upper terrace, all soils are above groundwater, which would make excavation less complicated. As a result, excavation of the upper terrace could be completed for a similar or lower cost, when compared to other remedies while providing a preferred solution by permanently removing impacted materials from this portion of the site.

In the lower terrace, the increased cost and complexity associated with operating below the groundwater table in close proximity to the Hudson River would make excavation much more difficult to implement, and more costly. In addition, the complexity of this excavation would be expected to lead to a much longer construction period, resulting in increased disruption to the community. The ability of solidification to meet the remedial goals with less short term impacts and less cost than excavation would make this the preferred remedy for the lower terrace.

Chemical oxidation of the lower terrace (Alternative S-4) would be more cost effective than Alternative S-3, and would result in the permanent destruction of the hazardous waste. However, the site's location along the Hudson River would make it especially difficult to establishing hydraulic control over the injected chemical and it would be difficult to establish a performance criteria. In comparing these two alternatives, there was greater confidence that Alternative S-3 could be effectively implemented at this site.

All four of the groundwater remedies would be expected to have similar levels of reliability and effectiveness. Alternatives GW1 and GW-4 are significantly less expensive than GW-2 and GW-3, and would be similar in there ability to meet remedial objectives. Groundwater alternatives GW-1 and GW-2 would require extended operation periods to be effective. Alternative GW-4 would address contamination effectively, quickly and at a reasonable cost.

The estimated present worth cost to implement the combined groundwater and soil remedy is $11,806,000. The cost to construct the combined remedy is estimated to be $9,835,000 and the estimated average annual operation, maintenance, and monitoring costs for 30 years is $70,000.

The elements of the selected remedy are as follows:

1. A remedial design program will be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. This will include treatability studies to allow the design of in-situ chemical oxidation of the bedrock and Hudson Vista Associates property.

2. In the upper terrace, all MGP structures, including piping, and soils which contain total PAHs over 500 ppm or which are visibly impacted by coal tar will be excavated and transported to an off-site permitted treatment/disposal facility. The excavation will occur in a manner which will control emissions of odors, dust, and VOCs. Following excavation, slopes will be stabilized using on-site material meeting the cleanup criteria.

3. Wells and/or trenches will be used to recover flowable NAPL in the bedrock in both the upper and lower terrace to the extent practicable. NAPL removal actions will continue until the volume of NAPL recovered is no longer significant.

4. In the lower terrace, major obstructions such as rip rap, concrete debris, piping and remaining MGP structures will be removed by conventional excavation. This excavation will also remove gross contamination in and immediately adjacent to subsurface structures and piping which will be removed to the extent practicable. Where excavation is not practicable, flowable NAPL will be extracted by recovery wells. The excavation will be conducted in a manner which controls the emission of dust, odors, and VOCs.

5. Soils in the lower terrace which contain total PAHs over 500 ppm or which are visibly impacted by coal tar will be augered and mixed with pozzolanic agents (typically Portland cement). This process, in-situ solidification, will produce overlapping columns of solidified soil, resulting in a low permeability, solidified mass.

6. In the steeply sloped area between the upper and lower terraces, all soils which contain total PAHs over 500 ppm or which are visibly impacted by coal tar which are above the groundwater table will be excavated and transported off-site. All soils which contain total PAHs over 500 ppm or which are visibly impacted by coal tar and which are below the groundwater will either be excavated or solidified using in-situ solidification.

7. Residual contamination in the bedrock will be treated using in-situ chemical oxidation.

8. MGP related contamination on the Hudson Vista Associates property will be treated using in-situ chemical oxidation. In-situ solidification (ISS) may be used if it is determined during the design program that ISS would be preferable to oxidation in this location.

9. Since the remedy results in MGP waste remaining at the site, a long term monitoring program will be instituted. A monitoring plan will be developed which will include installing monitoring wells and sampling them on an annual basis. Analysis will include BTEX and PAHs. This monitoring program and the effectiveness of the remedy will periodically be re-evaluated. If site groundwater conditions improve and the site remedy remains physically secure, the monitoring interval could be extended.

10. Since the remedy will result in soil remaining on site with PAHs above individual TAGM 4046 soil cleanup objectives, the entire site will be covered with two feet of clean fill, pavement, or buildings.

11. A site management plan will be developed to: (a) address residual contaminated soils that may be excavated from the site during future redevelopment. The plan will require soil characterization and, where applicable, disposal/reuse in accordance with NYSDEC regulations, (b) ensure that appropriate barriers (soil, paving or buildings) remain in place between the ground surface and residual contaminated soils, (c) evaluate the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified, and (d) identify use restrictions for groundwater.

12. The property owner will provide an annual certification, prepared and submitted by a professional engineer or environmental professional acceptable to the Department, which will certify that the institutional controls and engineering controls put in place, are unchanged from the previous certification and nothing has occurred that would impair the ability of the control to protect public health or the environment or constitute a violation or failure to comply with any operation an maintenance or soil management plan.

13. An institutional control will be imposed in the form of an environmental easement that will: (a) require compliance with the approved site management plan, (b) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Rockland County Department of Health, and (c) require the property owner to complete and submit to the NYSDEC an annual certification as indicated above.

14. Since no significant contamination has been observed on the western (holder) parcel, no active remediation will be undertaken on this parcel as part of this remedy. If ongoing testing detects residual contamination which could present a potential human health risk to workers who may excavate the site in the future, the site management plan would include appropriate safety measure to be in place and would require appropriate handling and disposal of all excavated soils.

SECTION 9: HIGHLIGHTS OF COMMUNITY PARTICIPATION

As part of the remedial investigation process, a number of Citizen Participation activities were undertaken to inform and educate the public about conditions at the site and the potential remedial alternatives. The following public participation activities were conducted for the site:

- Repositories for documents pertaining to the site were established;

- A public contact list, which included nearby property owners, elected officials, local media and other interested parties, was established;

- A fact sheet was distributed to the public contact list announcing the availability of the PRAP and the public meeting;.

- The fact sheet included an internet address where the PRAP could be downloaded from the NYSDEC website;

- A public meeting was held on February 25, 2004 to present and receive comments on the PRAP; and

- A responsiveness summary (Appendix A) was prepared to address the comments received during the public comment period for the PRAP.

TABLE 1
Nature and Extent of Contamination
Sampling performed September 1999 through January 2002

SURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs)	Total PAHs	6-836	NA	NA
Individual cPAHs	Benzo(a)anthracene	0.55-37	0.224	9 of 9
	Chrysene	0.59-30	0.4	9 of 9
	Benzo(b)fluoranthene	0.52-16	1.1	8 of 9
	Benzo(k)fluoranthene	0.51-23	1.1	8 of 9
	Benzo(a)pyrene	0.52-40	0.061	9 of 9
	Indeno(1,2,3-cd)anthracene	0.36-16	3.2	7 of 9
	Dibenzo(a,h)anthracene	0.15-6	0.014	9 of 9
	Total cPAHs*	3-158	NA	NA
Inorganic Compounds	Cyanide	ND-14	NA	NA

*Total cPAHs values are calculated from discreet samples and are less than the sum of the individual maximum values listed.

TABLE 1 (Cont.)
Nature and Extent of Contamination
Sampling performed September 1999 through January 2002

SUBSURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND-270	0.060	13 of 55
	Toluene	ND-780	1.5	7 of 55
	Ethylbenzene	ND-1,000	5.5	15 of 55
	Xylene	ND-1,000	1.2	19 of 55
	Total BTEX*	ND-2,860	10	17 of 55
Semivolatile Organic Compounds (SVOCs)	Total PAHs	ND-19,388	500	21 of 55
Individual cPAHs	Benzo(a)anthracene	ND - 450	0.224	48 of 55
	Chrysene	ND - 410	0.4	44 of 55
	Benzo(b)fluoranthene	ND - 280	1.1	36 of 55
	Benzo(k)fluoranthene	ND - 240	1.1	35 of 55
	Benzo(a)pyrene	ND - 430	0.061	49 of 55
	Indeno(1,2,3-cd)anthracene	ND - 150	3.2	31 of 55
	Dibenzo(a,h)anthracene	ND - 58	0.014	46 of 55
	Total cPAHs	ND-1,936	NA	NA
Inorganic Compounds	Cyanide	ND-56	NA	NA

*Total cPAHs and BTEX values are calculated from discreet samples and are less than the sum of the individual maximum values listed.

TABLE 1 (Cont.)
Nature and Extent of Contamination
Sampling performed September 1999 through January 2002

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND-47,000	1	19 of 30
	Toluene	ND-4,500	5	6 of 30
	Ethylbenzene	ND-62,000	5	14 of 30
	Xylene	ND-86,000	5	15 of 30
Semivolatile Organic Compounds (SVOCs)	Total PAHs	ND-11,450	NA	NA
	Total cPAHs	ND-717	NA	NA
Inorganic Compounds	Cyanide	ND-495	200	1 of 30

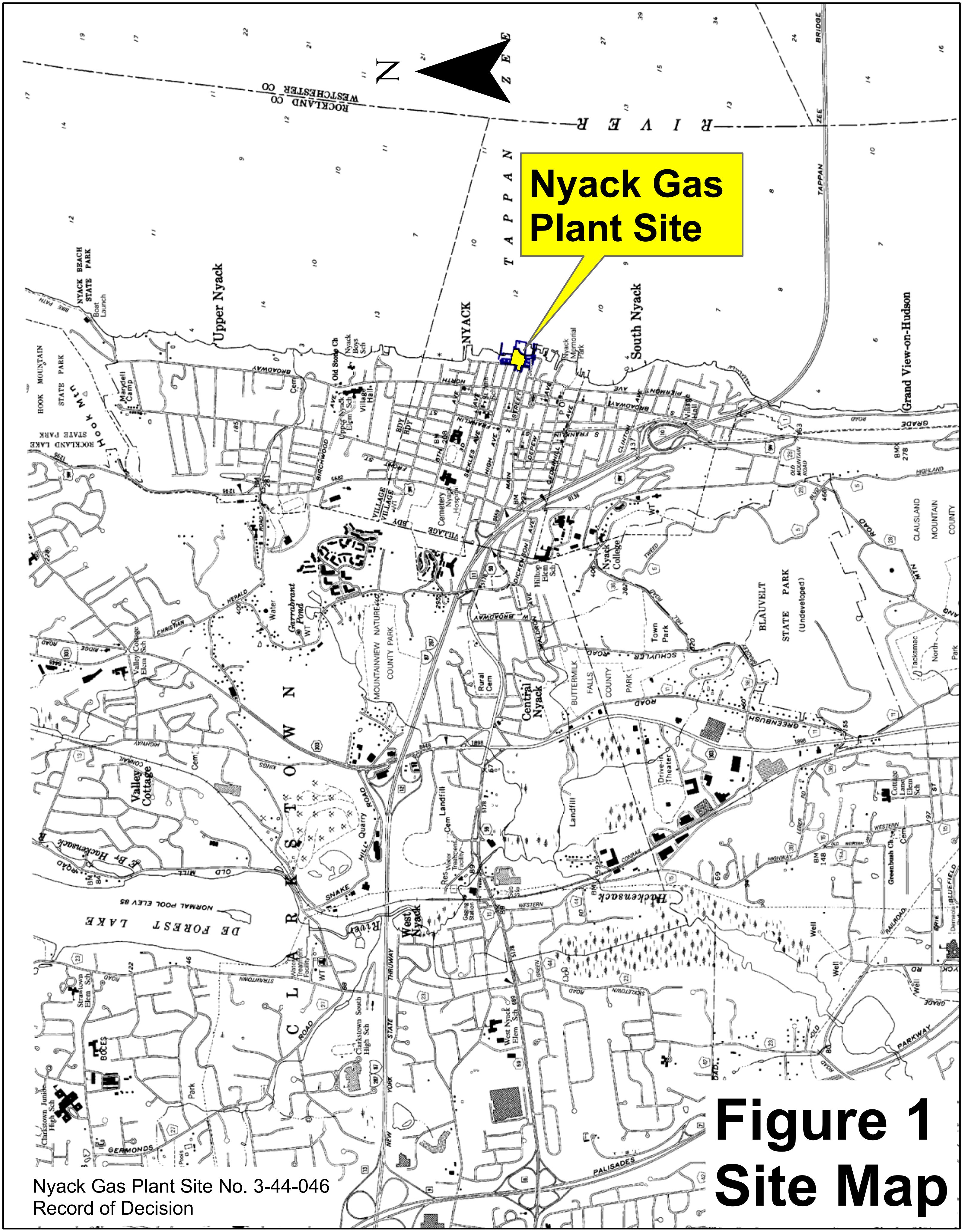
SOIL GAS	Contaminants of Concern	Concentration Range Detected ($\mu g/m^3$)[a]	SCG[b] ($\mu g/m^3$)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND - 61	NA	NA
	Toluene	4 - 68	NA	NA
	Ethylbenzene	ND - 23	NA	NA
	Xylene	13 - 130	NA	NA

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water;
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
ug/m^3 = micrograms per cubic meter

[b] SCG = standards, criteria, and guidance values;
Coal Tar - N/A
Surface and Subsurface Soil - NYSDEC TAGM 4046 Remedial Cleanup Objectives
Groundwater - NYS DEC Groundwater Standards
ND=No detection above the laboratory method detection limit.
NA=No applicable SCG.

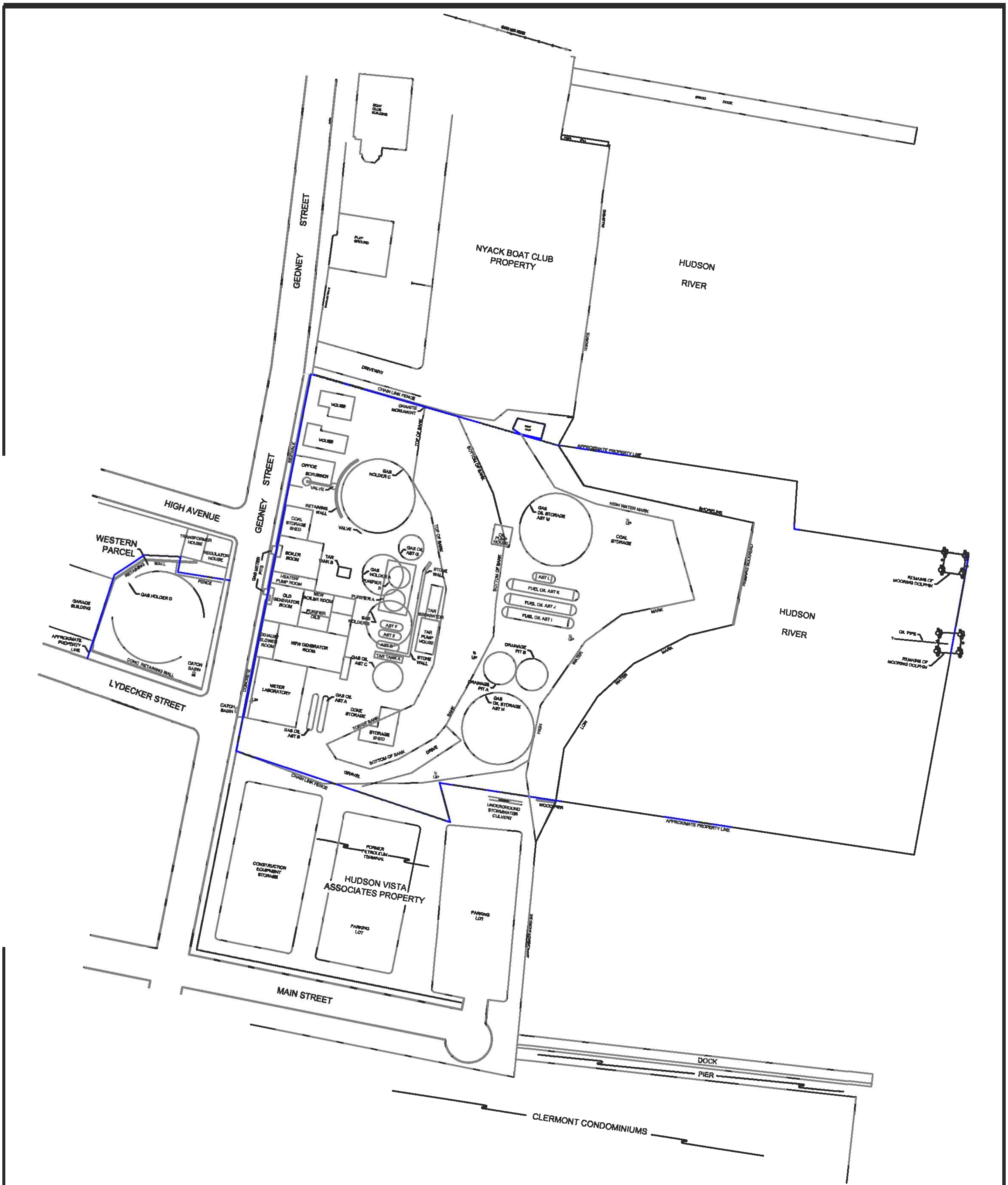
Table 2
Remedial Alternative Costs

Remedial Alternative		Capital Cost	Annual OM&M	Total Present Worth
SOIL ALTERNATIVES		**Capital Cost**	**O&M NPV**	**Total NPV**
S-1	ISS of Upper and Lower Terraces	$8,072,000		$8,072,000
S-2	ISS of Lower Terrace/ Excavation and Ex-situ Solidification of Upper Terrace	$8,282,000		$8,282,000
S-3	ISS of Lower Terrace/ Excavation and Offsite Transport of Upper Terrace	$8,426,000		$8,426,000
S-4	Excavation of Upper Terrace with Offsite Transport/ Partial Excavation of Lower Terrace and In-situ Chemical Oxidation of NAPL in Soils	$6,936,000		$6,936,000
S-5	Excavation with Offsite Transport of All Soils	$10,095,000		$10,095,000
GROUNDWATER/NAPL ALTERNATIVES		**Capital Cost**	**O&M NPV**	**Total NPV**
GW-1	In-situ Biotreatment and NAPL Recovery	$2,776,000	$2,046,000	$4,822,000
GW-2	Groundwater/NAPL Recovery and Treatment	$4,389,000	$1,678,000	$6,067,000
GW-3	Rapid NAPL Recovery followed by Bedrock Isolation	$5,876,000	$1,063,000	$6,939,000
GW4	In-situ Chemical Oxidation and NAPL Recovery	$2,938,000	$1,971,000	$4,178,000



Nyack Gas Plant Site No. 3-44-046
Record of Decision

Figure 1
Site Map

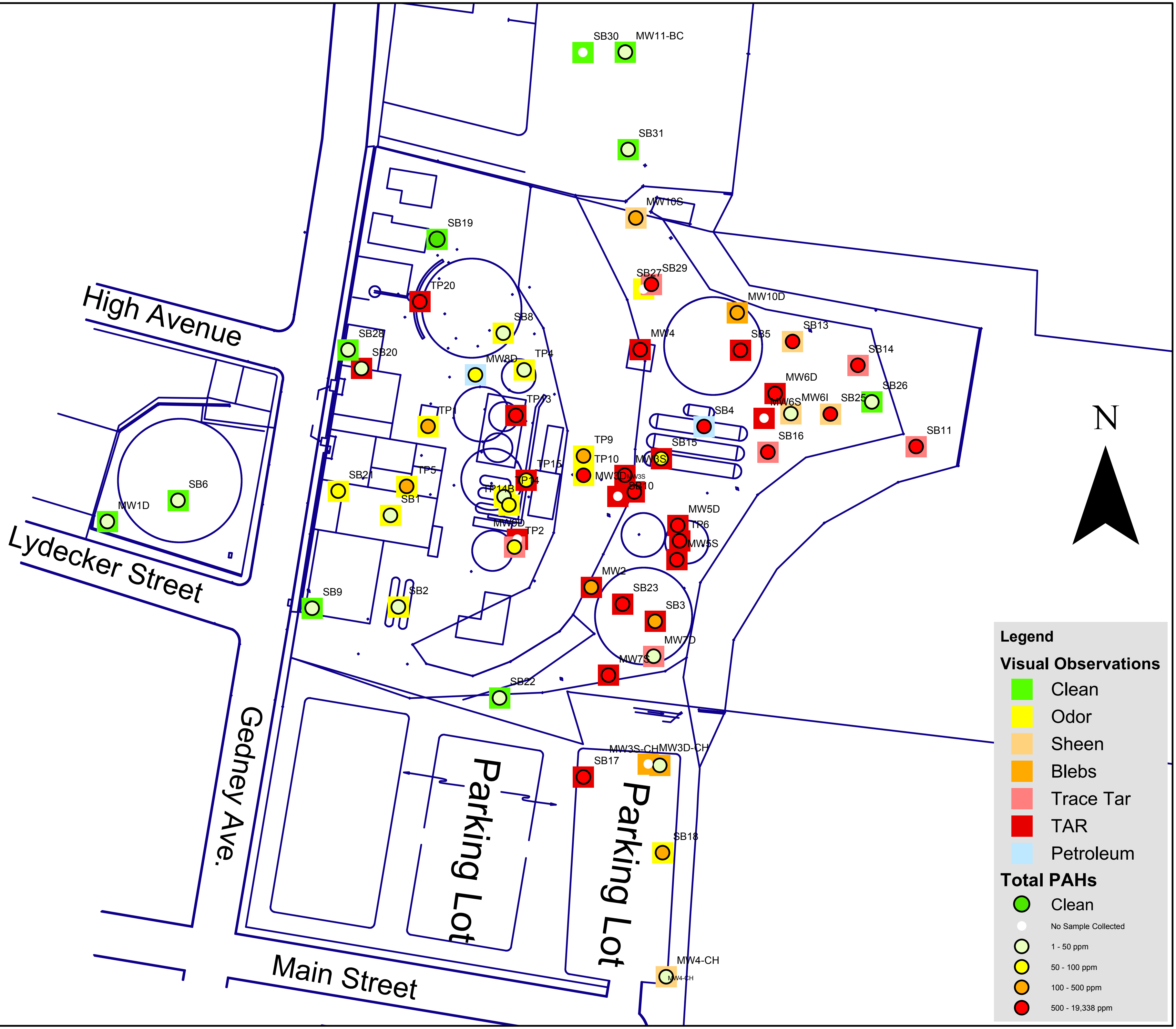


NYACK GAS PLANT SITE (OU-I)
NYACK (C), ROCKLAND COUNTY, NEW YORK
SITE NO. 3-44-046

HISTORIC STRUCTURES

FIGURE 2

Figure 3
Extent of Contamination



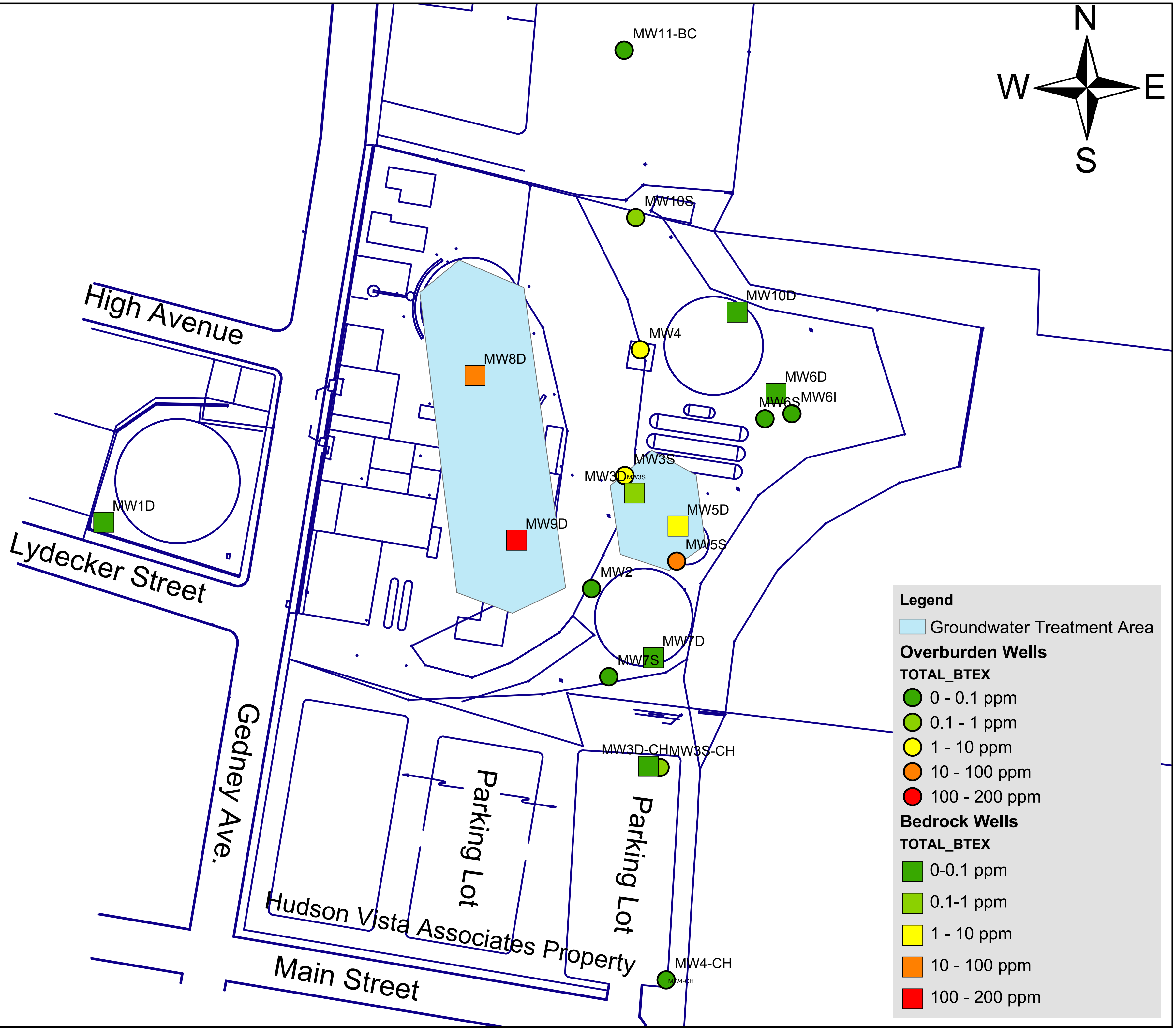


Figure 4: Extent of Groundwater Contamination and Selected Groundwater Remedy

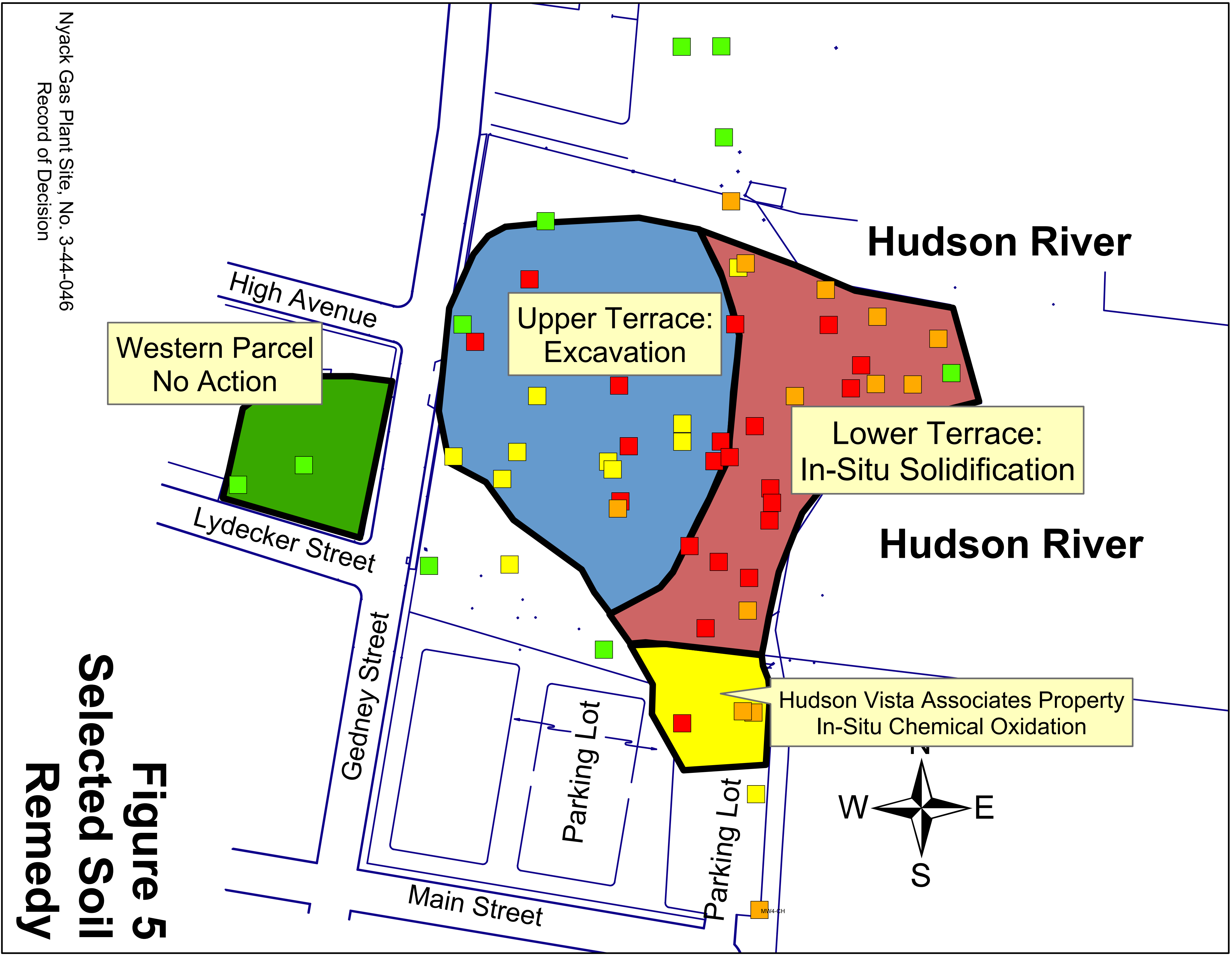


Figure 5
Selected Soil Remedy

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Nyack Gas Plant Site
Operable Unit No. 1 - Former Plant Site
Nyack (V), Rockland County, New York
Site No. 3-44-046

The Proposed Remedial Action Plan (PRAP) for the Nyack Gas Plant site, was prepared by the New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on February 9, 2004. The PRAP outlined the remedial measure proposed for the contaminated soil, and groundwater at the Nyack Gas Plant site.

The release of the PRAP was announced by sending a notice to the public contact list, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on February 25, 2004, which included a presentation of the Remedial Investigation (RI) and the Feasibility Study (FS) as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the PRAP ended on March 12, 2004.

This responsiveness summary responds to all questions and comments raised during the public comment period.

The following are the comments received at the meeting, with the NYSDEC's responses:

COMMENT 1: What are the two pools in the lower terrace?
RESPONSE 1: This is the drainage pit area, one of the more heavily contaminated areas of the site. In historic figures, they are referred to as the drainage pits. Tar and other materials mixed with the water from the operations and collected in the drainage pits.

COMMENT 2: Would the remedy include solidification of the heavy coal tar contamination in the area of the drainage pits?
RESPONSE 2: No, the remedy will eliminate mobile tar before in-situ solidification. The remedy would excavate the structures and grossly contaminated material associated with the structures, and use NAPL collection to remove the mobile tar that is not feasible to remove through excavation.

COMMENT 3: What will be solidified?
RESPONSE 3: The material to be solidified on the lower terrace generally consists of coal tar impacted soils with PAHs above 500 ppm. Some of the soil has seams of tar or blebs (small points of tar), but does not include large volumes of tar saturated soil.

COMMENT 4: Where would the excavated material go during remediation?

RESPONSE 4: Excavated material would be sent off-site to a permitted treatment or disposal facility. Much of the coal tar contaminated soil generated at MGP sites goes to low temperature thermal desorption units. This process heats the dirt, driving the organic chemicals off. Those chemicals are then collected or destroyed. The large stones and the structural debris would have to go to a landfill.

COMMENT 5: Who will be conducting the cleanup?
RESPONSE 5: Orange and Rockland Utilities Inc.

COMMENT 6: Does Orange and Rockland own the property?
RESPONSE 6: No. Orange and Rockland does not own the property.

COMMENT 7: What would happen if you did not have hydraulic control over the chemical oxidation process.
RESPONSE 7: It depends on the chemical used. It could be as innocuous as adding a lot of oxygen to the river water, but it could also involve release of other chemicals, including intermediate products of oxidation.

COMMENT 8: Is chemical oxidation of the bedrock groundwater limited to the upper terrace?
RESPONSE 8: No. Both, the upper and lower terrace have bedrock contamination which will be addressed using chemical oxidation.

COMMENT 9: If the public is not using the groundwater, why spend millions of dollars to clean it up?
RESPONSE 9: A cleanup can either be driven by environmental concerns or it can be driven by public health concerns. In this case, even though the groundwater isn't used for consumption, it still represents an environmental contamination concern which has to be addressed. There would also be a potential for health impacts from vapor intrusion if the contamination is not remediated and the site is redeveloped.

COMMENT 10: What is coal tar? What can that do to you?
RESPONSE 10: Coal tar contains polycyclic aromatic hydrocarbons (PAHs) and benzene, toluene, ethylbenzene, and toluene (BTEX) compounds. Seven of these PAHs and benzene are identified human carcinogens. A number of other compounds have been associated with other health risks. From the standpoint of the community, the coal tar doesn't represent any on-going health exposure because it is in the ground and there is no groundwater use in the area. The Department of Health has indicated that there is no current exposure to the site related contamination.

COMMENT 11: I know that the State Department of Health, has done some past surveys in this County about cancer. Have they done any in that particular area or that street or that neighborhood?
RESPONSE 11: Cancer incidence studies have not been conducted specifically for the Village of Nyack. However, information about cancer and the incidence of the four most common types of cancer in New York State has been gathered as part of the New York State Department of Health's *Cancer Surveillance Improvement Initiative* project. The information includes comparisons of the actual incidence of the four cancer types for individual zip codes with the expected incidence of each cancer type for the zip code. For more information about the project or about cancer, you may call 1-800-458-1158 or look at the Department of Health's Web Page on the Internet at www.health.state.ny.us.

COMMENT 12: Can the site reasonably be developed for commercial or residential use. It would seem that the stigma of the hazardous waste would make potential end users of the property uneasy. Are there examples of sites being used for residential or commercial purposes following remediation?
RESPONSE 12: There are many examples of sites which have been successfully remediated and returned to productive use. There are even sites that have been continuously used for residential purposes before, during, and after remediation. In all cases, it is critqical that potential exposure is eliminated before the property is reused. Exposure to any residual contamination at this site would be controlled by imposing the institutional and engineering controls described in the ROD: appropriate cover, vapor control for structures, and a site management plan required by an environmental easement.

COMMENT 13: Where you've called for in-situ solidification, on the lower terrace, could that area then be excavated for the construction of buildings?
RESPONSE 13: You can construct on material that's been solidified. The solidified material would have a greater bearing capacity than the original soil, so it's ability to support slab-on-grade construction would be improved. In addition, the material would not be as hard as concrete - it would be soft enough to drill through if the proposed construction required placing piles to bedrock.

COMMENT 14: On the lower terrace, why don't you just excavate the whole thing? Why are you going to excavate that huge section above and leave that little section down below to solidify? Why not do it all?
RESPONSE 14: The process of excavating the lower terrace would be much more complex and much more expensive than excavating the upper terrace. On the upper terrace, the bedrock is shallow (~10 feet), and there is no groundwater above bedrock, so, that area can be excavated easily and relatively inexpensively. On the lower terrace, the contamination extends much deeper, and the groundwater is quite shallow. It would be a much more expensive, much more complicated process to do an excavation on the lower terrace. There will be some excavation on the lower terrace to clear MGP structures and obstructions and eliminate gross contamination in the immediate vicinity of the structures.

COMMENT 15: Can you elaborate on your remedial goals for, both, soils and groundwater?
RESPONSE 15: As indicated in section 6 the ROD, the remediation goals for this site are to eliminate or reduce to the extent practicable:1)the presence of NAPL and MGP-related contaminants as the sources of soil, groundwater and soil gas contamination, 2)migration of NAPL and MGP-related contaminants that would result in soil, groundwater or soil gas contamination, 3)the release of contaminants from NAPL in on-site soil into groundwater that result in exceedances of groundwater quality standards, 4)the potential for ingestion of groundwater with contaminant levels exceeding drinking water standards, 5)the potential for ingestion/direct contact with contaminated soil, 6)impacts to biota from ingestion/direct contact with soil, and 7)the release of contaminants from subsurface soil under buildings into indoor air through soil gas migration and intrusion. Further, the goals for the site include attaining to the extent practicable recommended soil cleanup objectives in TAGM 4046 and ambient groundwater quality standards.

COMMENT 16: What do TAGM numbers mean for soil? Are they suitable for residential use versus commercial use?
RESPONSE 16: TAGM 4046 provides screening levels for various compounds. There are two separate sets of TAGM numbers that we looked at for this site. One is a total PAH level of 500 ppm and the other is the levels for individual compounds. The levels for individual compounds are applicable for direct contact. Because

there will be soil remaining on site with individual PAH levels above TAGM levels, appropriate cover will be required. By providing appropriate cover, a site management plan, and engineering controls, exposure to residual contamination would be eliminated, which will allow the property to be used for restricted residential purposes.

COMMENT 17: For the groundwater, what numbers are you going to clean up to? Is it going to be protective of surface water criteria? I understand you're going to defer the Hudson River sediments to OU-2, but what about the Hudson River surface water?
RESPONSE 17: Since soil with total PAHs above 500 ppm will be removed, treated, or solidified as part of this remedy, the source of continuing water contamination will be eliminated, and natural processes will work over time to bring groundwater and the ground water discharging to the Hudson into compliance with applicable standards. Ongoing monitoring of the groundwater will be performed to verify the effectiveness of the remedy. Also refer to RESPONSE 24.

COMMENT 18: I know there's a house at High Avenue and Gedney. Is there groundwater contamination underneath that house?
RESPONSE 18: No. This house is upgradient from the contamination. Wells between the contamination and this house were not contaminated.

COMMENT 19: Is there some contamination? Do they have to worry about vapor intrusion into their basement?
RESPONSE 19: Some investigation of the soil gas has been completed, and soil gas levels were not of concern. Additional testing of the soil gas will be conducted this spring to confirm soil gas does not present an exposure risk.

COMMENT 20: Does that include indoor air sampling?
RESPONSE 20: Typically, not. The indoor air would only be sampled if there was some evidence of soil gas contamination.

COMMENT 21: Is groundwater analyzed for PAHs, or just BTEX?
RESPONSE 21: Groundwater is sampled for an extensive suite of chemicals, including volatile and semivolatile organic chemicals, which include BTEX and PAHs.

COMMENT 22: How can you be sure that there's not groundwater contamination or soil contamination at the High/Gedney Street intersection? Is that going to be included in your future investigation?
RESPONSE 22: We have clean wells and borings bounding the proposed remedy to the west, which is why we do not think we have any contamination extending west beyond Gedney Street. During the cleanup, the sidewall of the excavation will be observed and sampled to confirm there is no remaining material which shows visible evidence of coal tar or PAH levels above 500 ppm. In addition, our investigations have shown the groundwater and tar moving toward the river, making contamination west of Gedney Street even less likely.

COMMENT 23: What are your remedial goals for groundwater? Would it be compared to surface water standards or groundwater standards?
RESPONSE 23: Our goal is to meet ambient groundwater standards to the extent practical. The proposed remedy provides the best chance of meeting groundwater criteria at this site. However, particularly with the

NAPL in the bedrock, we anticipate that groundwater standards may not be achieved immediately following completion of the remedy. For that reason, the remedy includes a restriction of groundwater use and continued monitoring of the groundwater. Even if groundwater standards are not initially achieved, groundwater quality would be expected to improve over time, since gross contamination, which would be a continuing source of groundwater impacts, will be removed. Please also refer to RESPONSE 24.

COMMENT 24: Are the surface water standards more stringent than the groundwater standards? Do you plan on mitigating to groundwater standards or to surface water standards? Will you address groundwater discharging to surface water?
RESPONSE 24: There will be no man-made discharge from this site, so surface water discharge standards would not be applicable. Sampling of surface water already completed shows that ambient surface water standards are met, even before remediation. Although ambient surface water standards can be more stringent than groundwater standards, these standards can not be directly applied as discharge criteria. Discharge criteria would include assessment of the assimilative capacity of the receiving water to determine whether the discharge would be likely to create ambient conditions that would not meet standards. In this case, the groundwater standards are more stringent than surface water standards, and those are the standards that we have identified as a remedial goal.

COMMENT 25: My chief concerns is discharge of contaminated groundwater into the Hudson River. I would like to request that a careful analysis be made to consider this concern as this remedy and the remedy for OU2 are assessed.
RESPONSE 25: The inter-tidal zone, where groundwater appears to be discharging to the surface water, will be assessed during the design of the OU1 remedy and during the Feasibility Study for OU2.

COMMENT 26: Will there be surface water sampling as a part of the ongoing monitoring following the cleanup?
RESPONSE 26: None is planned since pre-remedial samples have not identified any problems. Groundwater monitoring has been identified as the appropriate measure of the effectiveness of the remedy, since surface water samples would be significantly diluted by river water. Please also refer to RESPONSE 24.

COMMENT 27: Have you seen coal tar globules surfacing in the intertidal zone?
RESPONSE 27: No, but hand probing of the near-shore area did produce hydrocarbon like sheens in some locations.

COMMENT 28: You're talking about making this impermeable barrier, because it's going to encapsulate the contamination. We have all this water coming down the hill and it sounds like we're going to have a big concrete dam. What's going to keep that from turning into a swamp behind this concrete dam along the front right up to the top and all the water coming down from the bedrock?
RESPONSE 28: The groundwater which would be of concern is the water which flows through the bedrock, and then enters the unconsolidated material in the lower terrace. Orange and Rockland’s engineer has identified this as an important design consideration, and a hydraulic analysis will be incorporated into the design to ensure that there are no unintended complications from the redirection of groundwater.

COMMENT 29: There are incentives for a riverfront walk in this location. Will the proposed remedy in anyway limit access to the riverfront?

RESPONSE 29: No, the remedy would not preclude a riverfront walk or other public access.

COMMENT 30: How significant are the risks to public health from the excavation? Who monitors the health effects from the excavation and how often is the monitoring done?
RESPONSE 30: Orange and Rockland has indicated that they intend to perform the excavation under a temporary structure with negative pressure air handling and treatment. This will provide the best protection for the community against both vapors and nuisance odors. There will be an approved Community Health and Safety Plan in place, providing for continuous air monitoring for both volatile organic compounds and particulates. If levels exceed the criteria in the health and safety plan, appropriate engineering controls will be required.

In addition, Orange and Rockland has indicated that they intend to use a state-of-the-art perimeter air monitoring system to monitor the air 24 hours a day, 7 days a week, with an after-hours paging system. Should the air quality be compromised, even if nobody is on site, the monitoring system would alert the contractor that something needs to be done. This system was used very successfully during an earlier remediation of their Haverstraw site.

COMMENT 31: When will the work begin? How long do you anticipate it will go for?
RESPONSE 31: Based on the schedule being discussed at this time, the design process should take 12 to 16 months. Construction could begin in the winter of 2005. The complete project should take four years to complete. Overall, the project could continue through 2008.

COMMENT 32: Suppose we decided to let sleeping hydrocarbons lie. Suppose the people in the area decided we wanted to keep this property as open space. Would the State have any objection if the Village took the property and kept it as open space. We could even add the soil cover and have the environmental easements to enact the site management plan?
RESPONSE 32: Restricting the end use for this property would not significantly change the remedy. This comment proposes to break the human exposure pathways only, and not to eliminate any of the source material. This would leave the site continuing to discharge contamination to the Hudson River, impacting both the river water and the sediments. In addition, the coal tar would remain on site. This material is highly mobile, and can be made to move significantly by relatively minor disturbances such as changes in groundwater flow patterns, vibration from construction equipment or traffic, or nearby construction or earthwork. Any of these disturbances could make the tar move - potentially off-site, or into the Hudson River. Unless the source material is addressed, there will always be a potential for this tar to migrate to where it could cause harm to the environment or to human health.

COMMENT 33: What would be the potential use of the property following remediation.
RESPONSE 33: There would not be any development restrictions on the property. There would be institutional controls to address any residual contamination, including the requirement to have a sub-slab vapor control system on any on-site buildings and appropriate cover for any open space.

COMMENT 34: Would appropriate cover include grass?
RESPONSE 34: The site management plan, which is part of the remedy, will require that there is appropriate cover across the entire site. That cover could be buildings, two feet of clean fill with vegetative cover, or

pavement. There will be an environmental easement established, which will require that the site management plan is followed for this property.

COMMENT 35: If this site were to be left as open space, or used for industrial purposes, is it fair to say that you would not have to do this?
RESPONSE 35: No, please refer to RESPONSE 32.

COMMENT 36: I have a question about the process. Who initiated this project?
RESPONSE 36: In 1996, the State approached various New York State utilities, asking them to identify manufactured gas plant sites. Orange and Rockland identified 8 sites and signed an initial consent order in 1996 agreeing to investigate these sites. Following this, Orange and Rockland signed subsequent consent orders to remediate these sites where contamination was found. The order for the Nyack site was signed in 1999.

COMMENT 37: Usually, with in-situ oxidation, you control vapors. Will this be considered in the Remedial Design.
RESPONSE 37: The potential need to control vapors during chemical oxidation will be assessed during the Remedial Design. Not all chemical oxidation applications require vapor control.

COMMENT 38: Would a vapor control system be consistent with the adjacent residential development.
RESPONSE 38: If a vapor collection system is necessary, it would be designed to be compatible with site development. Air monitoring will be conducted to ensure compliance with the site specific health and safety plan.

COMMENT 39: How was the southern boundary on the cleanup defined? I notice there's one test on the Hudson Vista Associates property with PAHs between 100 to 500 parts per million which is not included in the area to be remediated.
RESPONSE 39: Soils with total PAHs above the NYSDEC TAGM 4046 value of 500 ppm will be excavated, solidified or treated. Orange and Rockland will conduct a design level investigation to accurately determine the areal extent of those impacts.

COMMENT 40: When is the next time the public can have input?
RESPONSE 40: After the ROD is finalized, the detailed design of the remedy will begin. A fact sheet will announce the availability of the Remedial Design for public review and comment.

COMMENT41: When would the community expect to hear about OU-2?
RESPONSE 41: Orange and Rockland submitted a detailed Remedial Investigation Report to the NYSDEC in 2003. Once the DEC has reviewed that report, we will be able to assess the schedule more clearly. Once the Remedial Investigation Report is approved, work would begin on the Feasibility Study (FS). If the site cleanup could impact the decisions made in the OU-2 FS, completion of the FS could be delayed until the conclusion of the land based cleanup.

COMMENT 42: I would appreciate clarification with regard to existing environmental concerns as the property exists now.

RESPONSE 42: Contaminated groundwater is going into the Hudson River, and unless the source material is removed, there is a potential for coal tar to be released to the Hudson River.

COMMENT 43: Can we submit comments via E-mail?
RESPONSE 43: Yes, an e-mail address is on the handout and on the Fact Sheet.

The following comments were received by e-mail from Diane Cutt on March 12, 2004:

COMMENT 44: It is difficult to determine by the figures in the PRAP if the extent of soil and groundwater contamination have been defined to TAGM levels and groundwater standards, respectively. The contaminant levels on Figures 3 and 4 are represented as ranges, therefore, it is difficult to determine the actual concentrations of each contaminant at each sampling location. Of particular concern is that no sampling appears to have been conducted on the west side of Gedney Avenue at its intersection with High Avenue. I respectfully request that the actual concentrations at each sampling location be provided to the public. If these data indicate that additional sampling, including new monitoring wells and soil borings, are required to fully define the extent of contamination, I respectfully request that the soil and groundwater contamination be fully defined and remediated and that any proposed work to do so be made available to the community.
RESPONSE 44: The actual results of each sampling point are provided in the Remedial Investigation Report, which is in the document repository. This report defines the nature and extent of contamination at this site. Based on a full review of this data, additional investigation work was called for in the ROD. The additional investigation includes work on the west side of Gedney Avenue; soil borings south of High Street, and soil gas points both north and south of High Street. No additional groundwater investigation is necessary based on existing data. When the work plan for this work is finalized, it will be added to the document repository, as will results of this investigation. The definition of the extent of contamination and remediation will be further clarified during the design process.

COMMENT 45: The PRAP indicates that "of concern is the potential for the intrusion of contaminated soil gas into the basements or foundations of any newly constructed buildings resulting in discernable impacts to indoor air quality." Presumably this is directed at any new structures built on the site. Has an off-site vapor intrusion study been conducted? Houses located directly across Gedney Avenue may be impacted by vapor intrusion.
RESPONSE 45: A soil gas investigation of this area is currently planned, as indicated in RESPONSE 44.

COMMENT 46: I am concerned that only sediments in the Hudson River that have been contaminated by this site will be addressed in Operable Unit-2. It was my impression from comments made by Orange and Rockland, the responsible party, at the public meeting on February 25 that it is their opinion that groundwater from this site is not discharging to the Hudson River and is not impacting the River. However, without technical evidence of this, I believe, as a geologist and groundwater specialist, that groundwater from this site likely discharges to the Hudson River and that it is important to identify that a primary remedial goal of OU-1 is to prevent the further migration of contaminated groundwater to the Hudson River. Will the groundwater remedies proposed in the PRAP prevent further migration of contaminated groundwater into the Hudson River?
RESPONSE 46: Please refer to RESPONSE 24.

COMMENT 47: Based on the information provided in the PRAP, no soil remediation alternatives were developed for the Western Parcel and the South Area, the Hudson Vista Association Property. How will contaminated soils in these areas be addressed?

RESPONSE 47: No contaminated soils were encountered in the Western Parcel. On the Hudson Vista Associates property, the selected remedy calls for contaminated soil to be treated by chemical oxidation, if this remedy is demonstrated to be effective during design. If work completed during the remedial design fails to demonstrate that chemical oxidation will successfully remediate these contaminated soils, the Hudson Vista Associates Property will be remediated using in-situ solidification.

The following comment was received from Hudson Vista Associates in a letter dated March 9, 2004:

COMMENT 48: We are the owners of the property to the south of the subject site. We attended the Public Hearing on February 25, 2004 and had previously been advised by Orange and Rockland that they would be required to do some work on our property.
We want to express our support for the work to be performed and offer our cooperation. We are however; disappointed with the schedule indicating the remedial action will not be completed until 2006.
We understand that the work on our site is small in relation to the overall project. Can the work on our site be expedited? We have been waiting for this work to take place since 1996, so that we can proceed with the development of our property. Anything that you can do to expedite the work will be greatly appreciated.
RESPONSE 48: The NYSDEC will work to complete this remediation as expeditiously as possible.

The following comments were received in a letter dated March 11, 2004 from David S. Yudelson of Sive, Paget and Riesel, P.C. on behalf of Presidential Life Insurance, the owner of the site:

COMMENT 49: The site has been out of productive use for a number of decades. Thus, in addition to protecting human health and the environment, a primary goal of this remediation must be to facilitate the re-use of the site as expeditiously as possible and without undue restrictions. This is consistent with State policy as well as being in the best interests of the public.
RESPONSE 49: The NYSDEC will work to complete this remediation as expeditiously as possible. This remediation will facilitate the safe re-use of the site without undue restrictions.

COMMENT 50: Restrictions that can be eased or avoided with a reasonable amount of additional remedial effort must be. If the site is unduly encumbered with deed restrictions and obligations reuse will be delayed if not prevented outright.
RESPONSE 50: Anticipated restrictions on the future use of the plant site property have been minimized to the extent practicable.

COMMENT 51: In order to minimize or eliminate the need for further review, approval or involvement by NYSDEC and NYSDOH in any as yet unspecified redevelopment plan, the competent bedrock surface on the upper terrace and the top surface of the solidified "monolith" should include a clean concrete or grout cap and vapor barrier.
RESPONSE 51: The proposed cap and vapor barrier would not decrease the involvement of the DEC and DOH.

COMMENT 52: Any soils above TAGM found on the lower terrace that can be excavated and disposed of off-site without unreasonable difficulty, should be. At minimum, this must include excavation of any soils above TAGM that can be removed without significant de-watering.

RESPONSE 52: Removal of additional soils on the lower terrace would not increase the effectiveness of the remedy nor decrease the future restrictions on the property.

COMMENT 53: It must be planned that any work on OU2 must be undertaken from the water and not through the site.
RESPONSE 53: Routing of material or equipment associated with the OU2 remediation will be addressed in the remedial design for that project. Since a remedy for that portion of the site has not been selected, it is premature to address short term impacts to implementation.

COMMENT 54: The western parcel should be removed from classification as part of the site as soon as possible. Any testing required to accomplish should be undertaken without delay.
RESPONSE 54: This site has not been listed on the State's registry of inactive hazardous waste disposal sites, so no de-listing is necessary.

COMMENT 55: Serious thought must be given to a means of expediting the flowing product recovery phase of both the upper and lower terraces. It is possible that injection grouting should be used in conjunction with removal and oxidation so that defined schedules can be met. It will be unacceptable if trenches or recovery wells are used for extended periods thus delaying implementation of the ultimate remedy of soil removal and oxidation/solidification.
RESPONSE 55: The selected remedy recognizes the importance of an expeditious completion of the bedrock remedy. Based on the Feasibility Study, it is anticipated that the NAPL extraction and chemical oxidation can be accomplished in a similar time frame as the above proposed injection grouting. All parties will work to ensure that the remedy is implemented in an effective and timely manner.

COMMENT 56: We anticipate that during the design phase of the remediation we will provide input on the specifications for the solidification material and on the determination on whether such monolith should extend to bedrock on the lower terrace. The purpose of such input is to ensure that implementation of the remedy does not preclude or interfere with any reuse of the site.
RESPONSE 56: The property owner will be given the opportunity to provide input on the specifications for the solidification material and on the determination on whether such monolith should extend to bedrock on the lower terrace.

COMMENT 57: We also anticipate being a party to any discussions that bear on the suggested environmental easement and site restrictions. Thus, we respectfully request that a Presidential representative be present for any future communication or discussion respecting the final choice of remedy and phasing.
RESPONSE 57: The ROD dictates the scope of the environmental easements required. The degree of involvement between the property owner and Orange and Rockland during the design and implementation of the remedy should be negotiated between those two parties.

The following comments were received from Robert J. Nelson in a letter dated March 14, 2004:

COMMENT 58: I would like the former plant site (OU-1) to be maintained as open space; a park-like location with riverfront access to the Hudson and its scenic beauty.
RESPONSE 58: The redevelopment of the site following remediation is a subject for the municipal planning and zoning officials.

COMMENT 59: I would like to see no residential development on the site to minimize the necessary clean-up of contamination resulting from its former industrial use.
RESPONSE 59: Please refer to RESPONSE 32.

COMMENT 60: I would prefer the contamination to be contained to prevent contamination in the river's sediments (OU-2).
RESPONSE 60: The selected remedy on the lower terrace is a containment remedy. A containment remedy was considered for the upper terrace, and the excavation remedy was selected because it will permanently remove the contamination at a cost similar to the containment remedy, with similar short term impacts.

The following comment was received from Rockland County Conservation Association Inc. in a letter dated March 14, 2004:

COMMENT 61: The referenced site on Gedney Street in Nyack is being considered for remediation of contamination to the standard of safety for building and occupation of enclosed dwellings. The Rockland County Conservation Association, Inc. is interested in contemplation of a less restrictive proposal: clean-up to the extent of safe public use including a riverfront walk and park for utilization and enjoyment as open space by the people of the State of New York. This possibility should in no way alter protecting the Hudson River from adjacent soil contaminants and measures for their containment and/or removal (OU-2).

RCCA is a seventy-two year old organization devoted to the preservation of our region's environment. One on-going tenet is its advocacy of public access to the scenic beauty of the Hudson with its accompanying communication with nature and restorative recreational and educational capabilities.

The Gedney Street site is within the state designated Tappan Zee Scenic District (NYSDEC, 1987). Its availablity is a rare opportunity to renew New York's commitment to the public covenant. We welcome the inclusion of this letter in the comments from the public about the project.
RESPONSE 61: Please refer to RESPONSES 32, 59 and 60.

APPENDIX B

Administrative Record

Administrative Record

Nyack Gas Plant Site
Operable Unit No. 1 - Former Plant Site
Nyack (V), Rockland County, New York
Site No. 3-44-046

1. Proposed Remedial Action Plan for the Nyack Gas Plant site, Operable Unit No.1 - Former Plant Site, dated February 2004, prepared by the NYSDEC.

2. Order on Consent, Index No. D3-0002-9412, between NYSDEC and Orange and Rockland Utilities Inc., executed on January 8, 1996.

3. Order on Consent, Index No. D3-0001-98-08, between NYSDEC and Orange and Rockland Utilities Inc., executed on March 11, 1996.

4. Remedial Investigation Report, Former Manufactured Gas Plant Site, Nyack New York," January 11, 2002, Prepared by the Retec Group, Inc.

5. "Feasibility Study Former MGP Site - Nyack, New York", January 26, 2004. Prepared by the Retec Group, Inc.

6. Fact Sheet, February 2004: Notice of Public Meeting, Proposed Remedial Action Plan, Nyack Gas Plant Site, OU-1 Former MGP Plant Site and Structures

7. Transcript, Nyack Gas Plant Site, Proposed Remedial Action Plan Public Meeting, Nyack College, Hilltop Auditorium, February 25, 2004

8. Letter Dated March 9, 2004 from William F. Hellmer, Hudson Vista Associates, Inc.

9. Letter Dated March 11, 2004 from David S. Yudelson of Sive, Paget, & Riesel, P.C. Representing Presidential Life Insurance.

10. E-mail dated March 12, 2004 from Diana Cutt

11. Letter dated March 14, 2004 from Robert J. Nelson

12. Letter dated March 14, 2004 from Rockland County Conservation Association.

RECORD OF DECISION

OR - Nyack MGP
Operable Unit Number: 02
Nyack, Rockland County
Site No. 344046
March 2011

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - RECORD OF DECISION

OR - Nyack MGP
Operable Unit Number: 02
Nyack, Rockland County
Site No. 344046
March 2011

Statement of Purpose and Basis

This document presents the remedy for Operable Unit Number: 02 of the OR - Nyack MGP site, a Class 2 inactive hazardous waste disposal site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375, and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for Operable Unit Number: 02 of the OR - Nyack MGP site and the public's input to the proposed remedy presented by the Department. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Description of Selected Remedy

The elements of the selected remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. A pre-design investigation will be necessary to confirm sediment conditions north of the boat club dock and in the immediate vicinity of off-shore mooring structures (a.k.a. the "dolphins") and to confirm conditions in the on-shore and intertidal areas. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:
a. Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
b. Reducing direct and indirect greenhouse gas and other emissions;
c. Increasing energy efficiency and minimizing use of non-renewable energy;
d. Conserving and efficiently managing resources and materials;
e. Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste. To support these objectives, the Department would consider incorporating excess stabilized soil into the existing, OU1 monolith;
f. Maximizing habitat value and creating habitat when possible. This could include reusing oversized stone from the current rip-rap shoreline for restoration of the original shoreline and

intertidal zone in the vicinity of the jetty;
g. Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
h. Integrating the remedy with the end use where possible and encouraging green and sustainable re-development

2. On-shore areas (above the mean high water mark and below the existing ISS monolith which extends to the 100 year flood line) where MGP tar is present in the soil at less than 7 feet below ground surface (bgs) will be excavated and transported to a permitted, off-site treatment/disposal facility. The excavation will occur in a manner which controls emissions of odors, dust, and VOCs. Following excavation, slopes would be restored using existing soil/sediment/rip-rap meeting the cleanup criteria and vegetation.

3. On-shore areas where significant quantities of MGP tar are present at greater than 7 feet bgs will be treated using in-situ solidification (ISS). The ISS will create a low permeability cement monolith which will effectively isolate the MGP contamination from human contact and the environment, eliminating potential exposure pathways. Implementing ISS at this site will require conducting a treatability study to verify that the design standards (permeability less than 10-6 cm/sec and unconfined compressive strength between 50 and 500 psi) can be achieved by the ISS method being employed. Following solidification, post-mix sampling will be conducted to verify effectiveness. Appropriate steps will also be taken to protect the solidified soil from frost damage and wave erosion, and to isolate it from the environment.

4. Sediment (below the mean high water mark) which contains visible MGP tar or which, through multiple lines of evidence has been shown to contain MGP-related contamination resulting in an impact to the environment, will be removed by dredging and transported to a permitted, off-site treatment and disposal facility. The approximate extent of this removal is shown on Figure 6. Following completion of the remedial action, the steam bed and banks will be restored with a minimum 2 foot thick clean substrate layer. The design will include a restoration plan for areas disturbed by the remedy and will be consistent with the requirements of 6 NYCRR Part 608.

5. The remedy will result in some on-shore soil and solidified material remaining at the site which contains site contaminants at levels above restricted residential soil cleanup objectives (SCOs). These materials will be isolated from the public by a minimum of 2 feet of soil meeting restricted residential SCOs, or another barrier acceptable to the NYSDEC and NYSDOH (e.g., asphalt). For the areas where underlying soil does not meet SCOs, a demarcation layer will be provided. For areas where solidified material underlies the cover, the material itself will serve as the demarcation layer due to the nature of the material. The two feet of clean soil cover currently in place in OU1 will also be restored as necessary following OU2 remedial activities. This restoration will ensure that the remedy for OU1 will not be negatively impacted by the work proposed for OU2.

6. The remedy selected for Operable Unit 1 included the imposition of an institutional control. The following updates the requirements for that institutional control to be consistent with current regulations and guidance. The institutional control, in the form of an environmental

easement will:

a) require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).

b) allow the use and development of the controlled property for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), though land use is subject to local zoning laws;

c) restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH;

d) prohibit agriculture or vegetable gardens on the controlled property;

e) require compliance with the Department approved Site Management Plan;

7. The remedy selected for Operable Unit 1 required a Site Management Plan. The following updates the requirements for that plan to be consistent with current regulations and guidance, including the following:

a) an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

i) Institutional Controls: The Environmental Easement discussed in Paragraph 6 above.

ii) Engineering Controls: The soil cover discussed in Paragraph 5.

iii) This plan includes, but may not be limited to: (1) Soil Management Plan which details the provisions for management of future excavations in areas of remaining contamination; (2) descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions; (3) a provision for evaluation of the potential for soil vapor intrusion for any buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;(4)provisions for the management and inspection of the identified engineering controls;(5)maintaining site access controls and Department notification; and (6) the steps necessary for the periodic reviews and certification of the institutional and engineering controls;

b) a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

i) monitoring of groundwater to assess the performance and effectiveness of the remedy;

ii) Monitoring the steps taken to protect the solidified soil from frost damage and wave erosion, and to isolate it from the environment;

iii) monitoring the success of restoration;

iv) a schedule of monitoring and frequency of submittals to the Department;

v) monitoring for vapor intrusion for any buildings developed on the site, as may be required pursuant to item 7.a.iii above.

8. The property owner or remedial party will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal will: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved

modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

MAR 31 2011

Date

Dale A. Desnoyers, Director
Division of Environmental Remediation

RECORD OF DECISION

OR - Nyack MGP
Nyack, Rockland County
Site No. 344046
March 2011

SECTION 1: <u>SUMMARY AND PURPOSE</u>

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), has selected a remedy for the above referenced site. The disposal of hazardous wastes at the site has resulted in threats to public health and the environment that would be addressed by the remedy. The disposal or release of hazardous wastes at this site, as more fully described in this document, has contaminated various environmental media. The remedy is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This Record of Decision (ROD) identifies the selected remedy, summarizes the other alternatives considered, and discusses the reasons for selecting the remedy.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and 6 NYCRR Part 375. This document is a summary of the information that can be found in the site-related reports and documents.

SECTION 2: <u>SITE DESCRIPTION AND HISTORY</u>

Location: The Nyack Manufactured Gas Plant (MGP) site a vacant property located on the west bank of the Hudson River in the downtown area of Nyack, Rockland County, NY.

Site Features: The site consists of an upper terrace at the elevation of Gedney Ave. and a lower terrace along the Hudson River. The entire site is currently landscaped to the rip/rap shoreline. The site is fenced to prevent trespassing.

Current Zoning/Use: Downtown Nyack has a blend of residential and commercial properties, including a marina immediately to the north and a multi-unit residential complex immediately to the south of the site. The site is zoned “waterfront,” which is intended to encourage uses along and near the Hudson River related to, and appropriate for, a waterfront area.

Historical Use: A manufactured gas plant (MGP) operated at this site from 1852 until 1965. Gas was made by heating coal and/or petroleum products in closed vessels. The gas was then cooled, purified, and distributed through a network of underground pipes in surrounding communities, where it was used in much the same way that natural gas is used today. Routine use of the plant was discontinued in 1938. From 1938 until 1965, the MGP was used only during times of peak demand, a practice known as “peak shaving.” The site-related contamination is coal tar, which was a condensate from the gas manufacturing process. Tar would condense from the hot gas as it was being cooled and purified. Some of this tar escaped from pipes, storage vessels, and other subsurface structures into the surrounding soils. The locations of former MGP structures are shown on Figure 2.

Operable Units: The site has been divided into 2 operable units. An operable unit represents a portion of the site that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. This document pertains to Operable Unit 2.

Remediation of Operable Unit 1 (OU1), the portion of the site above the 100 year flood line, is complete. A large scale excavation was completed in the western portion of OU1 during 2006. Contaminated soils in two other areas to the south and east were treated with an in-situ solidification process in 2006 and 2007. The OU1 area was then covered with clean topsoil and restored to a park-like setting.

Operable Unit 2 (OU2), which is the subject of this document, consists of the remaining land (below the 100 year flood line and above the mean high water mark) and the Hudson River sediment which has been impacted by site-related contamination.

Site Geology and Hydrogeology: OU2 is covered with a varying thickness of fill. The jetty area which protrudes into the Hudson River has the thickest layer of fill (13 feet). A second significant area of fill is the slope between the upper and lower terraces, which was apparently placed after plant operations had ended. A layer of native silty sand generally underlies the fill material. A layer of glacial till was noted in one boring on the upper terrace. Underlying the silty sand is sandstone bedrock. The bedrock is a productive aquifer with the groundwater flowing upward through the bedrock. The overburden in the upper terrace is entirely above groundwater. In the lower terrace, groundwater is found in the overburden, and is seen to fluctuate with the tide, indicating some hydraulic communication between the river and the groundwater.

Operable Unit (OU) Number 02 is the subject of this document.

A Record of Decision was issued previously for OU 01.

A site location map is attached as Figure 1.

SECTION 3: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, alternatives (or an alternative) that restrict(s) the use of the site to as described in Part 375-1.8(g) is/are being evaluated in addition to an alternative which would allow for unrestricted use of the site.

A comparison of the results of the investigation to the appropriate standards, criteria and guidance values (SCGs) for the identified land use and the unrestricted use SCGs for the site contaminants is included in the Tables for the media being evaluated in Exhibit A.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRPs for the site, documented to date, include:

Orange and Rockland Utilities Inc.

The NYSDEC and Orange and Rockland Utilities, Inc. (O and R) entered into a Consent Order on January 2, 1996. This order was superseded by a second order dated March 5, 1999 (Index #D3-0001-98-08). These orders obligate O and R to investigate, and as necessary, remediate the Nyack Gas Plant Site.

SECTION 5: SITE CONTAMINATION

5.1: Summary of the Remedial Investigation

A Remedial Investigation (RI) has been conducted. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in the RI Report.

The following general activities are conducted during an RI:

- Research of historical information,
- Geophysical survey to determine the lateral extent of wastes,
- Test pits, soil borings, and monitoring well installations,
- Sampling of waste, surface and subsurface soils, groundwater, and soil vapor,
- Sampling of surface water and sediment,
- Ecological and Human Health Exposure Assessments.

5.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in Exhibit A list the applicable SCGs in the footnotes. For a full listing of all SCGs see: http://www.dec.ny.gov/regulations/61794.html

5.1.2: RI Information

The analytical data collected on this site includes data for:

- groundwater
- surface water
- soil
- sediment
- soil vapor

The data have identified contaminants of concern. A "contaminant of concern" is a hazardous waste that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized in Exhibit A. Additionally, the RI Report contains a full discussion of the data. The contaminant(s) of concern identified for this Operable Unit at this site is/are:

coal tar	polycyclic aromatic hydrocarbons (PAHs), total

As illustrated in Exhibit A, the contaminant(s) of concern exceed the applicable SCGs for:

- groundwater
- soil
- sediment

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Record of Decision.

There were no IRMs performed at this site during the RI.

5.3: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure*.

Operable Unit 1:
Since the site is covered by a combination of asphalt and clean soil, people will not come in contact with subsurface contamination unless they dig below these cover materials. People are not drinking contaminated groundwater because the area is served by a public water supply that is not affected by this contamination. They will not come into contact with contaminated groundwater unless they dig deeper than six feet below the ground surface.
Volatile organic compounds in the groundwater and/or soil may move into the soil vapor (air spaces within the soil), which in turn may move into overlying buildings and affect indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil vapor intrusion. Data indicate inhalation of site-related contaminants via soil vapor intrusion is not a concern off-site. The potential for soil vapor intrusion will be evaluated for any buildings developed on-site.

Operable Unit 2:
Persons who dig below the ground surface may come in contact with contaminants in subsurface soil. People may come in contact with contaminants present in shallow river sediments while entering or exiting the river.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water.

The Fish and Wildlife Resources Impact Analysis (FWRIA) for OU 02, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

The primary contaminant of concern at this site is coal tar (a condensate from the gas manufacturing process). Coal tar contains BTEX compounds (benzene, toluene, ethylbenzene, and xylene) and PAHs (polycyclic aromatic hydrocarbons). Investigations have shown coal tar and contaminated groundwater to be present at the site. Site related contaminants have also been observed in the sediment in the Hudson River at levels above applicable sediment standards. No site related contamination has been observed in surface water at levels above applicable standards.

The site presents an environmental threat due to the ongoing presence of coal tar in the subsurface and releases of contamination from the coal tar into the groundwater and into the aquatic environment.

SECTION 6: SUMMARY OF THE EVALUATION OF ALTERNATIVES

To be selected the remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the site, which are presented in

Exhibit B. Potential remedial alternatives for the Site were identified, screened and evaluated in the feasibility study (FS) report.

A summary of the remedial alternatives that were considered for this site is presented in Exhibit C. Cost information is presented in the form of present worth, which represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved. A summary of the Remedial Alternatives Costs is included as Exhibit D.

6.1: Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The next six "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

4. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

5. Short-term Impacts and Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

8. Land Use. When cleanup to pre-disposal conditions is determined to be infeasible, the Department may consider the current, intended, and reasonable anticipated future land use of the site and its surroundings in the selection of the soil remedy.

The final criterion, Community Acceptance, is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

9. Community Acceptance. Concerns of the community regarding the investigation, the evaluation of alternatives, and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

6.2: Elements of the Remedy

The basis for the Department's remedy is set forth at Exhibit E.

The estimated present worth cost to implement the remedy is $14,300,000. The cost to construct the remedy is estimated to be $12,000,000 and the estimated average annual cost is $130,000.

The elements of the selected remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. A pre-design investigation will be necessary to confirm sediment conditions north of the boat club dock and in the immediate vicinity of off-shore mooring structures (a.k.a. the "dolphins") and to confirm conditions in the on-shore and intertidal areas. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:
a. Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
b. Reducing direct and indirect greenhouse gas and other emissions;

c. Increasing energy efficiency and minimizing use of non-renewable energy;
d. Conserving and efficiently managing resources and materials;
e. Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste. To support these objectives, the Department would consider incorporating excess stabilized soil into the existing, OU1 monolith;
f. Maximizing habitat value and creating habitat when possible. This could include reusing oversized stone from the current rip-rap shoreline for restoration of the original shoreline and intertidal zone in the vicinity of the jetty;
g. Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
h. Integrating the remedy with the end use where possible and encouraging green and sustainable re-development

2. On-shore areas (above the mean high water mark and below the existing ISS monolith which extends to the 100 year flood line) where MGP tar is present in the soil at less than 7 feet below ground surface (bgs) will be excavated and transported to a permitted, off-site treatment/disposal facility. The excavation will occur in a manner which controls emissions of odors, dust, and VOCs. Following excavation, slopes would be restored using existing soil/sediment/rip-rap meeting the cleanup criteria and vegetation.

3. On-shore areas where significant quantities of MGP tar are present at greater than 7 feet bgs will be treated using in-situ solidification (ISS). The ISS will create a low permeability cement monolith which will effectively isolate the MGP contamination from human contact and the environment, eliminating potential exposure pathways. Implementing ISS at this site will require conducting a treatability study to verify that the design standards (permeability less than 10-6 cm/sec and unconfined compressive strength between 50 and 500 psi) can be achieved by the ISS method being employed. Following solidification, post-mix sampling will be conducted to verify effectiveness. Appropriate steps will also be taken to protect the solidified soil from frost damage and wave erosion, and to isolate it from the environment.

4. Sediment (below the mean high water mark) which contains visible MGP tar or which, through multiple lines of evidence has been shown to contain MGP-related contamination resulting in an impact to the environment, will be removed by dredging and transported to a permitted, off-site treatment and disposal facility. The approximate extent of this removal is shown on Figure 6. Following completion of the remedial action, the steam bed and banks will be restored with a minimum 2 foot thick clean substrate layer. The design will include a restoration plan for areas disturbed by the remedy and will be consistent with the requirements of 6 NYCRR Part 608.

5. The remedy will result in some on-shore soil and solidified material remaining at the site which contains site contaminants at levels above restricted residential soil cleanup objectives (SCOs). These materials will be isolated from the public by a minimum of 2 feet of soil meeting restricted residential SCOs, or another barrier acceptable to the NYSDEC and NYSDOH (e.g., asphalt). For the areas where underlying soil does not meet SCOs, a demarcation layer will be provided. For areas where solidified material underlies the cover, the material itself will serve as the demarcation layer due to the nature of the material. The two feet of clean soil cover currently

in place in OU1 will also be restored as necessary following OU2 remedial activities. This restoration will ensure that the remedy for OU1 will not be negatively impacted by the work proposed for OU2.

6. The remedy selected for Operable Unit 1 included the imposition of an institutional control. The following updates the requirements for that institutional control to be consistent with current regulations and guidance. The institutional control, in the form of an environmental easement will:

a) require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3).

b) allow the use and development of the controlled property for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), though land use is subject to local zoning laws;

c) restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or County DOH;

d) prohibit agriculture or vegetable gardens on the controlled property;

e) require compliance with the Department approved Site Management Plan;

7. The remedy selected for Operable Unit 1 required a Site Management Plan. The following updates the requirements for that plan to be consistent with current regulations and guidance, including the following:

a) an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

i) Institutional Controls: The Environmental Easement discussed in Paragraph 6 above.

ii) Engineering Controls: The soil cover discussed in Paragraph 5.

iii) This plan includes, but may not be limited to: (1) Soil Management Plan which details the provisions for management of future excavations in areas of remaining contamination; (2) descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions; (3) a provision for evaluation of the potential for soil vapor intrusion for any buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;(4)provisions for the management and inspection of the identified engineering controls;(5)maintaining site access controls and Department notification; and (6) the steps necessary for the periodic reviews and certification of the institutional and engineering controls;

b) a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

i) monitoring of groundwater to assess the performance and effectiveness of the remedy;

ii) Monitoring the steps taken to protect the solidified soil from frost damage and wave erosion, and to isolate it from the environment;

iii) monitoring the success of restoration;

iv) a schedule of monitoring and frequency of submittals to the Department;

v) monitoring for vapor intrusion for any buildings developed on the site, as may be required pursuant to item 7.a.iii above.

8. The property owner or remedial party will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal will: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

Exhibit A

NATURE AND EXTENT OF CONTAMINATION

The principal waste product produced at the former MGP site was coal tar, which is an oily, dark colored liquid with a strong, objectionable odor. Unlike most materials labeled as “tar”, this is not a semi-solid, viscous material. Rather, it has a physical consistency similar to motor oil, which enables it to move through the subsurface. Coal tar is referred to as a dense non-aqueous phase liquid or DNAPL since it is slightly heavier than water and will not readily dissolve in water. When released into the subsurface, it will sink through the groundwater until it reaches some less permeable material which it cannot penetrate. It can, under certain conditions, move laterally away from the point where it was initially released.

The tar contains high levels of volatile and semi-volatile organic compounds (VOCs and SVOCs). The principal VOCs are benzene, toluene, ethylbenzene, and xylenes. These compounds, collectively known as BTEX, are slightly soluble in water. Groundwater which comes into contact with tar or tar-contaminated soils will become contaminated with BTEX compounds. This contaminated groundwater can then move through the subsurface along with the ordinary groundwater flow.

The principal SVOCs in the tar are a group of compounds known as polycyclic aromatic hydrocarbons, commonly abbreviated as PAHs. PAH compounds are generally less soluble than BTEX, and are consequently less likely to dissolve in groundwater. This makes PAH compounds less mobile in the subsurface, so the highest levels of PAHs are normally found in close proximity to the tar from which they are derived. The specific semivolatile organic compounds of concern in soil and groundwater are the following polycyclic aromatic hydrocarbons (PAHs):

acenaphthene	acenaphthylene	anthracene	benzo(a)anthracene
benzo(a)pyrene	benzo(b)fluoranthene	benzo(g,h,i)perylene	benzo(k)fluoranthene
dibenzo(a,h)anthracene	chrysene	fluoranthene	fluorene
indeno(1,2,3-cd) pyrene	2-methylnaphthalene	naphthalene	phenanthrene
pyrene			

In this document, PAH concentrations are referred to as total PAHs (TPAHs). The TPAH concentration is the sum of the concentrations of each PAH listed above.

All of the BTEX and PAH contaminants which dissolve in groundwater are subject to degradation by natural processes. Common soil bacteria are capable of using these chemical compounds as a food source, converting them to carbon dioxide and water. This degradation process takes place more rapidly when abundant oxygen is present in the groundwater, and can in many cases be expedited by the introduction of additional oxygen. However, contaminants which still remain in the tar itself, undissolved in water, remain beyond the reach of bacteria and can remain in their undegraded state indefinitely.

Figures 2 through 5 summarize the degree of contamination for the contaminants of concern in soil, groundwater, sediment and surface water and compare the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Waste/Source Areas

Wastes are defined in 6 NYCRR Part 375-1.2 (aw) and include solid, industrial and/or hazardous wastes. Source Areas are defined in 6 NYCRR Part 375 (au). Source areas are areas of concern at a site were substantial quantities of contaminants are found which can migrate and release significant levels of contaminants to another environmental medium. Wastes and Source areas identified at the site include locations where coal tar is present.

The extent of coal tar is shown on Figure 2. Some coal tar is present along the eastern edge of the area solidified in OU-1. Most of the contamination is found at depths of 10 feet or more below the ground surface.

However, one notable exception is the area immediately downgradient of the former MGP “drainage pits,” just south of the jetty. Here tar is present in subsurface soil as shallow as 2.5 feet below the ground surface. This is also the only area coal tar was seen in the sediment.

Groundwater

The extent of groundwater contamination (both before and after completion of OU-1) is shown on Figure 4. The primary groundwater contaminants associated with the former MGP are benzene, toluene, ethylbenzene and xylene (BTEX). In OU-1, groundwater contamination in the bedrock in the upper terrace was addressed by removing the source material in the overburden, and treating coal tar in the bedrock with chemical oxidation.

Based on a comparison of the groundwater results before and after treatment, groundwater contamination has decreased in that treatment area. However, immediately downgradient of the solidified area, significant groundwater contamination is still present where the groundwater is still in direct contact with coal tar. The highest levels of groundwater contamination are directly downgradient of the former drainage pits.

Table 1 – Groundwater OU2 On-Shore Area

Detected Constituents	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)	Frequency Exceeding SCG
Benzene	5,000 – 11,000	1	2 of 2
Toluene	11 - 1,500	5	2 of 2
Ethylbenzene	230 - 2,500	5	2 of 2
Xylene	130 – 3,300	5	2 of 2

a - ppb: parts per billion, which is equivalent to micrograms per liter, ug/L, in water.
b- SCG: Standard Criteria or Guidance - Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).

Based on the findings of the RI, the disposal of hazardous waste has resulted in the contamination of groundwater with benzene, toluene, ethylbenzene and xylene (BTEX). These contaminants are considered to be the primary contaminants of concern which will drive the remediation of groundwater to be addressed by the remedy selection process.

Soil

Subsurface soil samples were collected at the site during the RI. Since the area of OU-2 is limited to the intertidal zone and the Hudson River, surface material is addressed as sediment and not surface soil. The results indicate that underlying soils that are visibly impacted by coal tar exceed the unrestricted SCG for volatile and semi-volatile organics. The principal volatile organic chemicals of concern are the BTEX compounds, and the principal semi-volatile organic chemicals of concern are the PAH compounds. The BTEX compounds are generally co-located with the PAHs. At this site, remediation will be driven by PAHs, which are shown on Figure 3.

Table 2 – Soil

Detected Constituents	Concentration Range Detected (ppm)[a]	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG	Restricted Residential/ Ecological resources SCG[c] (ppm)	Frequency Exceeding Restricted SCG
VOCs:					
Acetone	Undetected-1.7	0.05	54/55	2.2	0/55
Benzene	Undetected-7.5	0.06	16/55	4.8	2/55
Toluene	Undetected-1.3	0.7	1/55	36	0/55
Ethylbenzene	Undetected-220	1	14/55	41	2/55
Xylene	0.02-38	0.26	15/55	.26	15/55
SVOCs:					
Acenaphthene	Undetected-1400	20	17/55	20	17/55
Acenaphthylene	Undetected-170	100	1/55	100	1/55
Anthracene	Undetected-760	100	2/55	100	2/55
Benzo(a)anthracene	Undetected-430	1	27/55	1	27/55
Benzo(a)pyrene	Undetected-360	1	26/55	1	26/55
Benzo(b)fluoranthene	Undetected-290	1	26/55	1	26/55
Benzo(k)fluoranthene	Undetected-84	0.8	23/55	3.9	15/55
Chrysene	Undetected-400	1	27/55	3.9	23/55
Dibenzo(a,h)anthracene	Undetected-39	0.33	23/55	0.33	23/55
Fluoranthene	Undetected-770	100	3/55	100	3/55
Fluorene	Undetected-680	30	6/55	30	6/55
Indeno(1,2,3-cd)pyrene	Undetected-130	0.5	26/55	0.5	26/55
Naphthalene	Undetected-4200	12	15/55	100	9/55
Phenanthrene	Undetected-2600	100	11/55	100	11/55
Pyrene	Undetected-1300	100	6/55	100	6/55
Benzo(ghi)perylene	Undetected-190	100	2/55	100	2/55
Fluoranthene	Undetected-770	100	3/55	100	3/55
Inorganics					
Arsenic	Undetected-22.4	13	1/55	13	1/55

Cadmium	Undetected-11.5	2.5	2/55	4.0	1/55
Chromium	2.92-27.5	30	0/55	41	0/55
Lead	4.08-520	63	24/55	63	24/55

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil.
b - SCG: Part 375-6.8(a), Unrestricted Soil Cleanup Objectives.
c - SCG: Part 375-6.8(b), The lower of the Soil Cleanup Objectives for restricted residential or protection of ecological resources.

The primary soil contaminants are polycyclic aromatic hydrocarbons (PAHs) and benzene, toluene, ethylbenzene, and xylene (BTEX) associated with residues from the operation of the former MGP. As noted on Figure 5, the primary soil contamination is co-located with soils which are visually impacted by coal tar.

Based on the findings of the Remedial Investigation, the disposal of hazardous waste has resulted in the contamination of soil. PAHs are considered the primary contaminants of concern in subsurface soils, to be addressed by the remedy selection process.

Surface Water

Surface water samples were collected from 3 locations in the Hudson River during the RI: adjacent to the site, upstream of the site, and downstream of the site. The results indicate that no site-related contamination is present in the Hudson River in the vicinity of the site at levels exceeding the Department's SCGs.

Table 3 - Surface Water

Detected Constituents	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)	Frequency Exceeding SCG
VOCs			
Ethylbenzene	Undetected-.1	4.5	0 out of 3
Xylene	Undetected-0.3	170	0 out of 3

a - ppb: parts per billion, which is equivalent to micrograms per liter, ug/L, in water.
b-SCG: Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1) and 6NYCRR Part 703: Surface Water and Groundwater Quality Standards.

No site-related surface water contamination of concern was identified during the RI. Therefore, no remedial alternatives need to be evaluated for surface water.

Sediments

Sediment samples were collected during the RI from the Hudson River in both the intertidal zone and the river bottom to assess the potential for impacts to river sediments from the site. The results indicate that sediments exceed the Department's SCGs for polycyclic aromatic hydrocarbons (PAHs). In addition to chemical analysis of the sediment samples, the Department used multiple lines of evidence to determine whether sediment is impacted by site related contamination and whether the impacted sediment has the potential to negatively impact the environment. These lines of evidence include visual observation of the sediment cores, the results of sediment probing, forensic analysis of sediments to determine the source of the chemicals present, ecological toxicity testing, and surveying of benthic communities.

The results of the analytical data as well as the lines of evidence evaluation from the sediment investigation are shown on Figure 5.

Table 4 - Sediment

Detected Constituents	Concentration Range Detected (ppm)[a]	ERL[b] (ppm)	Frequency Exceeding ERL[b]	ERM [c] (ppm)	Frequency Exceeding ERM [c]
Polycyclic Aromatic Hydrocarbons (PAHs) Total	Undetected-1,238	4	47 out of 61	45	10 out of 61

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in sediment.
b - ERL: Effects Range – Low from the Department's "Technical Guidance for Screening Contaminated Sediments."
c - ERM: Effects Range – Medium from the Department's "Technical Guidance for Screening Contaminated Sediments."

The sediment contaminants of concern are PAH compounds. As shown on Figure 6, the primary sediment contamination is found along the shore of the former MGP and adjacent to the "mooring dolphins" which are structures where ships were secured while they delivered oil to the plant.

Some of the PAHs found in sediments were determined to be from sources other than the MGP. In particular, the area directly south of the site is impacted primarily by storm water discharge, and not the MGP.

Based on the findings of the Remedial Investigation, the disposal of hazardous waste has resulted in the contamination of the sediment. PAHs are the site contaminants that are considered to be the primary contaminants of concern which will drive the remediation of sediment.

Exhibit B

SUMMARY OF THE REMEDIATION OBJECTIVES

The objectives for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial objectives for this site are:

Public Health Protection

Groundwater

- Prevent contact with contaminated groundwater.

Soil

- Prevent ingestion/direct contact with contaminated soil.

Sediment

- Prevent direct contact with contaminated sediments.

Environmental Protection

Groundwater

- Restore the groundwater aquifer to meet ambient groundwater quality criteria, to the extent feasible.
- Prevent discharge of contaminated groundwater to surface water.

Soil

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Sediment

- Prevent releases of contaminants from sediment that would result in surface water levels in excess of ambient water quality criteria.
- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity.

Exhibit C

DESCRIPTION OF REMEDIAL ALTERNATIVES

The following alternatives were considered based on the remedial action objectives (see Exhibit B) to address the contaminated media identified at the site as describe in Section 5:

Sediment Removal - General Discussion:

Alternatives 3-6 each require removal of contaminated sediments. In each of these alternatives, a pre-design investigation would be required to provide a more detailed delineation of the sediment to be removed. In particular, the areas north of the boat club dock and near the dolphins would require additional investigation. Multiple lines of evidence would be used to determine if the sediment is impacted by site-related contamination at levels which represent a threat to the environment.

It is anticipated that the sediment would be removed in the wet (i.e. without dewatering the excavation). Temporary sheeting would likely be required for deeper sediment excavation. Silt curtains or sheet piling would be required to control turbidity. Dredged sediments would be staged, dewatered, stabilized and characterized for off-site treatment/disposal. A temporary treatment system would be utilized at the site to treat sediment dewatering liquids. Treated water would be monitored to ensure it meets applicable requirements before being discharged to the local publically owned treatment works (POTW) or the Hudson River.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative leaves the site in its present condition and does not provide any additional protection to public health and the environment.

Alternative 2: Site Management, Long Term Monitoring

The Site Management Alternative requires only institutional controls for the site, and would not include any active measures to remediate contamination. Institutional and engineering controls would be required as part of OU-1, including groundwater use restrictions and groundwater monitoring until such time that groundwater meets State standards. The cost of these controls was included in OU-1 and is not repeated here.

This alternative would include long-term monitoring of groundwater and sediment quality. The costs for this alternative do not include the costs of the institutional controls already considered for OU-1.

Present Worth:..$2,900,000
Capital Cost:...$200,000
Annual Costs:..$156,000

**Alternative 3: Restoration to Unrestricted Conditions:
Excavation of Deep and Shallow MGP Impacted Soil and Sediment**

This alternative would include excavation of all shallow and deep coal tar impacted soils and sediments. Sediment removal would be accomplished with conventional excavation equipment. All excavated soils would be trucked off-site for off-site treatment or disposal, and the excavation would then be backfilled with clean soil.

Institutional and engineering controls would be required as part of OU-1, including groundwater use restrictions and groundwater monitoring until such time that groundwater meets State standards. The cost of these controls was included in OU-1 and is not repeated here.

This alternative achieves all of the SCGs discussed in Section 5.1.1 and soil meets the unrestricted soil clean objectives listed in Part 375-6.8(a).

Capital Cost:..$17,300,000

**Alternative 4: In-Situ Solidification of Deep Coal Tar Impacted Soil, Shallow Soil Removal,
Shallow MGP Impacted Sediment Removal;
Groundwater Monitoring and Institutional Controls**

This alternative would include a partial removal of MGP impacted soil, and stabilization of the contamination at depth. MGP-impacted soils in the shallower fill material (up to 7 feet below ground surface) would be excavated and trucked off-site for proper treatment and disposal. MGP impacted soil below this elevation would be treated using in-situ solidification, a process in which soils are thoroughly mixed with Portland cement or similar materials. The result is a stabilized, low permeability monolith which would immobilize that contamination in its current location. Underlying soils which contain contaminants at levels above unrestricted SCOs will be isolated from the public by a minimum of 2 feet of soil meeting restricted residential SCOs, or another barrier acceptable to the NYSDEC and NYSDOH (e.g. asphalt). Appropriate steps will also be taken to protect the solidified soil from frost damage and wave erosion, and to isolate it from the environment. Groundwater monitoring and institutional controls would be provided as indicated in Alternative 2.

Sediments impacted by MGP contamination would be removed. A small area of deep sediment in the southeastern portion of the study area would be left in place.

Present Worth:..$14,300,000
Capital Cost:..$12,000,000
Annual Costs:..$130,000

**Alternative 5: Shallow Soil Excavation, Coal Tar Recovery;
Shallow MGP Impacted Sediment Removal;
Groundwater Monitoring and Institutional Controls**

This alternative would be similar to Alternative 4, but the deeper MGP impacted soils would be left in place with no action taken. Coal tar found in deeper (silty sand) soils would be recovered using extraction wells.

Shallow sediment would be removed as indicated in Alternative 4. Groundwater monitoring and institutional controls would be provided as indicated in Alternative 2.

Present Worth: *$13,900,000*
Capital Cost: *$11,700,000*
Annual Costs: *$124,000*

Alternative 6: Slurry Wall, Soil Cap and Coal Tar Recovery; Sediment Capping, Groundwater Monitoring and Institutional Controls

This alternative is intended to rely primarily on physical barriers to prevent contact with the contaminated materials. It would include construction of a low permeability, vertical subsurface barrier to prevent MGP tar contamination in the subsurface soil from migrating into the Hudson River. It also would include 2 foot soil cover over the contaminated soil to prevent exposure to the environment or people.

The top 2 feet of sediment would be removed and trucked off-site from proper treatment and disposal. An engineered cap would isolate the contaminated sediment from the environment. Groundwater monitoring and institutional controls would be provided as indicated in Alternative 2.

Present Worth: *$13,300,000*
Capital Cost: *$9,800,000*
Annual Costs: *$200,000*

Exhibit D

TABLE 1
REMEDIAL ALTERNATIVE COSTS

Remedial Alternative	Capital Cost ($)	Present Worth of Annual Costs ($)	Total Present Worth ($)
No Action	0	0	0
Alternative 2: Site Management, Long Term Monitoring	$200,000	$2,700,000	$2,900,000
Alternative 3: Restoration to Unrestricted Conditions: Excavation of Deep and Shallow MGP Impacted Soil and Sediment	$17,300,000	$500,000	$17,800,000
Alternative 4: In-Situ Solidification of Deep Coal Tar Impacted Soil, Shallow Soil Removal, Shallow MGP Impacted Sediment Removal; Groundwater Monitoring and Institutional Controls	$12,000,000	$2,300,000	$14,300,000
Alternative 5: Shallow Soil Excavation, Coal Tar Recovery; Shallow MGP Impacted Sediment Removal; Groundwater Monitoring and Institutional Controls	$11,700,000	$2,200,000	$13,900,000
Alternative 6: Slurry Wall, Soil Cap and Coal Tar Recovery; Sediment Capping, Groundwater Monitoring and Institutional Controls	$9,800,000	$3,500,000	$13,300,000

Exhibit E

SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative 4 "In-Situ Solidification of Deep Coal Tar Impacted Soil, Shallow Soil Removal, Shallow MGP Impacted Sediment Removal; Groundwater Monitoring and Institutional Controls" as the remedy for this site. The elements of this remedy are described in Section 7.2. The proposed remedy is depicted in Figure 6.

Basis for Selection

The proposed remedy is based on the results of the RI and the evaluation of alternatives.

Alternative 4 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the balancing criterion described in Exhibit C. It would achieve the remediation goals for the site by removing the readily accessible contamination and immobilizing the contamination that cannot be readily excavated.

Alternative 1 (No Action) does not provide any protection to public health and the environment and will not be evaluated further. Alternative 2 (Site Management, Long Term Monitoring) would leave shallow sediment impacts in the Hudson River, which are not under the control of the remedial party or the State. As such, these controls would not be effective and this alternative will not be considered further. Alternative 3, by removing all soil contaminated above the "unrestricted" soil cleanup objectives, meets the threshold criteria. Alternatives 4 and 5 also comply with these criteria but to a lesser degree or with lower certainty. Because Alternatives 3, 4, and 5 satisfy the threshold criteria, the remaining criteria are particularly important in selecting a final remedy for the site.

There are only two remedial technologies available which could reasonably address sediment contamination at this site: dredging and capping. Capping would involve removal a minimum of 2 feet of existing material to make room for the cap while maintaining the depth of the river. As such, a capping alternative would require a significant amount of dredging. The difference is that the capping remedy would leave significant contamination in place, and attempt to isolate it from the environment with a protective layer. The dredging alternative would permanently remove that contamination. The dredging alternative would be more reliable and would be more effective in the long term. All other selection criteria, including protection of human health and the environment, compliance with SCGs, and cost; would be similar for both dredging and capping. As such, dredging is preferred over capping.

An additional consideration in remediating the sediment is whether to address an isolated area of MGP contamination which is at least 4 feet below the sediment surface. This contamination is effectively isolated from the environment.

In the on-shore and intertidal area, there are two zones of contamination. The first zone is significantly below the ground surface, and appears to have migrated through the subsurface from on-shore source areas. This contamination is deep enough that full excavation would be difficult to implement, and would be likely to damage the existing solidified mass created during the remedial program for OU1 of this project. The potential for damaging the OU1 remedy makes deep excavation (Alternative 3) less desirable than a barrier wall (Alternative 6) or ISS (Alternative 4). Alternative 5 addresses this contamination with coal tar recovery only, which would not be as effective as Alternative 6 which combines coal tar recovery with a barrier wall. ISS would generally be considered more reliable than a barrier wall, and as such Alternative 4 would be preferred over Alternative 6. The choice comes down to deep excavation or ISS, and ISS is the most protective of the OU1 remedy.

The second zone of contamination in the on-shore and intertidal area is shallow. It appears to have been deposited as a surface deposit, possibly from the historic drainage pits. This material is readily accessible to standard excavation equipment. Many of the challenges that would normally make excavation near the Hudson River prohibitive are already being addressed by the sediment removal. The removal of this material, which is the most likely contamination to be contacted by both human and environmental receptors, is clearly the most attractive alternative. Removal of this material is included in Alternatives 3, 4, and 5. Alternative 6 proposes to cap these materials, but ongoing maintenance of this cap would be expected to be similar in cost to the cost of the added excavation, and would be less reliable than removal over the long term.

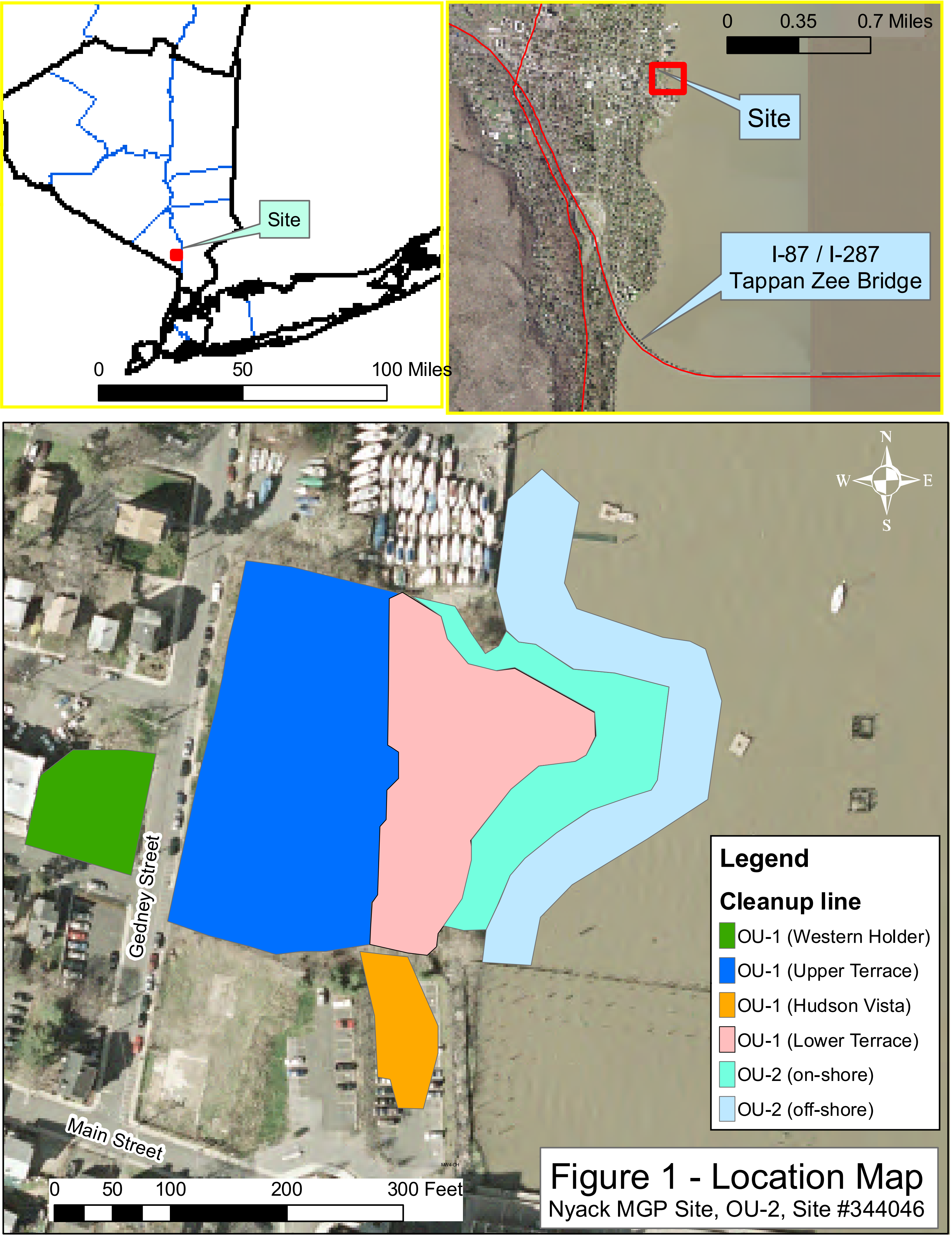


Figure 1 - Location Map

Nyack MGP Site, OU-2, Site #344046

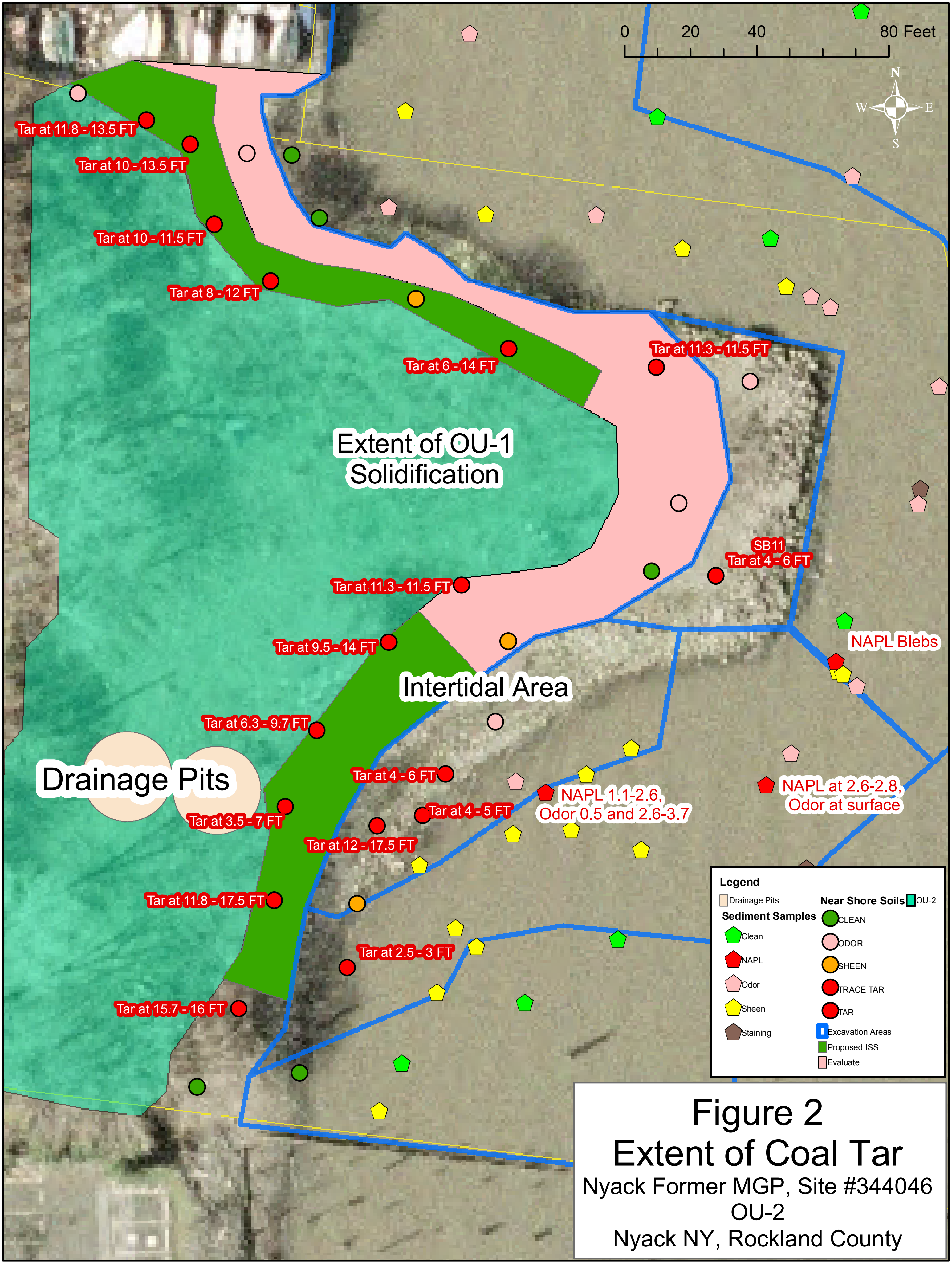


Figure 2
Extent of Coal Tar
Nyack Former MGP, Site #344046
OU-2
Nyack NY, Rockland County

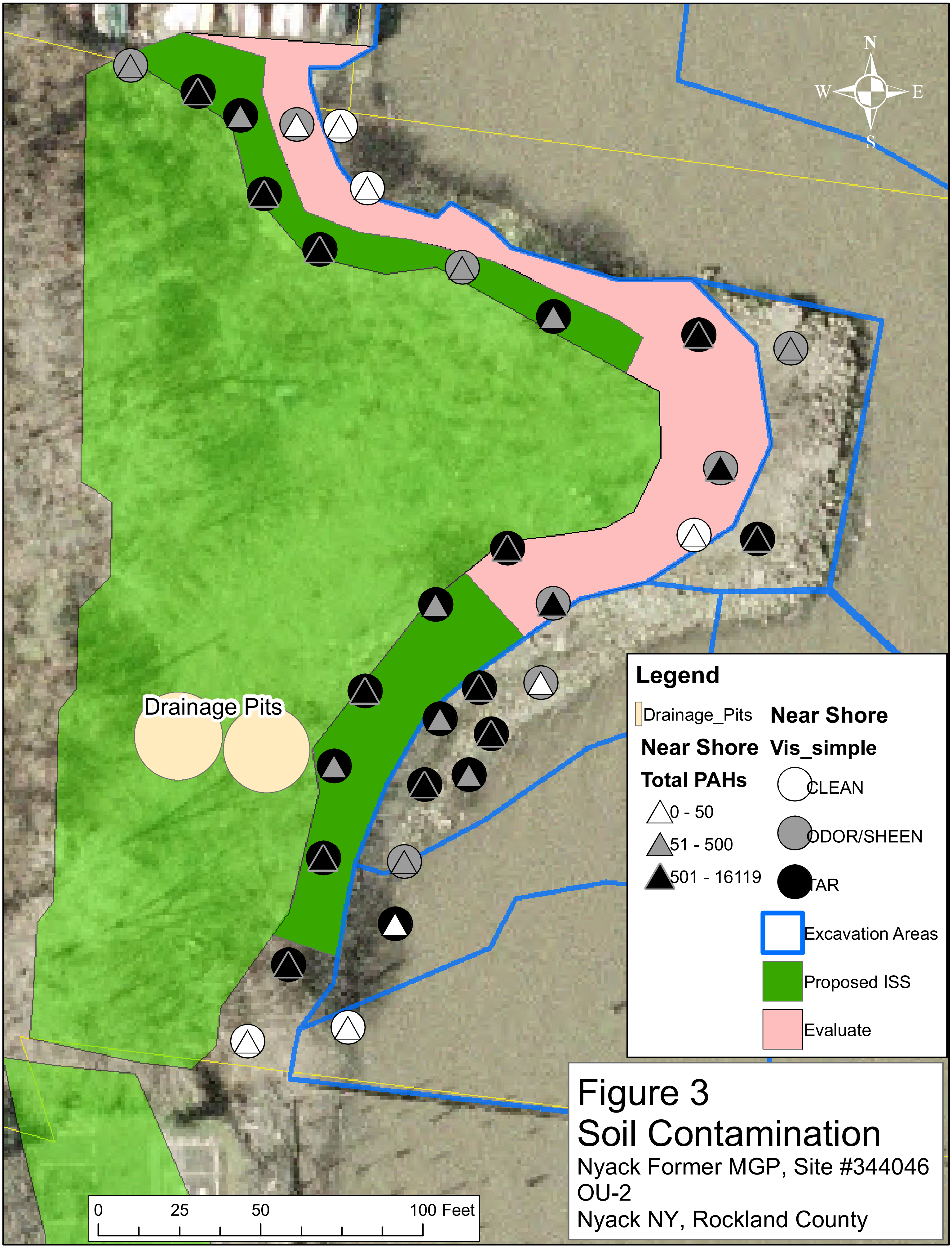


Figure 3
Soil Contamination
Nyack Former MGP, Site #344046
OU-2
Nyack NY, Rockland County

Figure 4
Groundwater
Nyack Former MGP Site #344046
Nyack, Rockland County, NY

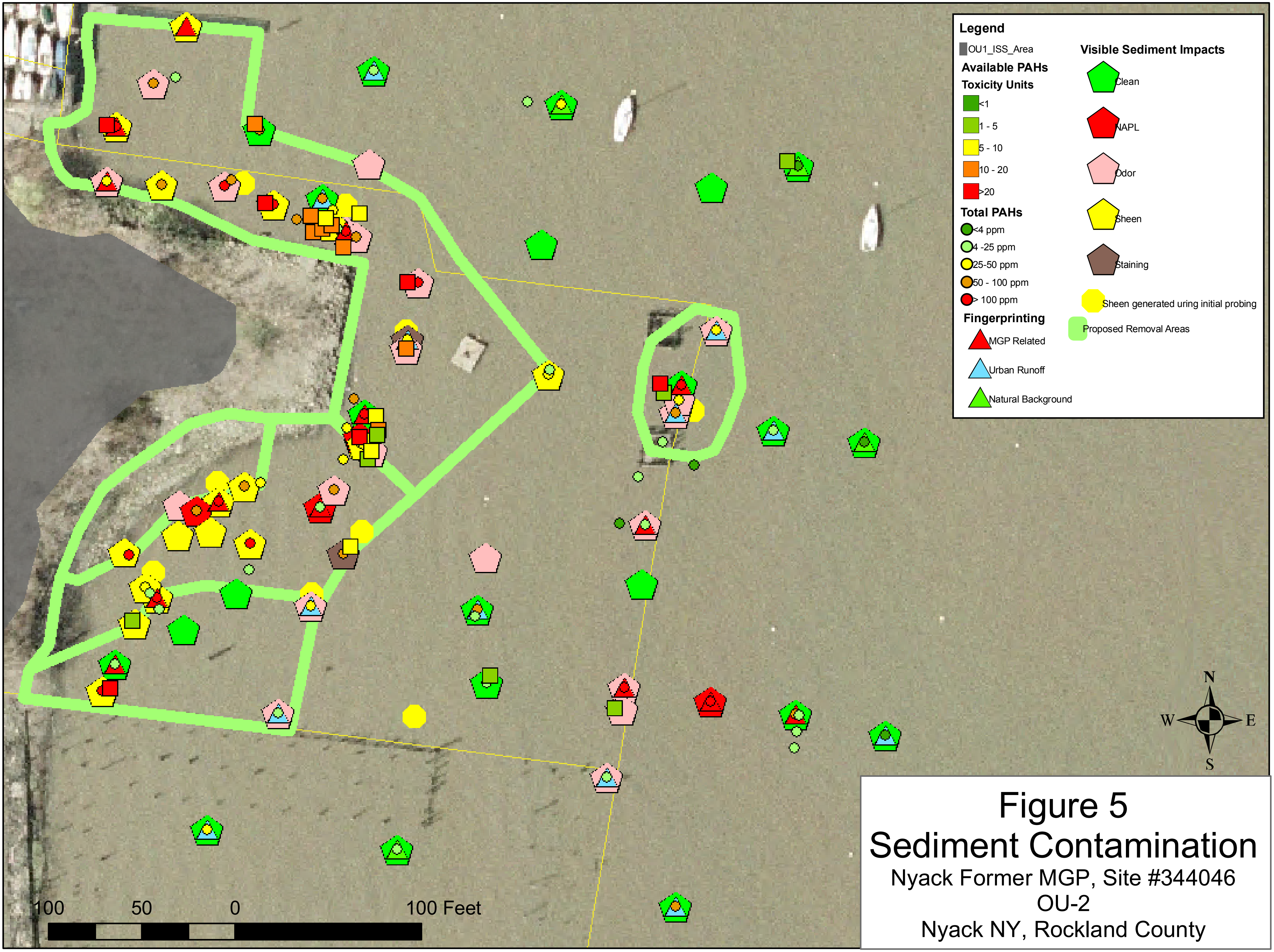
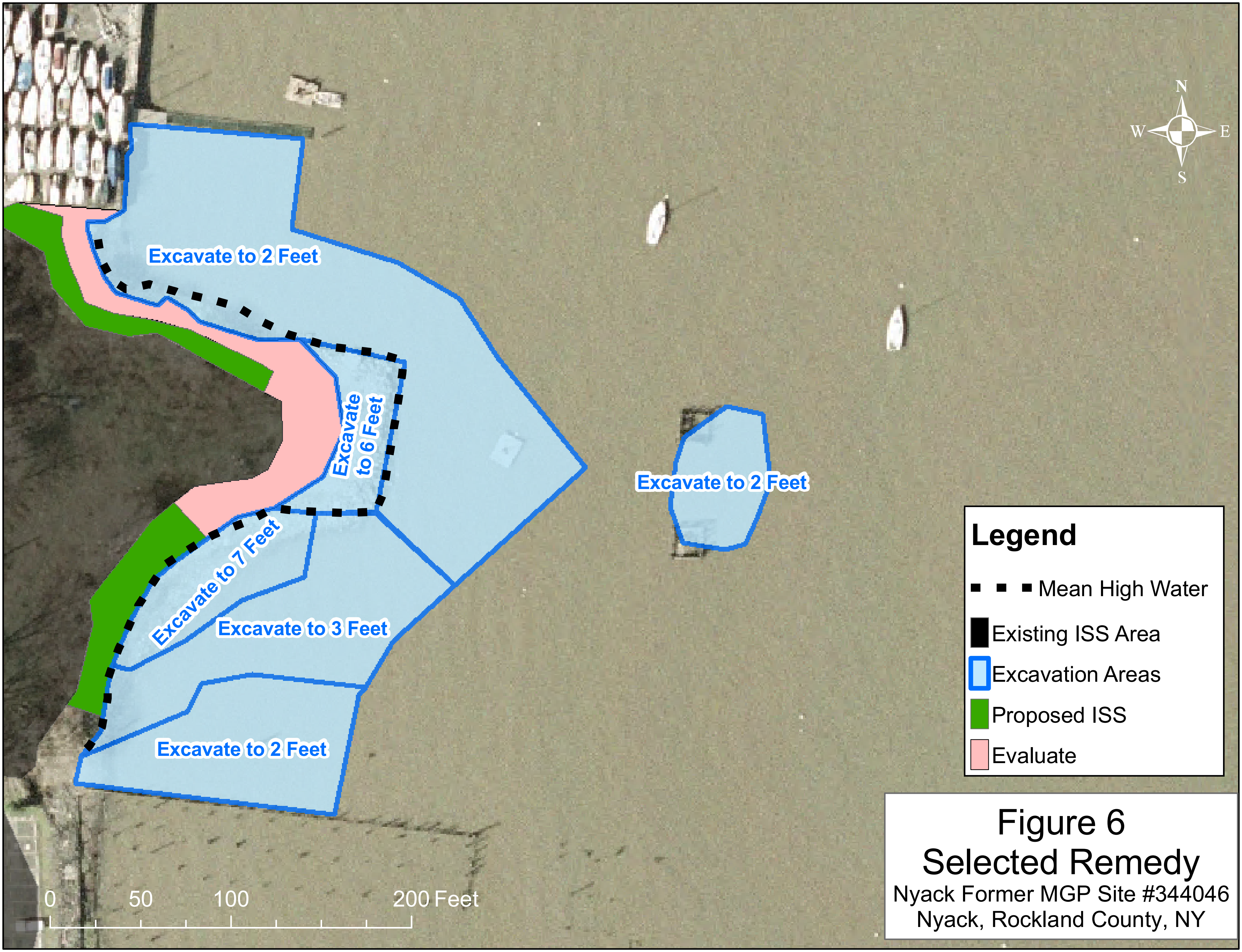


Figure 5
Sediment Contamination

Nyack Former MGP, Site #344046

OU-2

Nyack NY, Rockland County



Excavate to 2 Feet
Excavate to 6 Feet
Excavate to 7 Feet
Excavate to 3 Feet
Excavate to 2 Feet
Excavate to 2 Feet
N
S
E
W
Legend
Mean High Water
Existing ISS Area
Excavation Areas
Proposed ISS
Evaluate
0
50
100
200 Feet
Figure 6
Selected Remedy
Nyack Former MGP Site #344046
Nyack, Rockland County, NY

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

OR - Nyack MGP
Operable Unit No. 2
Nyack, Rockland County, New York
Site No. 344046

The Proposed Remedial Action Plan (PRAP) for the OR - Nyack MGP site, was prepared by the New York State Department of Environmental Conservation (the Department) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on March 31, 2011. The PRAP outlined the remedial measure proposed for the contaminated soil and groundwater at the OR - Nyack MGP site.

The release of the PRAP was announced by sending a notice to the public contact list, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on March 14, 2011, which included a presentation of the remedial investigation, feasibility study (RI/FS) for the OR - Nyack MGP site as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the PRAP ended on March 27, 2011.

This responsiveness summary responds to all questions and comments raised during the public comment period. The following are the comments received, with the Department's responses:

COMMENT 1: Is the Piedmont Pier Parking lot part of this site?

RESPONSE 1: Yes. The parking lot was treated using in-situ solidification as part of Operable Unit No. 1 (OU1). This area is referred to as the “Hudson Vista” portion of that project.

COMMENT 2: What is the depth of the river in the vicinity of this project?

RESPONSE 2: From the shoreline, the river depth soon increases to a fairly uniform depth of approximately 10 feet.

COMMENT 3: Were people recently taking a “Penguin Plunge” exposed to contamination?

RESPONSE 3: No. This swimming event took place at Memorial Park, a significant distance south of the site. Access to the site is restricted by a fence which would discourage an organized swimming event.

COMMENT 4: In the summer, 30-40 people fish in the evenings near the site. Is there any health concern associated with this activity?

RESPONSE 4: Fishing and catching fish in itself would not pose a health concern as long as the people were practicing catch and release. The New York State Department of Health produces an annual Fish Advisory which provides recommendations on the amount fish that may be safely eaten from water ways throughout New York State. The Hudson River is included in this report. The Fish Advisory may be found on the NYSDOH website at http://www.health.state.ny.us/environmental/outdoors/fish/docs/fish.pdf .

COMMENT 5: In the sediment, how close to the surface is the contamination, and how far down does it extend?

RESPONSE 5: In the area where remediation is proposed, surface sediment (top 6”) contains elevated levels of site-related chemicals (PAHs). In some areas, these impacts extend as deep as 7 feet below the mud line (i.e. the top of the sediment surface).

COMMENT 6: When in-situ solidification (ISS) is used at a site, can it be redeveloped?

RESPONSE 6: Yes. This technology is frequently used to improve the bearing strength of soils to support construction activities. The site management plan will describe the approvals needed prior to redevelopment which will ensure that the remedy remains protective of human health and the environment during and after redevelopment.

COMMENT 7: Will O&R have to pay any of this cost?

RESPONSE 7: Yes, O&R has the responsibility to pay for the cleanup of this site.

COMMENT 8: Does that mean our rates will go up?

RESPONSE 8: The Public Service Commission has allowed utilities to recover costs of environmental cleanups from rate payers. How this might affect residential utility rates is outside the scope of the Record of Decision.

COMMENT 9: Where do you take the soil you dig up?

RESPONSE 9: Soil can be sent to an appropriately permitted disposal facility (e.g., landfill) or treatment facility. The appropriate type of treatment and/or disposal will be evaluated during the remedial design.

COMMENT 10: Will there be dredging on the north side near the boat club?

RESPONSE 10: Yes, the dredging will extend north of the property line between the site and the Nyack Boat Club.

COMMENT 11: We (the boat club) have a ramp there. If it has to come out during the dredging, we'd want it put back the way it was afterwards.

RESPONSE 11: The remedy will require restoration of the disturbed areas of the boat club property.

COMMENT 12: During the OU1 remediation, the noise (machines, backup signals, diesel engines, the air handling fans, etc.) adversely affected the quality of our lives. The noise should be kept to an absolute minimum.

RESPONSE 12: Some noise during a large construction project is unavoidable. However, as was done during OU1, O&R and its contractors will work with the residents to minimize disruption.

COMMENT 13: There are kids trespassing on the site all the time.

RESPONSE 13: O&R has been made aware of trespassing on this site. Once the ice has cleared the Hudson River, O&R plans to extend the existing fence further into the river to discourage trespassing.

COMMENT 14: Does the size of the equipment determine the length of time the actual work will be taking place?

RESPONSE 14: Larger equipment can accelerate progress on a job, but for this job equipment size will likely be limited by the scope of the project. It is not a large enough project to justify the largest equipment.

COMMENT 15: If you use an excavator for ISS, don't you then have to deal with de-watering?

RESPONSE 15: No. ISS is generally conducted in saturated soils, when using either augers or an excavator.

COMMENT 16: How far south will the remedy extend?

RESPONSE 16: There was no evidence of site related contamination south of the site property line. No work south of the property line is anticipated at this time.

COMMENT 17: How far out in the river does this contamination go? How far out into the river will you need to go to establish an area of control?

RESPONSE 17: Site-related sediment impacts generally extend approximately 150 feet into the river. The alignment of controls will be determined during the remedial design. Controls could conceivably extend as far out as the mooring dolphins.

COMMENT 18: In the sediment, what is the density of both the mud as compared to the coal tar, and how with this effect the movement of tar?

RESPONSE 18: The specific gravity of the tar is just over 1. The specific gravity of mud is generally between 2 and 2.5. The density of the mud is high enough that the tar will move through pores within the mud the same way that it moves through pores in soil.

COMMENT 19: Why wasn't all this done the last time during OU-1?

RESPONSE 19: OU-1 presented fewer technical challenges than OU-2, because all of the contamination in OU-1 was on land. Consequently, it was possible to accelerate the cleanup of OU-

1 and get it completed first. For OU-2, we have the added complexity of working along the river bank and in the river itself, which creates a more complicated situation, both from an engineering perspective and due to the need to coordinate with other agencies such as the Army Corps of Engineers, which controls dredging activities.

COMMENT 20: I live on the second floor of a building on Gedney Way near the boat club, with a child who is bedridden with an immuno-deficiency condition. When you consider the noise, the time line, the possibility of adverse effects to the community, the whole idea proposed to address the situation is frightening to me. If it must go forward, what will you do to minimize the effect on our life and health? It goes beyond "exposure" issues to quality of life issues like the truck noise, cranes, back-up signals, pounding, auger sounds, etc.

RESPONSE 20: See Response 12.

COMMENT 21: Where are you in the EIS process?

RESPONSE 21: Environmental remediation is specifically exempted from the State Environmental Quality Review (SEQRA) process, so no environmental impact statement (EIS) is required. The environmental review, documentation of the analysis of alternatives and impacts as well as the public notice required as part of remedy selection (including this meeting) is considered to be addressed by the remedial program requirements.

COMMENT 22: Which alternative have you picked, and how much will it cost?

RESPONSE 22: Alternative 4 is the proposed remedy. The present worth of OU2 is $14,300,000.

COMMENT 23: When is the work scheduled to begin?

RESPONSE 23: It is assumed that the remedial design will take approximately 12 months to complete, however as noted above, the need to coordinate with the Army Corps of Engineers will likely extend this time frame. Due to the scale and complexity of this project, a start date in 2013 appears likely.

COMMENT 24: I'm a limnologist, whose daughter lives near this site. Because concrete fractures, I don't like using it for ISS. Bentonite is more flexible and would be the better alternative. Have you looked into using it in some combination with cement?

RESPONSE 24: Bentonite generally is evaluated during the treatability study and will be evaluated as part of the OU-2 treatability study. The ISS used in OU1 used a combination of cement and bentonite to take advantage of properties of both materials. Based on the results of the treatability study for OU-2, an appropriate combination of materials will be employed for the in-situ stabilization.

COMMENT 25: What dredging equipment do you expect to be used at this site?

RESPONSE 25: The exact equipment will likely not be identified until the contractor is selected to allow the contractor the flexibility to select the best tools for the job.

COMMENT 26: Since there is no surface run-off at this time, if the coal tar is 10-12' below sedimentation, just leave it there.

RESPONSE 26: There is no guarantee that the tar will stay where it is. Based on the ability of this material to move through the subsurface in unpredictable ways, material that is present in sufficient concentrations to be mobile should be removed or treated to prevent contaminant migration.

COMMENT 27: How do I get a look at the drawings once the Remedial Design is developed?

RESPONSE 27: The remedial design will be placed in the document repository. We plan to present the remedial design in a public meeting prior to the start of construction.

COMMENT 28: I agree with your preference that once you dredge out the sediments, it would be better to leave it dredged and let the river fill it in rather than try to put in fill.

RESPONSE 28: Since this is a net depositional area, the Department would support allowing naturally transported and deposited sediment to make up at least some of this layer. Results of a recently completed sediment removal in Newburgh indicate that this deposition can result in a higher quality benthic habitat layer, and that accumulation of sediment will occur in a reasonable time frame. This would also be consistent with the Department's "green remediation" guidance (DER-31) by eliminating mining and transportation of the backfill that would otherwise be required.

COMMENT 29: Any thoughts of using the property for a park once the remediation has been completed?

RESPONSE 29: Orange and Rockland does not own the site, and thus does not control decisions on potential redevelopment. Relative to future development, both the OU1 and OU2 remedies would allow redevelopment for restricted residential use, which would allow for passive recreational use (e.g., a park). Redevelopment of the property following remediation will need to proceed through the established State and local planning, zoning and environmental reviews (including SEQRA, as applicable) which are required for other such projects.

The following comments were received in an e-mail from Betsy Blair on Thursday, March 17, 2011:

COMMENT 30: Are there any tidal wetlands or submerged aquatic vegetation in the remedial area?

RESPONSE 30: No, there are none.

COMMENT 31: What the backfill plans are for the proposed excavation areas (source of material)?

RESPONSE 31: The PRAP calls for restoration to be completed consistent with the requirements of 6 NYCRR Part 608, including the establishment of a minimum 2 foot thick clean substrate layer. See also Response 29 regarding the potential to allow natural sedimentation to account for some of this 2 foot layer. The final dredging plan will be developed in consultation with the Army Corps of Engineers.

COMMENT 32: What is the extent of the proposed "solidification" of the in-sediment contaminants.

RESPONSE 32: At this time, no solidification of sediments is anticipated. The solidification called for by the remedy will be between the high water mark and the 100 year flood elevation location.

Joseph S. Scarmato, Past Commodore, Nyack Boat Club submitted a letter dated March 23, 2011, which included the following comments:

COMMENT 33: Our property is used for recreational purposes by our members whose health and safety we are obliged to protect. To that end, we support your plan for testing and research to insure that a proper clean up of the residue of the former MGP plant is performed. We also wish to recognize the representatives of Orange and Rockland Utilities ("O & R"), especially Maribeth McCormick, for her conscientious communication and cooperative effort to see to it that while the necessary work goes on, it does so with minimal disruption to our club's activities.

RESPONSE 33: Comment noted.

COMMENT 34: We understand that one of the plans under consideration for the remediation of the captioned site involves the dredging of contaminated materials from the river bed adjacent to the shoreline of both the MGP site as well as our own property and that dredged areas are to be refilled to maintain the original river bottom contours with clean material of a similar type. Being primarily a sailing venue, we have an ongoing interest in maintaining suitable draft along our bulkhead so that we may launch and retrieve our vessels throughout the year. We have over the years, battled the natural effects of the river to deposit silt in the area adjacent to our bulkhead and have applied for navigational dredge permits in the past. In fact, we have recently filed for a new navigational dredge permit to remove approximately 10,000 yards of material in the area immediately north of the contaminated areas shown in your presentation. So, in considering the proposed work, we would like to make you aware of our application to dredge and request your consideration for the following proposals in formulating your final plans.

Your presentation delineates an area north of the property line between the MGP site and our property running north along our bulkhead approximately 100 feet where it is proposed that the bottom will be dredged and the spoils removed to a depth of 2-3 feet below the current bottom. Specifically with respect to this area, we request that once the spoils are removed, you allow this area to remain at the new lowered bottom level and to not re-fill this area to the current bottom contour.

RESPONSE 34: The Department appreciates the boat club's need for adequate draft in the near shore area and will seek to accommodate this need as the design proceeds. The final determination regarding the finished water depth will be made with input from the US Army Corps of Engineers.

COMMENT 35: Your presentation also delineates areas on the MGP site running east from the high water mark in to the river where dredging is proposed to remove contaminants. I note with interest that the estimate of the volume of spoils to be removed is coincidentally similar to the volume of material that we project to remove in our navigational dredging plan. Furthermore, we understand from discussions with Ms. McCormick that preliminary testing in our proposed dredging area have not shown there to be contaminants that would require removal by O & R. That being the case, we propose to offer this presumably clean bottom material to O & R for use in filling and restoring the removal areas on the MGP site. We have discussed this proposal with Ms. McCormick as well as Mr. Larry Wilson of your department both of whom believe that the idea holds promise for both parties. The material is not contaminated, identical in nature to the material removed, close by and readily available. This would serve both our need for more navigable water along the bulkhead as well as save O & R and by extension the rate payers, the cost of securing and placing acceptable fill to restore the existing bottom contours with monolithic material. We would appreciate your giving these proposals your serious consideration in the formulation of the plans for the remediation of the Nyack MGP site.

RESPONSE 35: If the sediment in question meets the Department's backfill criteria, and if the physical challenges of handling the material can be addressed, then the Department will consider this concept if proposed by O&R. Eliminating the need to ship the dredged sediment off-site and to import clean fill onto the site would also be consistent with the Department's Green Remediation guidelines.

APPENDIX B

Administrative Record

Administrative Record

OR – Nyack MGP
Operable Unit No. 2
Nyack, Rockland County, New York
Site No. 344046

Proposed Remedial Action Plan for the OR Nyack MGP site, Operable Unit No. 2, dated February 2011, prepared by the Department.

Order on Consent, Index No. D3-0001-98-08, between the Department and Orange and Rockland Utilities Inc., executed on March 5, 1999.

"Feasibility Study Report Nyack Former MGP Site, Operable Unit 2, Nyack , New York, Site No. 3-44-046, August 2010", prepared by Arcadis.

"Remedial Investigation Report, Operable Unit 2, Former Manufactured Gas Plant Site, Nyack, NY" prepared by AECOM, April 24, 2009.

"Characterizing the Toxicity and Bioavailability of PAHs in Aquatic Sediments Collected Near Historic MGP Sites" January 31, 2006.

Letter report "Supplemental Sediment RI, Former Nyack (Gedney Street) MGP Site, Site Number 3-44-046" prepared by Retec, April 8, 2003.

"Investigation of Hydrocarbon Sources at the Former Manufacturing Gas Plant Site in Nyack, New York" prepared by META Environmental, Inc., February 19, 2003.

"Remedial Investigation Report Former Manufactured Gas Plant Site, Nyack, New York" prepared by Retec, January 11, 2002.

APPENDIX M – STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE
GW-003 Low Flow (Low Stress) Groundwater Sampling

1. Objective

Describe methods to collect groundwater samples most likely to produce results that represent aquifer conditions.

Low-flow purging is limited to wells that, with sustained pumping, exhibit no continuous drawdown.

2. Execution

- Prior to groundwater sampling consult with the project manager to confirm that the type of pump is appropriate and consistent with the approved work plan.
- Record activities in the field notebook (see SOP FD-001 Field Notebook) and on a Monitoring Well Sampling Record such as the examples in Attachment A. Use a separate form for each sampling location and event. You may forego the forms and record all information in the field notebook if the Project Manager approves.
- Calibrate pH, temperature, Specific Conductance (SC), turbidity, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP) on the meter(s). Use calibration methods provided by the manufacturer of the equipment. Note that appropriate calibration for dissolved oxygen requires a water saturated air environment, along with measured temperature and barometric pressure.
- Begin with the monitoring well believed to have the least contaminated groundwater and proceed systematically to the well with the most contaminated groundwater. Check the well, the lock, and the locking cap for damage or evidence of tampering.
- Slowly and gently measure the depth to water with a water level probe and/or oil-water interface probe. Do not measure depth to well bottom at this time (wait until sampling has been completed). Measure water level in accordance with SOP GW-001 Water Level Measurement.
- Attach new polyethylene or Teflon lined tubing to the sampling pump and the flow-through cell that contains the meter probes.
- Slowly and gently insert new polyethylene or Teflon lined tubing to the pump intake (or use dedicated tubing that remains in the well) and to the middle of the saturated screened interval or to the pre-determined sampling depth.
- The tubing intake should be kept at least two (2) feet above the bottom of the well to prevent disturbance or suspension of any sediment or Non-

Aqueous Phase Liquid (NAPL) present in the bottom of the well. Record the depth of the pump intake.

- If possible, position your sampling equipment and tubing so that it is in the shade. The goal is to minimize the effect of sunlight raising the temperature of water being collected.
- Start the pump on the lowest setting and increase slowly until flow begins. Adjust the pumping rate so that drawdown in the well is minimal (0.3 feet or less, is desirable but not mandatory). Use a pumping rate between 100 to 1,000 milliliters per minute (mL/min) (or approximately 0.1 to 1 quarts per minute). Measure flow rate on the pump or using a graduated container every 3 to 5 minutes and record. The minimum purge volume will be twice the combined volumes of the sampling string (i.e. pump, tubing, and flow-through cell).
- While purging, record water levels every 3 to 5 minutes and monitor and record the water quality indicator parameters: pH, temperature, specific conductance (SC), dissolved oxygen (DO), and turbidity. If specified in the field sampling plan also include ORP.
- Purging is complete when, after three consecutive measurements, the water quality parameters have stabilized as follows:

  - pH (+/- 0.1 standard units)
  - temperature (+/- 3%)
  - SC (+/- 3%)
  - turbidity (+/- 10% if >5 NTU; if 3 values are <5 NTU, consider the values as stabilized)
  - DO (+/-10% if >0.5 mg/L; if 3 values are <0.5 mg/L, consider the values as stabilized)
  - ORP (+/- 10 mV)

- Dispose of purge water according to the field plan.

Sample Collection:

- Following purge, remove the discharge tubing from the flow-through cell. Do not disturb pump and tubing between stabilization and sample collection.
- Fill sample containers directly from the sampling device in order of decreasing volatility (i.e., Volatile Organic Compounds (VOC) samples are collected first; see SOP SC-002 Sampling Handling). Fill all containers from the discharge end of the tubing. Collect samples at a flow rate equal to the steady state purge rate.
- If not using a dedicated pump, remove sampling device and decontaminate (see SOP QA-001 Equipment Decontamination). Discard used tubing.

- Store samples in a cooler on ice for transport to the laboratory.
- Measure depth to bottom of well.
- Secure the well cap.

3. Limitations

- Prior to departure for the field, obtain available information on well construction for use in field investigation (i.e., screen and riser material, well diameter and depth, screened interval, optimum sampling depth, etc.).
- If possible, when using dedicated equipment, install equipment into well at least 24 hours before sample collection to minimize disturbance of the water column and/or suspension of sediments or NAPL on bottom.
- If water quality indicator parameters do not stabilize after removing 3 to 5 well volumes or 2 hours, contact the Project Manager. Three options will be available: 1) continue purging until stabilization; 2) discontinue purging and do not sample; or 3) discontinue purging and sample.
- The key indicator parameter for VOCs is DO. The key indicator parameter for all other samples is turbidity.
- Fill all sample containers with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.
- Consult with the project manager before field filtering samples for metals if using low-flow sampling.
- Be aware of any preservatives in the sample bottles and handle with care, in accordance with the Health and Safety Plan.

4. References

Standard Reference for Monitoring Wells (April 19, 1991), Massachusetts DEP, DEP Publication No. WSC-310-91.

Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground Water Sampling (1994), M.J. Barcelona, H. A. Wehram, and M.D. Varljen, Ground Water, Vol. 32, No. 1, 12-22.

Low-Flow Purging and Sampling of Ground Water Monitoring Wells with Dedicated Systems (1995), R.W. Puls, and C.J. Paul, Groundwater Monitoring and Review, Summer 1995 116-123.

Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (2010), EQASOP-GW 001 Low Stress (Low Flow) SOP, Revision 3, U.S. Environmental Protection Agency, Region I, January 19, 2010.

Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling, (1998), Ground-Water Sampling SOP, Final, U.S. Environmental Protection Agency, Region II, March 16, 1998.

RCRA Ground-Water Monitoring: Draft Technical Guidance, (1993), U.S. Environmental Protection Agency, EPA/530-R-93-001.

To Filter, or Not to Filter, That is the Question, (1997), Special Topics Subcommittee Letter Report EPA-SAF-EEC-LTR-97-011, April 29, 1997, Meeting, U.S. Environmental Protection Agency, Science Advisory Board Environmental Engineering Committee, September 5, 1997.

Should Filtered or Unfiltered Groundwater and Surface Water Samples be Collected for the Risk Assessment?, (1995), MCP Q&A: Subparts I and J, Special #4, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection (DEP), February, 1995.

STANDARD OPERATING PROCEDURE

SG-002 Soil Vapor Sample Collection

1. Objective

This procedure outlines the general steps to collect soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary soil vapor probes should be installed using the procedures outlined below. All soil vapor probes should be installed using a direct-push drill rig (e.g., Geoprobe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe points.

- Record weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North);
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Soil Vapor Point Installation Specifications

Each soil vapor point should be constructed as follows:

- Six-inch stainless steel Geoprobe® AT86 series Permanent Implants (soil vapor screens) or equivalent and threaded to an (expendable) stainless steel anchor point.
- The implants should be fitted with inert Teflon or stainless steel tubing of laboratory or food grade quality.
- The annular space surrounding the vapor screen interval and a minimum of 6-inches above the top of the screen should be filled with a porous backfill

material (e.g., glass beads or coarse silica sand) to create a sampling zone 1 foot in length.

For temporary points, a hydrated bentonite surface seal should be created at the surface to minimize infiltration. For permanent points, the additional measures described below should be included.

- The soil vapor points should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet (or to grade, whichever is smaller) to prevent ambient air infiltration.
- If needed, the remainder of the borehole should be backfilled with clean material.
- A protective casing should be set around the top of the point tubing and grouted in place to the top of the bentonite to minimize infiltration of water or ambient air, as well as to prevent accidental damage to the soil vapor point.
- The tubing top should be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

2.3. Soil Vapor Sample Collection

Soil vapor samples should be collected as indicated in the work plan and in accordance with applicable state or federal guidance documents. Specifically, samples from the points should be collected as follows:

- Permanent soil vapor points should not be sampled or purged for a minimum of 24 hours after installation. Temporary points may be purged and sampled immediately following installation.
- Document pertinent field conditions prior to sampling as described above.
- A suction pump should be used to remove a minimum of three implant volumes from the soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples should be collected for volatile organic compounds (VOCs) in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate should not exceed 0.2 liters per minute.
- A helium tracer gas should be used to identify any potential migration or short circuiting of ambient air during sampling as described below.
- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing

laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.

- Connect the tubing from the soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample should be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- All laboratory analytical data should be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample.

A tracer gas evaluation should be conducted on the each temporary soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent soil vapor probe during the initial sampling event and a minimum of 10% of the soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.

- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber should have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber should have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that should be pre-calibrated to extract soil vapor at a rate of no more than 0.2 liters per minute. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary.

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred, however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Contact

Chris Berotti

STANDARD OPERATING PROCEDURE

SG-003 Sub-slab Soil Vapor Collection

1. Objective

This procedure outlines the general steps to collect sub-slab soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary sub-slab soil vapor probes will be installed using the procedures outlined below. All sub-slab soil vapor probes will be installed using a direct-push drill rig (e.g., Geoprobe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe locations.

- Record weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours. Record the indoor conditions (temperature, heating/cooling system active, windows open/closed, etc.).
- Measure the differential pressure at the building. Measure the indoor and outdoor barometric pressure using a high resolution device. Where possible, measure the sub-slab barometric pressure at the sampling point.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Indoor floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, heating, ventilating and air conditioning (HVAC) system air supply and return registers, compass orientation (North), footings that create separate foundation sections, and any other pertinent information should be completed;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sub-Slab Soil Vapor Point Installation Specifications

Each sub-slab soil vapor point will be constructed as follows:

- Drill an approximately 3/8-inch hole through the slab. If necessary, advance the drill bit 2-3 inches into the sub-slab material to create an open cavity.
- Using dedicated inert Teflon or stainless steel tubing of laboratory or food grade quality, insert the inlet of the tubing to the specified depth below the slab. For permanent installation, only stainless steel tubing and fittings will be used.
- For permanent point installations, the annular space surrounding the vapor probe tip will be filled with a porous backfill material (e.g., glass beads or coarse silica sand) to cover 1-inch of the above the tip of the probe.
- Seal the annular space between the hole and the tubing using an inert non-shrinking sealant such as melted 100% beeswax, permagum grout, putty, etc. For permanent installations, cement may be used.
- For permanent points, a protective casing will be set around the top of the point tubing and grouted in place minimize infiltration of water or ambient air, as well as to prevent accidental damage to he permanent point.
- The tubing top will be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

In cases where sub-slab sampling is impractical or infeasible, a surrogate location (attached garage, concrete patio, asphalt driveway, etc.) may be used if it is representative of sub-slab conditions. In surrogate locations, the vapor sampling point may be installed in accordance with SOP SG-002 Soil Vapor Collection.

2.3. Sub-Slab Soil Vapor Sample Collection

Sub-slab soil vapor samples will be collected as indicated in the site-specific Sampling and Analysis Work Plan and in accordance with state or Federal guidance documents. Specifically, sub-slab samples from the points will be collected as follows:

- Document pertinent field conditions prior to sampling as described above.
- A suction pump will be used to remove one to three implant volumes from the sub-slab soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples will be collected in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate will not exceed 0.2 liters per minute.
- A helium tracer gas will be used to identify any potential migration or short circuiting of ambient air during sampling as described below.

- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.
- Connect the tubing from the sub-slab soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples will be analyzed for volatile organic compounds (VOCs) and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the sub-slab soil vapor probe seal and assess the potential for introduction of indoor air into the sub-slab soil vapor sample. A tracer gas evaluation should be conducted on the each temporary sub-slab soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent sub-slab soil vapor probe during the initial sampling event and a minimum of 10% of the sub-slab soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

- Retain the tracer gas around the sub-slab sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the sub-slab soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract sub-slab soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and purge one to three tubing volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation will be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary:

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred; however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

4. Contact

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STANDARD OPERATING PROCEDURE
SG-004 Ambient Air Sample Collection

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1. Objective

Describe procedures to collect ambient air samples. The site-specific Work Plan should be consulted for proposed sample locations and sampling duration.

2. Execution

2.1. Document Field Conditions

Document pertinent field conditions prior to sample collection:

- Record weather information, if available (such as precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for at least the past 12 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sample Collection

- Samples should be collected in laboratory-certified clean SUMMA® canister (or equivalent) using a flow controller calibrated for the anticipated sample duration (1-hour, 8-hour, etc.). The regulator flow rate should not exceed 0.2 liters per minute.
- Place the canister at the sampling location. If the sample is collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet should be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.

- Connect the tubing to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- If possible, monitor the vacuum pressure in the canister routinely during sampling. During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, call the laboratory and discuss the sample viability with them. Determine whether another sample will be taken after sharing the laboratory's opinion with your project manager.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Contacts

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