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Consolidated Edison Company of New York, Inc.

Alternatives Analysis Report

Former Pemart Avenue Works Manufactured Gas Plant Site

Peekskill, New York
Site No. V00566

April 2013

ARCADIS

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Certification Statement

I, Margaret A. Carrillo-Sheridan, P.E. certify that I am currently a NYS registered professional engineer and that this *Alternatives Analysis Report* 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).

_____ Date _____

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Introduction

This *Alternatives Analysis Report* (AAR) presents an evaluation of remedial alternatives to address environmental impacts identified at the Consolidated Edison Company of New York, Inc. (Con Edison) Former Pemart Avenue Works Manufactured Gas Plant (MGP) site and the former electric generating plant (EGP) (collectively referred to as the site) located in Peekskill, New York (Site No. V00566). This AAR has been prepared in accordance with Voluntary Cleanup Agreement (VCA) Index Number D2-0003-02-08 between Con Edison and the New York State Department of Environmental Conservation (NYSDEC).

As discussed in further detail in this AAR, the area for remedial consideration consists of an upland area and a sediment area. The upland portion of the site is designated as Operable Unit No. 1 (OU-1) and consists of the properties of the former MGP and the former EGP, adjacent properties to the west-southwest and the MTA Metro-North Railroad (railroad) right-of-way. The former MGP property is comprised of Tax Block 5 (Lots 7 and 8) and Tax Block 8 (Lots 1, 2, 3). The former EGP property is comprised of Tax Block 5 (Lot 9) and Tax Block 8 (Lot 4). The sediment portion of the site is designated as Operable Unit No. 2 (OU-2) and consists of the land areas between the railroad right-of-way and the shoreline of Peekskill Bay and the near-shore sediment areas of Peekskill Bay that contain potentially MGP/EGP-related impacts. OU-1 and OU-2 are collectively referred to herein as “the site”.

The purpose of this AAR is to identify and evaluate remedial alternatives that are:

- Appropriate for site-specific conditions
- Protective of human health and the environment
- Consistent with relevant sections of NYSDEC guidance

The overall objective of this AAR is to recommend a reliable, cost-effective remedy that achieves the remedial action objectives (RAOs) established for the site.

Background

The site is comprised of approximately 1.9 acres located on North Water Street (formerly Old Pemart Avenue), northwest of the intersection of Main Street and Water Street in the City of Peekskill, Westchester County, New York. Currently, the site is used for commercial and industrial purposes, with the exception of residential uses at the Jan Peek Homeless Shelter (200 North Water Street). In general, commercial businesses surround the site to the northwest and southeast, and a private residence/commercial business located at 400 North Main Street borders the site to the south. The Briarcliff-Peekskill Parkway is located north/northeast of the site and the Hudson Line of the MTA Metro-North Railroad (formerly New York Central Railroad) right-of-way transects the site. The Peekskill Landing Superfund site is located south of the former MGP site along the waterfront. Peekskill Landing was used for a variety of purposes including office space, an art foundry, a lumber yard, boat repairing/storage facility, stone crushing operation, stove works, and coal storage.

Historical MGP operations were conducted at the site between 1899 and 1931 and primarily included the production of manufactured gas using the Lowe carbureted water gas process. In 1899 the Peekskill Gas Company (also previously named the Peekskill Lighting and Railroad Company, and the Westchester Lighting Company) commenced MGP operations, producing approximately 11 million cubic feet (cf) of carbureted gas per year. The gas production progressively increased from 11 million cf in 1899 to 116 million cf in 1930. Gas production continued through July 1, 1931, when the plant was placed on stand-by service status for several years.

The former EGP was operated by the Westchester Lighting Company from 1905 to approximately 1950. The building on the former EGP property was used to house electric generators, as well as other equipment and machinery associated with the EGP operations. The western portion of the site (i.e., where the former EGP was located) was sold in 1943. The former EGP building was expanded and occupied by the Ednal Company Optical Goods. After closure of the MGP, the site was operated by Westchester Lighting Company and later by Con Edison as a gas holder station and for gas distribution (until 1966). The remaining portion of the former MGP site was sold in 1978, with the exception of a small parcel (i.e., Block 8, Lot 2) south of North Water Street that was retained by Con Edison for use as a natural gas regulator station. The former gas regulator facility has since been removed and a new regulator has been installed in a subsurface vault beneath the sidewalk along the west side of North Water Street.

Currently, the battery house (a former EGP structure) and gas plant buildings (i.e., former Purifier House, Storage Boiler House, and Generating House) remain at the site. At the time of this remedial evaluation, the gas house is not occupied. In addition, the Jan Peek Homeless Shelter is operating in a building on the former EGP property west of the former MGP property.

Nature and Extent of Impacts

Coal tar dense non-aqueous phase liquid (DNAPL) with lesser amounts of petroleum-related NAPL were observed at the site. Coal tar is the primary byproduct of MGP operations and is characterized as a dense dark liquid with an acrid odor. Coal tar occurs at the site at apparent saturation levels to blebs/globules to sheens in subsurface soils and sediments. Petroleum fuel oils were used as feedstock during the operations of both the MGP and the EGP. For the purposes of this AAR, MGP-related coal tar DNAPL, petroleum fuel oil residuals, benzene, toluene, ethylbenzene, and xylene (BTEX), and polycyclic aromatic hydrocarbons (PAHs) are considered the constituents of concern (COCs) for this site. Physical evidence of coal tar, petroleum fuels, and elevated concentrations of BTEX and PAHs were used as the parameters for defining the extent of MGP-related impacts at the site.

In general, the NAPL impacts were encountered in soil samples collected throughout most of the former MGP area. The NAPL-impacted soil is present to the west, beneath the adjacent railroad tracks up to Peekskill Bay. NAPL impacts were observed in soil samples to depths of 20 feet below ground surface (bgs) where the upper silt/clay semi-confining layer is encountered. NAPL or MGP-related impacts have not been observed in or below the uppermost portion of the upper silt/clay.

NAPL impacts from the upland portion of the site migrated laterally to near-shore areas of Peekskill Bay. Similarly to the upland portion of the site, NAPL was not observed below the silt/clay unit in Peekskill Bay sediment. Coal tar NAPL and scattered globules are encountered in sediments of the Peekskill Bay at depth intervals ranging between 0.5 and 18 feet below sediment surface (bss). Potential shallow petroleum-related visual impacts (i.e., sheens and petroleum-like odors) were observed at one location (i.e., sediment sample location SD-34) outside the NAPL-impacted area.

Remedial Action Objectives

Remedial action objectives (RAOs) are developed to specify the COCs within the site, and to assist in developing goals for cleanup of COCs in each medium that may

require remediation. The RAOs presented in the following table have been developed based on the generic RAOs listed on NYSDEC's website (http://www.dec.ny.gov/regulations/67560.html).

Table ES.1 Remedial Action Objectives

RAOs for Soil and Groundwater
1. Prevent, to the extent practicable, ingestion/direct contact with soil containing MGP-related COCs and/or NAPL and groundwater containing MGP-related COCs at concentrations exceeding NYSDEC groundwater quality standards
2. Prevent, to the extent practicable, inhalation of or exposure to MGP-related COCs volatilizing from MGP-impacted soil and from groundwater containing MGP-related COCs at concentrations exceeding NYSDEC groundwater quality standards
3. Prevent, to the extent practicable, migration of MGP-related COCs and/or NAPL that could result in impacts to groundwater or surface water
4. Address, to the extent practicable, MGP-related COCs and/or NAPL as sources of soil and groundwater impacts
RAOs for Sediment
1. Prevent, to the extent practicable, direct contact with sediments containing MGP-related NAPL and/or PAHs at concentrations greater than the site-specific background concentrations
2. Prevent, to the extent practicable, the release of MGP-related COCs and/or NAPL from sediment that would result in surface water containing MGP-related COCs at concentrations greater than ambient surface water quality criteria
3. Prevent, to the extent practicable, impacts to biota from ingestion/direct contact with sediment containing MGP-related COCs and/or NAPL

Remedial Technology Screening and Development of Remedial Alternatives

The objective of the technology screening is to identify general response actions (GRAs), associated remedial technology types and technology process options, and then narrow the universe of process options to those that have had documented success at achieving similar RAOs at former MGP sites to identify options that are

implementable and potentially effective at addressing impacts identified for the project area. Based on this screening, remedial technology types and technology process options were eliminated or retained and subsequently combined into potential remedial alternatives for further, more detailed evaluation. This approach is consistent with the screening and selection process provided in DER-10.

Based on the results of the technology screening, the following potential remedial alternatives were developed:

- Alternative 1 – No Action
- Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment
- Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment
- Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment

Detailed Evaluation of Alternatives

Following the development of the remedial alternatives, a detailed description of each alternative was prepared and each alternative was evaluated with respect to the following criteria presented in DER-10:

- Short-Term Impacts and Effectiveness
- Long-Term Effectiveness and Permanence
- Land Use
- Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment
- Implementability
- Compliance with SCGs
- Overall Protectiveness of Public Health and the Environment
- Cost Effectiveness

Comparative Analysis of Alternatives

Following the detailed evaluation of each alternative, a comparative analysis of the alternatives was completed using the evaluation criteria. The comparative analysis

identified the advantages and disadvantages of each alternative relative to each other and with respect to the evaluation criteria. The results of the comparative analysis were used as a basis for recommending the preferred remedy for achieving the RAOs.

Preferred Remedial Alternative

The results of the comparative analysis were used as a basis for recommending Alternative 3 as the preferred remedial alternative for the site. The primary components Alternative 3 consist of the following:

- Conducting a pre-design investigation (PDI) in support of the remedial design of the soil excavation and sediment removal activities to be conducted under this alternative
- Excavating approximately 2,800 cubic-yards (cy) of soil and former MGP structures to address NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 (Block 5)
- Transporting excavated material off-site for disposal as a non-hazardous waste or for treatment via low-temperature thermal desorption (LTTD)
- Backfilling the excavation area with clean imported fill
- Constructing a NAPL barrier wall to prevent further migration of impacts to Peekskill Bay
- Installing NAPL recovery wells and conducting periodic NAPL monitoring/recovery
- Addressing debris/obstructions (i.e., wood piles and sunken barges) to facilitate sediment removal
- Removing approximately 6,000 cy of shallow sediment to address approximately 1,300 cy of visually impacted sediment in the area identified to contain MGP residuals.
- Excavating visually impacted sediment in the vicinity of sediment sampling location SD-34.

- Backfilling sediment removal areas with clean imported fill and/or natural deposition

- Constructing an engineered cap over areas where visually impacted sediment would remain below a minimum of 5 feet of visually clean material.

- Establishing institutional controls (in the form of deed restrictions and/or environmental easements) in the upland area to limit intrusive (i.e. subsurface) activities that could result in exposures to soil and groundwater containing site-related impacts, prohibit the use of site groundwater, and require compliance with a site management plan (SMP).

- Preparing an SMP to document the following:

  - The institutional controls that have been established and will be maintained for the site

  - Known locations of soil containing COCs at concentrations greater than 6 NYCRR Part 375-6 commercial use soil cleanup objectives

  - Protocols (including health and safety requirements) for conducting invasive (i.e., subsurface) upland activities and managing potentially impacted material encountered during these activities

  - Protocols and requirements for conducting periodic NAPL monitoring and recovery

  - Reporting requirements and frequency

Acronyms and Abbreviations

AAR	Alternatives Analysis Report
amsl	above mean sea level
BTEX	benzene, toluene, ethylbenzene, and xlyene
bgs	below ground surface
bss	below sediment surface
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cf	cubic-foot
cy	cubic-yard
CFR	Code of Federal Regulations
COCs	constituents of concern
DAR	Division of Air Resources
DER	Division of Environmental Remediation
DNAPL	dense non-aqueous phase liquid
DRO	diesel range organics
DUS/HPO	dynamic underground stripping and hydrous pyrolysis/oxidation
ECL	Environmental Conservation Law
EGP	Electric generating plant
FEMA	Federal Emergency Management Agency
FWMR	Fish, Wildlife, and Marine Resources
GRAs	general response actions
GRI	gas research institute
HASP	health and safety plan
IA/SG	indoor air/soil gas
ISCO	in-situ chemical oxidation
LDRs	Land Disposal Restrictions
LNAPL	light non-aqueous phase liquid
LTTD	low-temperature thermal desorption
LWDP	Local Waterfront Development Plan
mg/kg	milligram per kilogram
MGP	manufactured gas plant
MNR	monitored natural recovery
MOC	material of concern
NAPL	non-aqueous phase liquid
NCP	National Contingency Plan

NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination Systems
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PDI	pre-design investigation
PID	photoionization detector
POTW	publicly-owned treatment works
PPE	personal protective equipment
PRB	permeable reactive barrier
RCRA	Resource Conservation and Recovery Act
RAO	remedial action objective
SCGs	standards, criteria, and guidelines
SCOs	soil cleanup objectives
SHPO	State Historic Preservation Office
SEQR	State Environmental Quality Review
SMP	site management plan
SPDES	State Pollution Discharge Elimination Systems
SVOC	semi-volatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
µg/L	microgram per liter
USACE	United States Army Corp of Engineers
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTSs	Universal Treatment Standards
UV	ultra violet
VCA	Voluntary Cleanup Agreement
VOC	volatile organic compound

1. Introduction

This *Alternatives Analysis Report* (AAR) presents an evaluation of remedial alternatives to address environmental impacts identified at the Consolidated Edison Company of New York, Inc. (Con Edison) Former Pemart Avenue Works Manufactured Gas Plant (MGP) site and the former electric generating plant (EGP) (referred to as the site) located in Peekskill, New York (Site No. V00566). This AAR has been prepared in accordance with Voluntary Cleanup Agreement (VCA) Index Number D2-0003-02-08 between Con Edison and the New York State Department of Environmental Conservation (NYSDEC).

1.1 Regulatory Framework

This AAR has been prepared to evaluate remedial alternatives to address environmental impacts at the site in a manner consistent with the VCA and with NYSDEC *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010).

This AAR has also been prepared in consideration of applicable provisions of the New York State Environmental Conservation Law (ECL) and associated regulations, including Title 6 of the New York Code of Rules and Regulations (NYCRR) Part 375-6 (6 NYCRR Part 375-6).

1.2 Purpose

The purpose of this AAR is to identify and evaluate remedial alternatives that are:

- Appropriate for site-specific conditions
- Protective of human health and the environment
- Consistent with relevant sections of NYSDEC guidance

The overall objective of this AAR is to recommend a reliable, cost-effective remedy that achieves the remedial action objectives (RAOs) established for the site.

1.3 Report Organization

This AAR has been organized the sections described in Table 1.1.

Table 1.1 Report Organization

Section	Purpose
Section 1 – Introduction	Provides background information relevant to the development of remedial alternatives evaluated in this AAR.
Section 2 – Identification of Standards, Criteria, and Guidance	Identifies standards, criteria, and guidance (SCGs) that govern the development and selection of remedial alternatives.
Section 3 – Development of Remedial Action Objectives	Presents a summary of the site exposure assessment and develops site-specific RAOs that are protective of public health and the environment.
Section 4 – Technology Screening and Development of Remedial Alternatives	Presents the results of a screening process completed to identify potentially applicable remedial technologies and develops remedial alternatives that have the potential to meet the RAOs.
Section 5 – Detailed Evaluation of Remedial Alternatives	Presents a detailed description and analysis of each potential remedial alternative using the evaluation criteria presented in DER-10.
Section 6 – Comparative Analysis of Alternatives	Presents a comparative analysis of the remedial alternatives using the evaluation criteria.
Section 7 – Preferred Remedial Alternative	Identifies the preferred remedial alternative for addressing the environmental concerns at the site.
Section 8 – References	Provides a list of references utilized to prepare this AAR.

1.4 Background Information

This section summarizes site background information relevant to the development and evaluation of remedial alternatives, including site location and physical setting, site history and operation, and previous investigations conducted for the site.

1.4.1 Site Location and Physical Setting

The site is comprised of approximately 1.9 acres located on North Water Street (formerly Old Pemart Avenue), north of the intersection of Main Street and Water Street in the City of Peekskill, Westchester County, New York (Figure 1). Approximately one acre of the site is located west of North Water Street and 0.9 acres east of North Water Street. The former limits of the MGP operations include a portion

of the Peekskill Bay shoreline, a portion of North Water Street north of its intersection with Main Street. As discussed in further detail in this AAR, the area for remedial consideration consists of an upland area and a sediment area. The upland portion of the site is designated as Operable Unit No. 1 (OU-1) and consists of the properties of the former MGP and the former EGP, adjacent properties to the west and the MTA Metro-North Railroad (railroad) right-of-way. The former MGP property is comprised of Tax Block 5 (Lots 7 and 8) and Tax Block 8 (Lots 1, 2, 3). The former EGP property is comprised of Tax Block 5 (Lot 9) and Tax Block 8 (Lot 4). The sediment portion of the site is designated as Operable Unit No. 2 (OU-2) and consists of the land areas between the railroad right-of-way and the shoreline of Peekskill Bay and the near-shore sediment areas of Peekskill Bay that contain potentially site-related impacts.

According to the City of Peekskill Zoning Map (included as Appendix A), the site is zoned as Inland Waterfront Development (WF-2). Areas immediately east of the site are zoned as Residential (R-1B and R-6) and Planned Residential Developments (PRD). Currently, the site is used for commercial and industrial purposes, with the exception of residential uses at the Jan Peek Homeless Shelter (200 North Water Street). In general, commercial businesses surround the site to the northwest and southeast, and a private residence/commercial business located at 400 North Main Street borders the site to the south. The Briarcliff-Peekskill Parkway is located east of the site and the Hudson Line of the MTA Metro-North Railroad (formerly New York Central Railroad) right-of-way transects the site. The Peekskill Landing State Superfund site is located south of the former MGP site along the waterfront. Peekskill Landing was used for a variety of purposes including a marina, foundry, lumber yard, boat repairing/storage facility, stone crushing operations, stove works, and coal storage.

Topography slopes downward across the site, from the east-northeast near the Briarcliff-Peekskill Parkway right-of-way towards Peekskill Bay to the west-southwest. The elevation of the site varies between 100 and 87 feet above mean sea level (amsl) (in the North American Vertical Datum of 1988 [NAVD 88]) in the east-northeast to near sea level in the west-southwest.

Storm drains located in North Water Street capture runoff from the adjoining land and the street at and near the site and discharge into the Peekskill Bay just west of the site. Historic storm drains (i.e., those no longer maintained) discharged into Peekskill Bay just west and south of the site. In addition to these conveyances, no less than 28 storm drains were identified on city maps that currently or historically capture runoff from the

Peekskill area further to the north and to the south of the site and then discharge(d) to Peekskill Bay via outfalls.

In addition to sewer outfalls, Annsville Creek discharges to Peekskill Bay approximately 1,500 feet upstream (northwest) of the site.

Peekskill Bay and the stretch of the Hudson River adjacent to Peekskill are within the mid-Hudson estuary and fall within the oligohaline (low-salinity) zone. North of Peekskill, the Hudson River is narrow and deep with steep shorelines, while at Peekskill the river widens and forms Peekskill Bay, a shallow (2 to 5 foot water column) bay on the east side of the river. Per 6 NYCRR 864.6, the section of the Hudson River inclusive of Peekskill Bay is classified for use as primary and secondary contact recreation and fishing, and suitable for fish propagation and survival (Class SB).

1.4.2 Site History and Operation

A summary of the MGP and non-MGP history is presented in the following subsections. A detailed account of the site history and past site ownership was presented in the January 2003 *Historical Investigation Report* prepared by the RETEC Group, Inc. (RETEC), now AECOM (RETEC, 2003).

RETEC conducted a historical investigation on behalf of Con Edison. The historical investigation documented the history, operational layout and present configuration and conditions of the site. This investigation was part of a comprehensive program to research and document operations of former MGP sites that were operated by Con Edison's predecessor companies. In addition, the historical investigation served as a preliminary site assessment designed to identify sites that posed potential acute risk to human health and/or the environment.

RETEC collected information from various sources to assess the historical ownership and former MGP/EGP operations, subsequent site uses, and current site conditions. These sources included historical records obtained from private and public repositories (e.g., federal, state, and local agencies), a chain-of-title search, tax and zoning records, review of geologic reports for the general area, and site reconnaissance. Findings were presented in the *Historical Investigation Report* (RETEC, 2003). RETEC concluded that MGP residuals (in soil and/or groundwater) might be present given the former uses of the site.

1.4.2.1 MGP and EGP Operational History

The known extent of the former MGP is shown on Figure 2. Historical MGP operations were conducted at the site between 1899 and 1931 and primarily included the production of manufactured gas using the Lowe carbureted water gas process. In 1899 the Peekskill Gas Company (also previously named the Peekskill Lighting and Railroad Company, and the Westchester Lighting Company) commenced MGP operations, producing approximately 11 million cubic feet (cf) of carbureted gas per year. The former MGP consisted of an MGP building (including generator house, boiler house, storage room, and purifying house) and a coal shed west of North Water Street. Two iron gas holders (100,000 and 30,000 cf), an oil tank (25,000 gallons), and a small battery house were located on the east side of North Water Street (Block 5, Lot 7). In 1905, a coal conveyor was constructed west of the MGP building and the site was expanded to include the EGP on the west side of North Water Street. An additional gas holder (200,000 cf) was constructed by 1924 east of North Water Street. The gas production progressively increased from 11 million cf in 1899 to 116 million cf in 1930. Gas production continued through July 1, 1931, when the plant was placed on stand-by service status for several years.

The known extent of the former EGP is shown on Figure 2. The former EGP was operated by the Westchester Lighting Company from 1905 to approximately 1950. As indicated above, a coal conveyor was constructed in 1905 to transfer coal from boats in Peekskill Bay to a coal pile between the EGP and MGP. The building on the former EGP property was used to house electric generators, as well as other equipment and machinery associated with the EGP operations. The portion of the site where the former EGP was located was sold in 1943. The former EGP building was expanded and occupied by the Ednal Company Optical Goods.

After closure of the MGP, the site was operated by Westchester Lighting Company and later by Con Edison as a gas holder station and for gas distribution (until 1966). The remaining portion of the former MGP site was sold in 1978, with the exception of a small parcel (i.e., Block 8, Lot 2) west of North Water Street that was retained by Con Edison for use as a natural gas regulator station. The former gas regulator facility has since been removed and a new regulator has been installed in a subsurface vault beneath the sidewalk along the west side of North Water Street.

1.4.2.2 Additional Site Operational History

Additional site operational history prior to and post former MGP and/or EGP operations included the following:

- The portion of the site that comprised the MGP was occupied by Jones & Mead Enameled Holloware Works and Enameling Iron Works as early as 1868.
- The portion of the site located north of the MGP was occupied for the manufacturing of lime kiln as early as 1868.
- The MGP and portions of the EGP were occupied by the New York Emery Company sometime before 1887, which provided manufacturing, milling and refining services.
- The site was not occupied immediately before the MGP started operations in 1899.
- The site was used for the manufacturing of optical goods by Ednal Company from 1950 to 1970.

Currently, the battery house and gas plant building (which contained the former purifiers, storage boiler, and gas generating operations) remain at the site. At the time of this remedial evaluation, the gas house is not occupied. Additionally, the Jan Peek Homeless Shelter is operating in a building on the former EGP property north of the former MGP property.

1.4.3 Summary of Previous Investigations and Site Activities

This subsection summarizes the previous investigations that have been conducted at and adjacent to the site. The results of the investigations were used to develop the site characterization presented in Section 1.5.

1.4.3.1 Remedial Investigation

ENSR Corporation (now AECOM) conducted a Remedial Investigation from August to September 2005 and from March to June 2006 with the following objectives:

- Determine the presence/absence of MGP and/or EGP impacts at the site

- Delineate the horizontal and vertical extent of impacts identified in soil and groundwater

- Determine if any structures related to the former site operations were present in the subsurface.

Remedial Investigation field activities including the following:

- Collection and analysis of 12 surface soil samples from locations across the site.

- Excavation of five tests pits in the area of the former MGP gas holders and fuel oil tank to determine the presence of historic MGP structures and MGP impacts. Three subsurface soil samples were collected from the tests pits.

- Installation of 46 soil borings and collection and analysis of 136 subsurface soil samples from the soil borings to determine the presence of MGP-related impacts.

- Installation of 28 groundwater monitoring wells and collection and analysis of 25 groundwater samples.

A total of 23 wells were screened in the shallow water table aquifer, two wells were screened in the intermediate zone (i.e., below the silt/clay unit, that effectively isolates the water table aquifer from the lower aquifer unit), and three wells were screened in bedrock. Groundwater was not sampled from three wells where physical evidence of non-aqueous phase liquid (NAPL) was observed. The detailed results of the Remedial Investigation activities were presented in the *Remedial Investigation Report* (RI Report) (ENSR, 2007). The RI showed that site-related impacts are present in subsurface soil and groundwater, as indicated by laboratory analytical results; presence of coal tar (dense non-aqueous phase liquid [DNAPL]) and or coal tar residue; and detections of odors, staining and sheen. The site-related impacts occur in the subsurface to depths up to 20 feet below grade and are isolated to soil and groundwater above the silt/clay unit. The impacts occur in the operational areas of the former MGP, and extend to the shoreline of Peekskill Bay adjacent to and downgradient from the site. The observed impacts are primarily related to the former MGP operations. No field evidence of contamination related to operations of the former EGP was detected. However, evidence of petroleum-like NAPL (which is associated with both the MGP and EGP operations) was detected in soils collected at the former EGP.

1.4.3.2 Remedial Investigation Addendum

ENSR conducted a Remedial Investigation Addendum in November and December 2007 to evaluate the quality of deep sediments in Peekskill Bay adjacent to and downgradient from the site. The objectives of the Remedial Investigation Addendum were to:

- Determine the presence/absence of site-related impacts from the historical site operations beneath Peekskill Bay

- If present, delineate the horizontal and vertical extent of site-related impacts in the deep sediments of the near-shore areas of Peekskill Bay adjacent to the site.

Sediment coring was conducted at 25 locations to characterize the nature of the deep sediments in Peekskill Bay downgradient from the site. In general, the remedial investigation addendum concluded that the coal tar NAPL identified in subsurface soils in the upland portion of the site extends into the subsurface soil/sediment beneath the downgradient area of Peekskill Bay. Detailed descriptions of the field activities and associated results were presented in the *Remedial Investigation Addendum* (RI Addendum) (ENSR, 2008).

1.4.3.3 Supplemental Sediment Investigation

As a follow up to NYSDEC, New York State Department of Health (NYSDOH), and New York State Department of Fish, Wildlife and Marine Resources (FWMR) comments on the *Remedial Investigation Addendum* (ENSR, 2008), ARCADIS conducted a supplemental sediment investigation. The objectives of this investigation were to:

- Determine background concentrations of polycyclic aromatic hydrocarbon compounds (PAHs) in surface sediments in Peekskill Bay.

- Determine if the surface sediments in Peekskill Bay have been affected by former site operations.

The Supplemental Sediment Investigation was conducted from September 28 to September 30, 2011 and included the collection and analysis of surface sediment samples from a total of 43 locations across Peekskill Bay. Sediment samples were collected from the following locations:

- Eight locations within the area previously shown to contain coal tar NAPL and coal tar residues in the deep near-shore sediments (i.e., per the findings of the RI Addendum).

- Thirty five locations throughout Peekskill Bay outside the area previously shown to contain coal tar residues in the deep sediments.

In general, the Supplemental Sediment Investigation concluded that surface sediments within the area of sediment containing MGP residuals may have been affected by underlying coal tar residues detected in the subsurface sediments. Additionally, sediment beyond the area identified to contain MGP residuals is not affected by coal tar. The results of the supplemental sediment investigation are presented in the *Supplemental Sediment Investigation Report* (ARCADIS, 2012).

1.4.3.4 Indoor Air and Soil Gas Investigations

AECOM conducted an Indoor Air and Soil Gas (IA/SG) Investigations in June 2008 and March 2010. The objectives of the IA/SG Investigations were to:

- Evaluate the potential for vapor intrusion including collection of samples under "worst-case" conditions (i.e., during the heating season) in the buildings previously sampled (2010 sampling).

- Evaluate indoor air quality at 200 North Water Street (2010 sampling).

A total of six indoor air samples and four sub-slab soil gas/manhole samples were collected from the 190 and 200 North Water Street and 400 Main Street properties. Detailed results of the IA/SG Investigation are presented in the *Indoor Air and Soil Gas Investigation* report (AECOM, 2010).

1.5 Site Characterization

This section presents an overall site characterization and a summary of the nature and extent of impacted media at the site based on the results obtained for the site investigation activities described in the previous subsection. The site characterization consists of an overview of site geology and hydrogeology followed by a summary of the nature and extent of impacts identified at the site.

1.5.1 Geology and Hydrology

A summary of the upland geology, hydrology and sediment geology is presented in the following subsection.

1.5.1.1 Upland Geology

The site is underlain by five primary lithologic units all overlying bedrock. The lithologies all consist of glaciofluvial sediments deposited in the Hudson River Valley along Peekskill Bay. These soils consist primarily of silt with interbedded layers of sand, clay, and peat. The five lithologic units encountered at the site, in descending order, consist of the following:

- Fill – The fill is present throughout the site to depths varying from approximately 3 to 20 feet below ground surface (bgs). The fill is comprised of an heterogeneous mixture of organic rich granular materials including silt, sand, gravel and various debris (e.g., glass, wire, bottle caps, plastic, clinker, coal fragments, wood fragments, concrete, steel plates, brick fragments, etc.). The water table is generally found within this unit.

- Upper Sand – The upper sand unit is located beneath the fill unit with a thickness varying from 2 to 18 feet. The upper sand unit is located primarily in the southern portion of the site and is absent in the eastern portion where the fill unit extends to the upper silt/clay, which is the next underlying unit. The upper sand unit is located from 15 to 30 feet bgs and is primarily comprised of fine- to medium-grained sand; however, some silt, coarse sand and/or fine gravel are present in lesser quantities.

- Upper Silt/Clay – The upper silt/clay unit is present beneath most of the site with a thickness that varies from 1 to 20 feet. The upper silt/clay unit was not observed in a small area in the eastern portion of the site where the overburden pinches out against the adjacent bedrock outcrops. The upper silt/clay unit is located between 7 to 22 feet bgs and varies from a sandy-silt unit to a silty-clay unit to alternating clay and silt. Isolated lenses of peat, sand and gravel occur sporadically in the upper silt/clay unit. Based on the low-permeability nature of this unit, a majority of NAPL observed in the upland portion of the site is located in the fill and upper sand units, on top of the upper silt/clay.

- Lower Sand – The lower sand unit is present beneath the entire site with a thickness varying from 1 to 7 feet. This unit is located between 17 and 40 feet bgs and is primarily comprised of fine to coarse grained sand.

- Lower Silt/Clay – The lower silt/clay unit is present beneath the entire site on top of the bedrock layer with a thickness varying from 2 to 10 feet. This unit is located between 24 and 43.5 feet bgs and ranges from silty-sand with clay, to clayey-silt, to clay.

- Bedrock – Bedrock outcrops in the eastern portion of the site and extends beneath the unconsolidated soil and sediments that underlie the majority of the site and south of the site. Accordingly bedrock occurs from grade in the north and east and ranges to a depth of up to 47.5 feet bgs in the southwestern portions of the site. A weathered bedrock zone with a thickness of 2.5 to 10 feet, was observed above the solid bedrock across most of the site. Bedrock is comprised of micaceous dark grey gneiss with light grey felsic bands.

Geologic cross-sections previously presented in the RI Report and RI Addendum are included as Appendix B of this AAR.

1.5.1.2 Hydrogeology

Groundwater flow beneath the site is primarily within the above-mentioned geologic units. A water table contour map previously presented in the RI Report is included in Appendix B. Groundwater flows to the southwest towards Peekskill Bay and the Hudson River. Groundwater levels are influenced by tidal fluctuations in the river. Recharge to the groundwater system at the site is primarily from three sources:

- Runoff from the elevated areas to the east. Some of this runoff is channeled into storm drains that drain the site.

- Infiltration of precipitation.

- Groundwater from bedrock fractures either as springs above the land surface or as direct flow to the aquifer system.

As indicated in the previous subsection, the water table lies within the fill unit at approximately 3 to 8 feet bgs. The aquifer system beneath the site consists of an upper aquifer separated from a lower aquifer by an intermediate low-permeability aquitard

(i.e., upper silt/clay unit), and a lower aquifer, which is generally separated from the bedrock aquifer by a deeper low permeability unit (i.e., the lower silt/clay unit). The site is relatively flat, so significant overland surface runoff is not likely from the site to the storm drains.

Groundwater at the site is classified as brackish (i.e., has more salinity than freshwater but not as much salinity as seawater).

1.5.1.3 Sediment Geology

The sediments in the Peekskill Bay of the Hudson River in the vicinity of the site are generally comprised of interbedded layers of organic silt, sand, gravel, silt, and clay. The river sediments are an extension of the soil lithologies that comprise the upland areas of the site. A primary distinction is that the upper sediments become finer and thicken away from the near shore areas. Geologic layers present beneath Peekskill Bay (in descending order) consist of the following:

- Upper Silt – This soft riverine silt is present at depths of approximately 2 to 12 feet below the sediment surface (bss). This unit is primarily comprised of dark brown to gray-black organic rich silt mixed with varying amounts of sand, gravel, detritus and assorted debris (e.g., clinker, coal fragments, wood from pilings and barge structures, metal, brick fragments, etc.). Near the shore, the upper sediments are coarser and generally consist of fine to medium sand and trace to some silt and away from the shore the upper sediments were generally consist of silt and clay with little to trace fine sand.

- Silt – This silt unit is located beneath the soft upper silt with a thickness varying from 1 to 16 feet. This unit is comprised of brown to dark gray silt with varying amounts of root matter. The top of the silt unit is located approximately 1 to 10 feet bss and the bottom extends between 8 and 20 feet bss.

  These silt units also contain isolated lenses of sand, silty clay and peat. Where present, sand lenses consisted primarily of gray fine to medium-grained sand, and varied in thickness from 2 to 8 feet. Based on their limited occurrence, the lenses appear to be present in former dredge channels and/or scour channels.

- Peat and Silt/Clay – A silt/clay unit, peat unit, or a silt/clay unit containing peat is located below the silt unit or sand lenses. The silt/clay unit is present beneath most of the investigated area within Peekskill Bay and is comprised primarily of firm brown silt to stiff gray clay. Where the silt/clay unit is not present, either a peat unit or a silt/clay unit containing peat is present. The silt/clay unit is contiguous with and is the submarine extension of the low-permeability silty/clay unit of the upland area described above and acts to prevent downward migration of NAPL. Accordingly, where present, DNAPL is located on top of this silt/clay unit both in the upland and beneath the river.

Geologic cross-sections previously presented in the RI Report and RI Addendum are included as Appendix B of this AAR.

1.5.2 Nature and Extent of Impacts

Coal tar DNAPL with lesser amounts of petroleum-related NAPL were observed at the site. Coal tar is the primary byproduct of MGP operations and is characterized as a dense dark liquid with an acrid odor. Due to these very distinct physical attributes, the presence or absence of coal tar is typically easy to identify in the field. Coal tar occurs at the site at apparent saturation levels to blebs/globules to sheens in subsurface soils and sediments. Petroleum fuel oils were used as feedstock during the operations of both the MGP and the EGP. Petroleum-type oil occurs at the site and is described as oil-like materials and/or oil-like or petroleum-like odors in subsurface soils.

Because coal tar is denser than water, when it is released to the environment, coal tar typically migrates vertically until it encounters a low-permeability material. At the site, the DNAPL has migrated vertically downward to the top of the low-permeability upper silt/clay unit and then migrated laterally following the slope of the top of this unit. The coal tar also accumulated in pools in localized depressions on the top of the upper silt/clay layer. The low-permeability nature of the upper silt/clay unit has prevented the NAPL from migrating deeper, and impacting soil, underling sediments, and groundwater. Unlike coal tar, fuel oil is lighter than water and when released, will migrate vertically until it encounters the water table, and then spreads laterally.

In addition to the respective physical characteristics, coal tar contains two primary classes of chemicals: volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The most prevalent VOCs consist of benzene, toluene, ethylbenzene, and xylenes which are referred to collectively as BTEX. The most prevalent SVOCs are PAHs. An example of a PAH compound is naphthalene, which

was a key ingredient in mothballs. The PAHs are primarily responsible for producing the strong odor associated with coal tar, which in some cases has a mothball-like odor. Additionally, BTEX and PAH compounds are similarly associated with petroleum fuel oil.

While both of these chemical classes are soluble in water, VOCs dissolve more readily than the SVOCs. As a result of the solubility, groundwater in contact with coal tar and soil containing coal tar residues contains elevated concentrations of both VOCs and SVOCs. Because coal tar typically contains elevated levels of these compounds, soil samples and groundwater monitoring wells that contain coal tar need not always be analyzed; rather the levels of one or more BTEX and PAH compounds are assumed to be above applicable SCGs.

In addition, due to a higher solubility, the VOCs volatilize more readily than the SVOCs. Accordingly, the VOCs may volatilize from soil with coal tar or coal tar impacted soils and or groundwater.

Therefore for the purposes of this AAR, coal tar DNAPL, petroleum fuel oil residuals, and BTEX/PAHs are considered the COCs for this site. Physical evidence of coal tar, petroleum fuels, and elevated concentrations of BTEX and PAHs were used as the parameters for defining the extent of MGP/EGP-related impacts at the site. The following subsections present a summary of the nature and extent of environmental concerns identified for the site based on these COCs and the presence of NAPL and petroleum fuel residuals.

1.5.2.1 NAPL Characterization and Distribution

The NAPL encountered at the site presents a distinguishing petrogenic (i.e. associated with fossil fuels such as petroleum, coal) and/or pyrogenic (i.e., produced by the combustion of fuels such as petroleum, coal) nature. The DNAPL presents characteristics similar to those of tars from a low-temperature combustion process, such as the water gas process. Diesel range organics (DRO), such as fuel oil and diesel fuel, appear to be the primary source of light non-aqueous phase liquid (LNAPL) impacts identified at the site.

In general, NAPL impacts were encountered in soil samples collected throughout most of the former MGP area. NAPL was observed in soil samples collected in southern portion of the EGP, as well as the majority of the former MGP property extending west from the 30,000 and 100,000 cf gas holders formerly located just east of North Water

Street. NAPL-impacted soil is present to the west, beneath the adjacent railroad tracks and the adjacent near-shore sediments of Peekskill Bay. NAPL impacts were observed in soil samples to depths of 20 feet bgs where the upper silt/clay unit is encountered. NAPL or MGP-related impacts have not been detected in or below the uppermost portion of the upper silt/clay. The approximate extent of NAPL based on the results of site investigation activities is shown on Figure 2.

As described above, NAPL impacts from the upland portion of the site migrated laterally to near-shore areas of Peekskill Bay. Similarly to the upland portion of the site, NAPL was not observed below the silt/clay unit in Peekskill Bay sediment. Coal tar NAPL and scattered globules are encountered in sediments of the Peekskill Bay at depth intervals ranging between 0.5 and 18 feet bss within the area identified as "Extent of Impacts" on Figure 2. Potential shallow petroleum-related visual impacts (i.e., sheens and petroleum-like odors) were observed at one location (i.e., sediment sample location SD-34) outside the NAPL impacted area. Note that storm drains that discharge into Peekskill Bay from a 12-inch bypass line are located near sediment sample location SD-34. The coal tar and petroleum impacts are located within an area of less than one acre, adjacent to the shore line downgradient of the site.

As indicated previously, the former MGP operated using the Lowe carbureted water gas process. Although typically denser than water, compared to NAPL associated with coal carbonization process, NAPL associated with the carbureted water gas process is typically lighter and less viscous. The DNAPL observed at the site is consistent with NAPL associated with the carbureted water gas process. More viscous NAPL, typically associated with the coal carbonization process, was not observed during the investigation activities completed at the site.

1.5.2.2 Surface Soil Quality

Surface soil samples were collected from twelve sampling locations during the Remedial Investigation, including five locations outside the former MGP and EGP operational areas. Analytical results for the surface soil samples were compared to the 6 NYCRR Part 375-6 unrestricted use soil cleanup objectives (unrestricted SCOs). Samples collected outside the former MGP and EGP operational areas exhibited concentrations similar to those inside the operational areas, suggesting that the there is no distinct contribution from the historical operations of the MGP or EGP and that the surface soil quality represents ambient conditions for this area of Peekskill. Several specific sources of PAHs for surface soils include train operations along the railroad and urban activities (i.e., local traffic) on North Water Street, as well as

exhaust from significant traffic volume on Route 9 (Briarcliff-Peekskill Parkway) which is at elevations higher than the entire site.

1.5.2.3 Subsurface Soil Quality

Total BTEX concentrations ranged from non-detect to 4,260 milligrams per kilogram (mg/kg). The higher BTEX concentrations were detected in samples collected below 9 feet bgs and above the upper silt/clay unit. Subsurface soil samples that exhibited elevated BTEX concentrations were generally collected from locations where MGP-residuals were observed. In addition to the BTEX compounds, two other VOCs, which included a gasoline additive and a component of refined fuels (i.e., methyl tert-butyl ether [MTBE] and isopropylbenzene, respectively), were also detected in the subsurface soil samples. The presence of these VOCs suggests an additional source(s) of BTEX and other VOCs at the site.

Total PAH concentrations ranged from non-detect to 42,500 mg/kg. Samples that contained elevated concentrations of PAHs typically also exhibited physical evidence of MGP-residues or petroleum, such as odor, staining, NAPL, and/or elevated photoionization detector (PID) readings. The higher PAH concentrations were detected in soil samples collected from approximately 5 and 11 feet bgs, above the upper silt/clay unit. Similar to BTEX, soil samples contained elevated concentrations of PAHs were generally collected from locations in the vicinity of the former MGP site where MGP-residuals were observed.

At locations outside in the area identified to contain MGP residuals, soil samples did not contain total BTEX or total PAHs at concentrations greater than 10 and/or 500 mg/kg, respectively.

Subsurface soil samples also contained cyanide at concentrations ranging from 1.39 to 38.2 mg/kg. Only one subsurface soil sample, collected at the north of the site near the former EGP, contained cyanide at concentrations greater than the 6NYCRR Part 375 unrestricted use SCO (i.e. 27 mg/kg). Cyanide is not considered a COC for site soil based on the relatively low concentrations and the limited (one) occurrence above the unrestricted use SCO. Further, the one sampling location where the most elevated cyanide concentrations was detected coincided with locations where elevated BTEX and PAHs were also encountered. No physical evidence of cyanide-containing residues, such as purifier waste (wood chips, spent lime, etc.) was observed during the remedial investigation.

1.5.2.4 Groundwater Quality

Analytical results for groundwater samples collected during the remedial investigation were compared to NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (TOGS 1.1.1 Standards and Guidance Values) (NYSDEC, 2004). Analytical results indicated the following:

- One or more BTEX compounds were detected at concentrations above NYSDEC groundwater criteria at four monitoring well locations in the vicinity of and downgradient from the 30,000 and 200,000 cf gas holders and the oil tank (i.e., at monitoring wells MW-5, MW-6, MW-9 and MW-12). Total detected BTEX concentrations ranged from 0.8 to 747 micrograms per liter (µg/l).

- Select PAH compounds (acenaphthene and naphthalene) were detected at concentrations that exceeded NYSDEC groundwater criteria in several of the groundwater samples. However, the monitoring well locations that these groundwater samples were collected coincided with those where elevated concentrations of BTEX were also detected. Total detected PAH concentrations ranged from 2.3 to 2,736 µg/l.

Additionally, chlorinated VOCs compounds were detected in 17 groundwater samples and exceeded NYSDEC groundwater criteria at six monitoring well locations. However, chlorinated VOCs are not related to MGP or EGP operations.

1.5.2.5 Sediment Quality

Sediment characterization consisted of a subsurface investigation completed during the Remedial Investigation and a surface sediment and background sediment investigation conducted as part of a supplemental sediment sampling event, The supplemental sediment sampling was conducted to establish background concentrations of PAHs in surface sediments in Peekskill Bay; and determine if the surface sediments in Peekskill Bay have been affected by underlying MGP residuals that were encountered in the subsurface sediments.

As identified above in Section , Coal tar NAPL and scattered globules are encountered in sediments of the Peekskill Bay at depth intervals ranging between 0.5 and 18 feet bss within the area identified as “Extent of Impacts” on Figure 2 (herein after referred to as the area identified to contain MGP residuals). MGP residual impacts NAPL in

subsurface sediments are segregated within a less than one acre area along the shoreline of Peekskill Bay of the Hudson River downgradient from the site. The extent of NAPL identified in sediment is shown on Figure 2.

In general, elevated BTEX and PAHs concentrations were detected in subsurface sediment samples in the area identified to contain MGP residuals. The highest concentrations corresponded to NAPL-impacted lenses. TOC concentrations in subsurface sediment samples varied from 1,420 mg/kg to 148,000 mg/kg.

- BTEX compounds were detected in 33 of the 45 subsurface sediment samples collected. Total detected BTEX concentrations ranged from 0.007 to 5,314 mg/kg. BTEX compounds were detected at concentrations exceeding NYSDEC TOC adjusted screening levels in 12 subsurface sediment samples. In general, BTEX concentrations greater than NYSDEC TOC-adjusted screening levels were detected in subsurface sediment samples in the area identified to contain MGP residuals. Non-BTEX VOCs were detected in most of the 45 samples and included chlorinated and non-chlorinated solvents. However, these VOCs are not considered typical MGP or EGP constituents and may be due to operations not related to the former MGP and EGP.

- PAH compounds were detected in 40 of the 45 subsurface sediment samples collected. Total detected PAH concentrations ranged from 1.81 to 8,263 mg/kg. PAH compounds were detected at concentrations exceeding NYSDEC TOC adjusted screening levels in 30 subsurface sediment samples. Similarly to BTEX, PAH concentrations above NYSDEC TOC adjusted screening levels were detected in subsurface sediment samples in the area identified to contain MGP residuals.

A statistical background analysis was performed using USEPA ProUCL (v.4.4.01) software (USEPA, 2010) to calculate the PAH background concentrations in surface sediment. The background concentrations were defined as the 90th percentile of the data set and were calculated for Total PAH_{17} using both a data set with potential outliers removed and the full data set of background values. The resulting background concentrations were 10.5 and 29 mg/kg with the potential outliers removed and with potential outliers retained in the data set, respectively. Total PAH_{17} concentrations in surface sediments within the area of sediments containing MGP residuals were higher than the statistically estimated background concentrations. Total PAH_{17} concentrations detected in select samples collected outside the area of sediment containing MGP residuals were higher than the statistically estimated background concentrations.

However, based on the proximity to the shoreline, outfalls, railroad, and other inactive hazardous waste sites, the increased PAH concentrations in surface samples collected outside the area of sediment containing MGP residuals (i.e., NAPLs, blebs/globules) are the result of input from anthropogenic activities, storm water discharges and surface water runoff and are not related to historical operations of the former MGP/EGP. Therefore, the sediment to be addressed is limited to those in the near shore area in the area identified to contain MGP residuals.

1.5.2.6 Soil Vapor Quality

Analytical results of the 2010 IA/SG Investigation indicated that ethylbenzene, a potential MGP-related VOC, was detected at a concentration greater than its NYSDOH guidance value for indoor air. The concentration of this VOC in the corresponding soil gas sample data was less than half of the indoor air concentrations. In general, VOCs detected in soil gas are consistent with coal tar, petroleum and/or non-MGP related source materials. However, the indoor air concentrations of VOCs are likely attributed to use and storage of cleaning products, and are generally consistent with background conditions. The vapor intrusion assessment concluded that, while VOCs were detected at low to moderate concentrations in the soil vapor, there generally was no evidence of VOC migration into the respective structures.

2. Identification of Standards, Criteria, and Guidance

This AAR was prepared in general conformance with the applicable guidelines, criteria and considerations set forth DER-10 and 6 NYCRR Part 375 Environmental Remediation Programs. This section presents the SCGs that have been identified for the site.

2.1 Definitions of Standards, Criteria, and Guidance

"Standards and criteria" are cleanup standards, standards of control and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance.

"Guidance" is non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as "standards and criteria;" however, remedial programs should be designed with consideration given to guidance documents that, based on professional judgment, are determined to be applicable to the project (6 NYCRR 375-1.8[f][2][ii]).

Standards, criteria and guidance will be applied so that the selected remedy will conform to standards and criteria that are generally applicable, consistently applied and officially promulgated; and that are either directly applicable, or that are not directly applicable but relevant and appropriate, unless good cause (as defined in 6 NYCRR 375-1.8 [f][2][i]) exists why conformity should be dispensed with.

2.2 Types of Standards, Criteria, and Guidance

Potential SCGs considered in this AAR were categorized in the following classifications:

- *Chemical-Specific SCGs* – These SCGs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values for each COC. These values establish the acceptable amount or concentration of chemical constituents that may be found in, or discharged to, the ambient environment.

- *Action-Specific SCGs* – These SCGs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous waste management and remediation of the site.

- *Location-Specific SCGs* – These SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in specific locations.

2.3 Standards, Criteria, and Guidance

The SCGs identified for the evaluation of remedial alternatives are presented in the following subsections. These SCGs have been identified as potentially applicable; their actual applicability will be determined during the evaluation of a particular remedy, and further described during development of the remedial design (i.e., after the final site remedy has been selected). Each potential remedy will comply with the identified SCGs, or indicate why compliance with an SCG cannot or will not be obtained.

2.3.1 Chemical-Specific SCGs

The potential chemical-specific SCGs for the site are summarized in Table 1. As mentioned above, chemical-specific SCGs are the criteria that typically drive the remedial efforts at former MGP sites because they are most directly associated with addressing potential human exposure. The primary chemical-specific SCGs that exist for impacted soil, groundwater, and sediment at the site are briefly summarized below.

The SCOs presented in 6 NYCRR Part 375-6 are chemical-specific SCGs that are relevant and appropriate to the site. Specifically, the commercial use SCOs for the protection of public health (commercial use SCOs), are applicable given the current and anticipated future use of the site. Additionally, CP-51 *Soil Cleanup Guidance* (NYSDEC, 2010b) allows for a subsurface soil total PAH SCO of 500 mg/kg at non-residential sites (i.e., commercial and industrial use sites).

Chemical-specific SCGs that potentially apply to the waste materials generated during remedial activities are the Resource Conservation and Recovery Act (RCRA) and New York State regulations regarding identifying and listing hazardous wastes outlined in 40 Code of Federal Regulations (CFR) 261 and 6 NYCRR Part 371, respectively. Included in these regulations are the regulated levels for the Toxicity Characteristic Leaching Procedure (TCLP) constituents. The TCLP constituent levels are a set of numerical criteria at which solid waste is considered a hazardous waste by the characteristic of

toxicity. In addition, the hazardous characteristics of ignitability, reactivity and corrosivity may also apply, depending upon the results of waste characterization activities.

Another set of chemical-specific SCGs that may apply to waste materials generated at the site (e.g., soil that is excavated and determined to be a hazardous waste) are the USEPA Universal Treatment Standards/Land Disposal Restrictions (UTSs/LDRs), as listed in 40 CFR Part 268. These standards and restrictions identify hazardous wastes for which land disposal is restricted and define acceptable treatment technologies or concentration limits for those hazardous wastes on the basis of their waste code characteristics. The UTSs/LDRs also provide a set of numerical criteria at which a hazardous waste is restricted from land disposal.

Groundwater beneath the site is classified as Class GA and, as such, the New York State Groundwater Quality Standards (6 NYCRR Parts 700-705) and ambient water quality standards presented in the NYSDEC's *Division of Water, Technical and Operational Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (NYSDEC, reissued June 1998 and addended April 2000 and June 2004) (NYSDEC Class GA Standards and Guidance Values) are potentially applicable. These standards identify acceptable levels of constituents in groundwater based on potable use.

The section of the Hudson River, inclusive of Peekskill Bay, at the site is classified as Class SB saline water per 6 NYCRR 864.6 and, as such, the New York State Surface Water and Groundwater Quality Standards (6 NYCRR Parts 700-705) are potentially applicable. Specifically, 6 NYCRR Part 703.2 identifies the surface water quality standards that need to be met during in-water activities, such as standards for turbidity and generation of sheens.

No cleanup standards, criteria, or limitations are currently promulgated under federal or state laws that specifically address concentrations of hazardous substances in sediment. However, the NYSDEC document *Technical Guidance for Screening Contaminated Sediments* (NYSDEC, 1999) describes methodology for establishing screening criteria that provide a set of chemical-specific SCGs potentially applicable to site sediment.

2.3.2 Action-Specific SCGs

Potential action-specific SCGs for this site are summarized in Table 2. Action-specific SCGs include general health and safety requirements, and general requirements regarding handling and disposal of waste materials (including transportation and disposal, permitting, manifesting, disposal and treatment facilities), discharge of water generated during implementation of remedial alternatives, and air monitoring requirements for site activities (including permitting requirements for on-site treatment systems). Action-specific criteria will be identified for the selected site remedy in the remedial design work plan; compliance with these criteria will be required. Several action-specific SCGs that may be applicable to this site are briefly summarized below.

The NYSDEC Division of Air Resources (DAR) policy document *DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants* (formerly issued as Air Guide 1), incorporates applicable federal and New York State regulations and requirements pertaining to air emissions, which may be applicable for alternatives that disturb impacted soil, groundwater, or sediment resulting in air emissions. Community air monitoring would be required in accordance with the NYSDOH Generic Community Air Monitoring Plan. New York Air Quality Standards provides requirements for air emissions (6 NYCRR Parts 257). Emissions from remedial activities will meet the air quality standards based on the air quality class set forth in the New York State Air Quality Classification System (6 NYCRR Part 256) and the permit requirements in New York Permits and Certificates (6 NYCRR Part 201).

6 NYCRR Parts 370-374 and 376 and NYSDEC's *Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants* (DER-4) (NYSDEC, 2002) may be applicable to alternatives that include the disposal of impacted soil. LDRs that regulate the disposal of hazardous wastes may be applicable to alternatives involving the disposal of hazardous waste (if any). MGP-impacted material is only considered a hazardous waste in New York State if it is removed (generated) and it exhibits a characteristic of a hazardous waste. However, if the MGP-impacted material only exhibits the hazardous characteristic of toxicity for benzene (D018), it is conditionally exempt from the hazardous waste management requirements. If MGP-related hazardous wastes are destined for land disposal in New York State, the state hazardous waste regulations apply, including LDRs and alternative LDR treatment standards for hazardous waste soil.

The NYSDEC will no longer allow amendment of soil at MGP sites with lime kiln dust/ quick lime containing greater than 50% calcium and/or magnesium oxide (Ca/MgO)

due to vapor issues associated with free oxides. Guidance issued in the form of a letter from the NYSDEC to the New York State utility companies, dated May 20, 2008, indicated that lime kiln dust/quick lime will not be permitted for use during future remedial activities.

The United States Department of Transportation (USDOT) and New York State rules for the transport of hazardous materials are provided in 49 CFR Parts 107 and 171.1 through 172.558 and 6 NYCRR 372.3. These rules include procedures for packaging, labeling, manifesting and transporting hazardous materials and are potentially applicable to the transport of hazardous materials under any remedial alternative.

Section 404 of the CWA establishes site-specific pollutant limitations and performance standards that are designed to protect surface water quality, and Section 401 of the CWA requires a 401 Water Quality Certification permit be obtained for those activities that may result in a discharge to a waters of the United States. The National Pollutant Discharge Elimination System (NPDES) program is also administered in New York by the NYSDEC as a State Pollutant Discharge Elimination System (SPDES). Permitting requirements for point source discharges would be followed in support of the treatment and disposal of water generated during remedial activities along the Hudson River. A – SPDES permit equivalent will be required for those activities that may result in a discharge to the Hudson River. If the selected remedial alternative for the site results in discharges to a publicly owned treatment works (POTW) due to dewatering or other activities, discharge limits must be established with the local POTW.

Remedial alternatives conducted within the site must comply with applicable requirements outlined under the Occupational Safety and Health Administration (OSHA) general industry standards (29 CFR 1910). These standards specify time-weighted average concentrations for worker exposure to various compounds and training requirements for workers involved with hazardous waste operations. The types of safety equipment and procedures to be followed during site remediation are specified under 29 CFR 1926, and record keeping and reporting-related regulations are outlined under 29 CFR 1904.In addition to OSHA requirements, the RCRA (40 CFR 264) preparedness and prevention procedures, contingency plan and emergency procedures are potentially relevant and appropriate to those remedial alternatives that include generation, treatment or storage of hazardous wastes.

The Rivers and Harbors Act Sections 9 and 10 and the Use and Protection of Waters Program 6 NYCRR Part 608 regulate alterations of navigable waters, including disturbance of the bed or banks and excavation or fill.

2.3.3 Location-Specific SCGs

Potential location-specific SCGs for the site are summarized in Table 3. Examples of potential location-specific SCGs include regulations and federal acts concerning activities conducted in floodplains, wetlands, historical areas, and activities affecting navigable waters and endangered/threatened or rare species.

Location-specific SCGs also include local requirements, such as local building permit conditions for permanent or semi-permanent facilities constructed during the remedial activities (if any), and local pollution requirements (air and noise).

Based on the Federal Emergency Management Agency (FEMA) National Flood Insurance Program Map Number 36119C0016F, dated September 28, 2007, the upland portion of the site, west of the railroad, is located within the limits of a 100-year floodplain. Because portions of the site are located within the 100-year floodplain of the Peekskill Bay, federal floodplain management laws and regulations are potential SCGs for remedial alternatives that involve excavation or backfilling within the floodplain. Federal requirements for activities conducted within floodplains are provided in 40 CFR Part 6.

The Hudson River is navigable water, and as such, Section 10 of the Rivers and Harbors Act, the Use and Protection of Waters Program (6 NYCRR Part 608), and Section 401 of the CWA are potential SCGs for potential sediment remediation activities. The following permits from the U.S. Army Corps of Engineers (USACE) and NYSDEC will likely be required:

- Nationwide Permit #38 authorization, for “specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority”.
- 401 Water Quality Certification.

To complete the USACE review and permitting process, the following Federal and State reviews may also be required, as identified below:

- Project Reviews, Section 7 of the Endangered Species Act (ESA) and Fish and Wildlife Coordination Act of 2002 which includes consultation with both the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

- New York Natural Heritage Program Review which includes a review for information on Federally- and State-listed species.

- Section 106 Review, National Historic Preservation Act which includes a review by the New York State Historic Preservation Office (SHPO).

In addition, a Protection of Waters Permit under 6 NYCRR Part 608 may be required for remedial alternatives involving placing a cap in the navigable waters of the Hudson River below the mean high water level. However, pursuant to New York Environmental Conservation Law, Title 14, Section 27, the NYSDEC is authorized to waive state and local permits such as the use of state-owned land by New York State Office of General Services and a Protection of Waters Permit from the NYSDEC. Based on the NYS Environmental Quality Review Act implementing regulations, 6 NYCRR 617.5(c)(29), completion of the State Environmental Quality Review (SEQR) Environmental Assessment Form is not required.

According to the City of Peekskill Local Waterfront Revitalization Plan (LWRP) (City of Peekskill, 2005), there is one protected species (Atlantic sturgeon) and one endangered species (short-nose sturgeon) that are known to live in the Hudson River and are identified on the United States Fish and Wildlife Service's list of Threatened, Endangered, Sensitive Species. The presence of these species may affect the timing and environmental controls associated with potential sediment remedial activities.

Based on the New York State Coastal Consistency Map (available online at: http://appext9.dos.ny.gov/coastal_map_public/map.aspx, accessed January 2, 2013), the Peekskill Bay section of the Hudson River of the site:

- Is located within the tidal range of the Hudson River
- Is not designated as a Significant Fish and Wildlife Habitat
- Is located in the City of Peekskill local waterfront revitalization area

Therefore, the remedial activities will require review by the New York State Department of State to assess the project's consistency with the New York State Coastal Management Program and by the City of Peekskill for consistency with the Local Waterfront Revitalization Plan.

3. Development of Remedial Action Objectives

This section presents the RAOs for impacted media identified at the site. These RAOs represent medium-specific goals that are protective of public health and the environment that have been developed through consideration of the results of the site investigation activities and with reference to potential SCGs, as well as current and foreseeable future anticipated uses of the site. RAOs are developed to specify the COCs within the site, and to assist in developing goals for cleanup of COCs in each medium that may require remediation.

3.1 Risk Assessment Summary

A qualitative exposure assessment was conducted as part of the Remedial Investigation and Remedial Investigation Addendum. Based on the results of these investigations, as a well as the Supplement Sediment Investigation, the overall exposure risk at the site (including sediments) is low. As indicated above, COCs consist of PAHs, BTEX, and NAPL. Based on the exposure assessment presented in the RI Report (ENSR, 2007), media-specific conclusions regarding potential exposure pathways at the site are summarized below.

- *Surface Soil* – PAHs were detected in surface soil samples at concentrations greater than the NYSDEC 6 NYCRR Part 375-6 SCOs. The media-specific considerations for surface soil are as follows:

    - Access to surface soil for on-site workers, recreational users, and residents is generally unrestricted. However, with the exception of an unpaved parking lot the surface soil is generally covered by buildings and other structures, or located on a steep and heavily vegetated hillside. Therefore, surface soil is not exposed or readily accessible. The unpaved parking lot is located at the east side of North Water Street, where surface soils are primarily imported and do not represent a potential risk.

    - PAHs were detected in surface soil samples at concentrations below background at all but three locations near the railroad right-of-way. Elevated PAH concentrations were detected in areas of impacted subsurface soils. Access to the right-of-way by the general public and utility workers is significantly restricted by the railroad.

- The low level concentrations of PAHs are attributed to non-point sources that contribute to the general urban background, such as runoff from and airborne emissions from vehicle traffic on the Briarcliff-Peekskill Parkway (NYS Route 9); emissions from the former EGP; and/or operations of historical commercial industries in the area such as the foundry, boat yard and marina, etc.

- Based on limited accessibility to surface soils, (i.e., surface soils are largely located on a steep, heavily vegetated hillside or are covered with buildings, structures, and paved surfaces) and locations where PAHs were detected at concentrations greater than background (i.e., in the same areas where subsurface soils are also impacted), surface soil will not be considered a separate media for the purposes of the AAR.

- *Subsurface Soil* – Visual indications of NAPL were observed along with concentrations of BTEX and PAHs that exceeded SCOs in subsurface soils at the site. The media-specific considerations for subsurface soil are as follows:

  - BTEX and PAHs at concentrations that exceeded their respective SCOs were primarily detected in samples collected from areas where NAPL-impacted soils have been identified. BTEX, PAHs and NAPL impacts were generally located within the limits of the former MGP and EGP operations.

  - A potentially complete exposure pathway exists for construction and utility workers who may contact subsurface soil during future on-site intrusive work.

  - Other receptors (i.e., residents and recreational users) are not likely to contact impacted subsurface soils.

- *Groundwater* – Groundwater samples collected from site monitoring wells contained BTEX and PAHs at concentrations exceeding NYSDEC Class GA Standards and Guidance Values. The media-specific considerations for groundwater are as follows:

  - Elevated concentrations of BTEX and PAHs were generally detected in samples collected from monitoring wells located within the limits of the subsurface soil impacts.

- Groundwater at the site is not used for drinking water due to its classification as brackish and due to the low volumes of water produced by the water table aquifer.

- A potentially complete exposure pathway to groundwater containing site-related COCs and/or NAPL only exists for construction and utility workers during future on-site intrusive work.

- *Sediment* – Based on the results of the Remedial Investigation, Remedial Investigation Addendum, and Supplemental Sediment Investigation, subsurface sediment within Peekskill Bay contains visual indications of NAPL (including coal tar and globules) and concentrations of PAHs greater than a site-specific background.

  - PAH and NAPL impacts in sediment are generally limited to an area approximately one acre of Peekskill Bay adjacent to the shoreline, immediately downgradient from the former MGP (i.e., southwest of the site).

  - There are several other potential contributors of PAHs to the sediment due to the industrial/urban site setting. Site-related PAHs at concentrations greater than background appear to be limited to the area identified to contain MGP residuals.

  - Although access to the Hudson River is generally unrestricted, the frequency at which potential human receptors use and disturb sediments in the affected portion of Peekskill Bay is minimal.

- *Vapor Intrusion* – The vapor intrusion assessment showed that, while VOCs were detected at low to moderate concentrations in the soil vapor, there generally was no evidence of VOCs migration into the respective structures.

  - VOC concentrations in soil gas were generally detected in samples collected from points located within the limits of the subsurface soil impacts. It is noted that VOCs concentrations in soil gas generally dissipate to low or non-detectable levels towards the air / soil interface.

  - Potential soil vapor exposure pathways include on-site workers, and residents. However, access to the areas where VOCs are present in soil gas is restricted

and or they are covered by impervious surfaces (i.e., building foundations concrete sidewalks, asphalt paving, etc.).

- Indoor air concentrations are consistent with indoor air background levels established by NYSDOH, and are generally limited to those VOCs that are also constituents of materials and/or products that are used and/or stored inside the buildings (i.e., paints, varnishes, solvents and cleaning products).

- Based on the lack of occupants and anticipated future site use, soil vapor intrusion to indoor air is not considered a potential exposure issue at this site.

3.2 Remedial Action Objectives

RAOs are developed to specify the COCs within the site, and to assist in developing goals for cleanup of COCs in each medium that may require remediation. The RAOs presented in the following table have been developed based on the generic RAOs listed on NYSDEC's website (http://www.dec.ny.gov/regulations/67560.html).

Table 3.1 Remedial Action Objectives

RAOs for Soil and Groundwater
1. Prevent, to the extent practicable, ingestion/direct contact with soil containing MGP-related COCs and/or NAPL and groundwater containing MGP-related COCs at concentrations exceeding NYSDEC groundwater quality standards
2. Prevent, to the extent practicable, inhalation of or exposure to MGP-related COCs volatilizing from MGP-impacted soil and from groundwater containing MGP-related COCs at concentrations exceeding NYSDEC groundwater quality standards
3. Prevent, to the extent practicable, migration of MGP-related COCs and/or NAPL that could result in impacts to groundwater or surface water
4. Address, to the extent practicable, MGP-related COCs and/or NAPL as sources of soil and groundwater impacts

RAOs for Sediment
1. Prevent, to the extent practicable, direct contact with shallow and deep sediments with MGP-related COCs in the sediment area identified to contain MGP residuals.
2. Prevent, to the extent practicable, the release of MGP-related COCs and/or NAPL from sediment that would result in surface water containing MGP-related COCs at concentrations greater than ambient surface water quality criteria
3. Prevent, to the extent practicable, impacts to biota from ingestion/direct contact with sediment containing MGP-related COCs in the sediment area identified to contain MGP residuals.

Potential site-wide remedial alternatives will be evaluated based on their ability to meet the RAOs and be protective of human health and the environment.

4. Technology Screening and Development of Remedial Activities

The objective of the technology screening conducted as a part of this AAR is to present general response actions (GRAs) and associated remedial technology types and technology process options that have documented success at achieving similar RAOs at MGP sites, and to identify options that are implementable and potentially effective at addressing site-specific concerns. Based on this screening, remedial technology types and technology process options were eliminated or retained and subsequently combined into potential site-wide remedial alternatives for more detailed evaluation. This approach is also consistent with the screening and selection process provided in DER-10.

This section identifies potential remedial alternatives to address impacted media within the site limits. As an initial step, GRAs potentially capable of addressing impacted media were identified. GRAs are medium-specific and describe actions that will satisfy the RAOs. GRAs may include various non-technology specific actions such as treatment, containment, institutional controls, and excavation, or any combination of such actions. Based on the GRAs, potential remedial technology types and process options were identified and screened to determine the technologies that were the most appropriate for the site. Technologies/process options that were retained through the screening were used to develop potential remedial alternatives. Detailed evaluations of these assembled remedial alternatives are presented in Section 5.

According to DER-10, the term “technology type” refers to general categories of technologies appropriate to the site-specific conditions and impacts, such as chemical treatment, immobilization, biodegradation, capping. The term “technology process options” refers to specific processes within each remedial technology type. For each GRA identified, a series of remedial technology types and associated technology process options has been assembled. Remedial technology types and technology process options can be identified by drawing on a variety of sources, including regulatory references and standard engineering texts not specifically directed toward impacted sites. In accordance with the DER-10 guidance document, each remedial technology type and associated technology process options are briefly described and screened, on a medium-specific basis, to identify those that are technically implementable and capable of meeting the RAOs. This approach was used to determine if the application of a particular remedial technology type and technology process option is applicable given site-specific conditions for remediation of the impacted media.

4.1 General Response Actions

Based on the RAOs identified in Section 3, the following GRAs have been established for soil, groundwater, and sediment:

- No Action
- Institutional Controls/Engineering Controls
- In-Situ Containment/Controls
- In-Situ Treatment
- Removal
- Ex-Situ On-Site Treatment and/or Disposal
- Off-Site Treatment and/or Disposal

4.2 Identification of Remedial Technologies

Remedial technology types that are potentially applicable for addressing the impacted media were identified through a variety of sources, including vendor information, engineering experience, and review of available literature that included the following documents:

- *Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010)

- *Presumptive/Proven Remedial Technologies for New York States Remedial Programs* (DER-15) (NYSDEC, 2007)

- "Management of Manufactured Gas Plant Sites" (Gas Research Institute [GRI], 1996)

- *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (TAGM 4030) (NYSDEC, 1990)

- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988)

Section 4.3 of DER-10 indicates that GRAs should be established such that they give preference to presumptive remedies. Although each former MGP site offers its own unique site characteristics, the evaluation of remedial technology types and process options that are applicable to MGP-related impacts, or have been implemented at other

MGP sites, is well documented. Therefore, this collective knowledge and experience, and regulatory acceptance of previous feasibility studies performed on MGP-related sites with similar impacts, were used to reduce the universe of potentially applicable process options for the site to those with documented success in achieving similar RAOs.

This AAR briefly presents GRAs and associated technology types and quickly focuses on the process options/remedial technologies that have documented success at achieving similar RAOs at former MGP sites. The identified remedial technologies for addressing impacted media are presented in the following subsections.

4.3 Remedial Technology Screening Criteria

Potentially applicable remedial technology types and technology process options were identified for each of the GRAs, and were screened on a medium-specific basis to retain the technology types and process options that could be implemented and would potentially be effective at achieving the site-specific RAOs. Screening was conducted to identify potential technologies and technology processes to address soil, groundwater, and sediment.

Technology process options were evaluated in relative terms to other technology process options of the same remedial technology type using the following criteria:

- *Implementability* – This criterion evaluates the ability to construct and reliably operate the technology process option as well as the availability of specific equipment and technical specialists to design, install, and operate and maintain the remedy.

- *Effectiveness* – This criterion is focused on the process option's ability to meet the site-specific RAOs, either as single technology or when used in combination with other technologies.

4.4 Remedial Technology Screening

A summary of the screening of remedial technologies to address impacted soil, groundwater, and sediment is presented in the following subsections and in Tables 4, 5, and 6, respectively. As required by DER-10, the "No Action" technology has been included and retained through the screening evaluation. The "No Action" GRA will

serve as a baseline for comparing the potential overall effectiveness of the other technologies.

4.4.1 Soil

This section describes the basis for retaining representative soil remedial technology types and technology process options through the technology screening.

No Action

No action would be completed to address impacted soil. The "No Action" alternative is readily implementable and was retained to serve as a baseline against which other alternatives will be compared.

Institutional Controls

The remedial technology types identified under this GRA consist of non-intrusive controls focused on minimizing potential exposure to impacted media. The remedial technology type screened under this GRA consists of institutional controls. Technology process options screened under this remedial technology type include deed restrictions, environmental land use restrictions, enforcement and permit controls, and informational devices. Institutional controls would be utilized to limit permissible future uses of the site, as well as establish health and safety requirements to be followed during subsurface activities that could result in construction worker exposure to impacted soil.

Institutional controls will not achieve the soil RAOs as a stand-alone process, as these measures would not treat, contain or remove impacted soil. However, this process option was retained because institutional controls can be implemented in conjunction with other remedial technologies to reduce the potential for exposure to impacted soil.

In-Situ Containment/Control

Remedial technology types associated with this GRA consist of measures to address the impacted media by reducing mobility and/or the potential for exposure without removal or treatment. The remedial technology type evaluated under this GRA consists of capping. Technology process options screened under this remedial technology type include: soil cap, asphalt/concrete cap, and multimedia cap.

None of the capping technology process options were retained. While each of these technology process options is readily implementable, construction of a cap would not provide any significant reduction to potential future exposures to impacts and would not achieve a majority of the site-specific RAOs.

In-Situ Treatment

Remedial technology types associated with this GRA consist of those that treat or stabilize impacted soil in-situ (i.e., without removal). These technologies would actively address MGP-related COCs in soil to achieve the RAOs. The remedial technology types evaluated under this GRA consist of immobilization, extraction/in-situ stripping, chemical treatment, and biological treatment. Technology process options screened under these remedial technology types include:

- solidification/stabilization (immobilization)
- dynamic underground stripping and hydrous pyrolysis/oxidation (DUS/HPO) (extraction/in-situ stripping)
- chemical oxidation and surfactant/co-solvent flushing (chemical treatment)
- biodegradation, enhanced biodegradation, and biosparging (biological treatment)

Solidification/stabilization is an effective means to reduce the mobility of MGP-related COCs, eliminate free liquids, and reduce the hydraulic conductivity of NAPL-impacted soil. However, the presence of buildings, subsurface structures (i.e., former MGP structures and existing utilities) and an active railroad could limit the implementability of solidification/stabilization of soil. Therefore, solidification/stabilization was not retained.

DUS/HPO, chemical oxidation, surfactant/co-solvent flushing, biodegradation, enhanced biodegradation, and biosparging were not retained due to general ineffectiveness at addressing NAPL-impacted soil. Additionally, each of these processes would require long-term operation and monitoring due to the nature of impacts.

Specific concerns related to DUS/HPO include the potential for the uncontrolled migration of NAPL that could limit the effectiveness of the technology process option. DUS/HPO is typically more effective for addressing chlorinated solvents.

Pilot studies conducted at other former MGP sites have shown that in-situ chemical oxidation (ISCO) (including surfactant/co-solvent flushing) is only partially effective in the treatment of NAPL-impacted soil. ISCO has been shown to be effective at treating the dissolved phase impacts associated with the NAPL, but does not effectively treat soil containing NAPL. Multiple applications with large quantities of highly reactive oxidants immediately adjacent to the Hudson River would be required due to the nature and location of impacts. Based on the ineffectiveness in addressing impacted soil, oxidant would need to be administrated over the long-term.

Removal

Remedial technology types associated with this GRA consist of measures to recover impacted soil/NAPL from the ground. The remedial technology types evaluated under this GRA consist of excavation and NAPL removal. Technology process options screened under these remedial technology types include:

- excavation
- active removal, passive removal (NAPL Removal)

Excavation is a proven technology to address impacted material and would achieve several RAOs. When combined with proper handling of the excavated material, this technology process would be effective at minimizing potential future exposures. Excavation could be implemented (i.e., equipment and contractors needed to complete soil removal are readily available).

Active and passive NAPL removal are effective means to reduce the mobility of the NAPL source and can be implemented in conjunction with other remedial technologies to achieve RAOs and reduce the potential for exposure to MGP-related impacts. These technologies involve the utilization of recovery wells that actively or passively (i.e., via automated pumps or bottom-loading bailers, manually operated pumps, respectively) remove NAPL from the subsurface.

Ex-Situ On-Site Treatment and/or Disposal

Remedial technology types associated with this GRA consist of measures to treat impacted soil on-site after soil has been excavated or otherwise removed from the ground. The remedial technology types evaluated under this GRA consist of on-site ex-situ immobilization, extraction, thermal destruction, chemical treatment, and on-site disposal. Technology process options screened under these remedial technology types include:

- solidification/stabilization (immobilization)
- low-temperature thermal desorption (LTTD) (extraction)
- incineration (thermal destruction)
- chemical oxidation and soil washing (chemical treatment)
- solid waste landfill and RCRA landfill (on-site disposal)

Due to the current and anticipated future uses of the site and surrounding areas, as well as space limitations, none of the ex-situ on-site treatment and/or disposal technology types and associated technology process options are considered practicable, technically implementable (with the exception of immobilization), or administratively feasible given lack of available space, public acceptance, and potential for exposures during on-site treatment/disposal. None of these process options were retained.

Off-Site Treatment and/or Disposal

Remedial technology types associated with this GRA consist of measures to treat/dispose of impacted soil at off-site locations after soil has been removed from the ground. The remedial technology types evaluated for this GRA consist of recycle/reuse, extraction, thermal destruction, and off-site disposal. Technology process options screened under these remedial technology types include:

- asphalt concrete batching, brick/concrete manufacturer, and fuel blending/co-burn in utility boiler (recycle/reuse)
- LTTD (extraction)
- incineration (thermal destruction)
- solid waste landfill and RCRA landfill (off-site disposal)

LTTD and off-site disposal at a solid waste landfill were retained. Disposal at an off-site solid waste landfill would be reserved for material that is not appropriate for treatment via LTTD (e.g., concrete, debris). While each of these process options were retained, the final off-site treatment or disposal of waste materials will be evaluated as part of the remedial design for the selected remedy. This will allow for an evaluation of the costs associated with these potential off-site treatment/disposal processes, which can fluctuate significantly based on season, market conditions, and treatment/disposal facility capacity. In addition, multiple off-site treatment technologies could be utilized to

treat or dispose of media with different concentrations of COCs. However, for the purpose of preparing this AAR, LTTD and solid waste landfill are assumed as the off-site treatment/disposal technology process options for hazardous (D018) and non-hazardous materials (respectively) that may be generated during remedial construction.

The asphalt concrete batch plant, brick/concrete manufacturer and fuel blending/co-burn in utility boiler technology processes are not considered implementable. The number of facilities capable of implementing these process and demand for raw materials are limited. Incineration and RCRA landfill technology processes were not retained through the technology screening. The relative cost for incineration is high and although incineration would be an effective means for treating soil containing MGP-related impacts, LTTD is equally effective for treating impacted soil at a lower cost. Disposal at a RCRA landfill was not retained as material that is characteristically hazardous would still require pre-treatment to meet New York State Universal Treatment Standards (UTSs)/LDRs prior to disposal.

4.4.2 Groundwater

This section describes the basis for retaining representative groundwater remedial technology types and technology process options through the technology screening.

No Action

No action would be completed to address impacted groundwater. The “No Action” alternative is readily implementable and was retained to serve as a baseline against which other alternatives will be compared.

Institutional Controls

Remedial technology types associated with this GRA generally consist of non-intrusive administrative controls used to minimize the potential for contact with, or use of site groundwater. The remedial technology type screened under this GRA consisted of institutional controls. Technology process options for institutional controls include deed restrictions, groundwater use restrictions, enforcement and permit controls, and informational devices. This technology process is considered readily implementable and therefore, was retained. Because institutional controls would not treat, contain or remove any COCs in groundwater, institutional controls alone would not achieve the RAOs established for the site. However, institutional controls would work toward

meeting the RAO of preventing potential human exposure to groundwater containing COCs. Institutional controls could enhance the effectiveness of other technology types/technology process options when included as part of a remedial alternative.

In-Situ Containment/Controls

Remedial technology types associated with this GRA involve addressing impacted groundwater without removal or treatment. The remedial technology type evaluated under this GRA consisted of containment. Technology process options screened under this remedial technology type consisted of sheet pile walls and slurry walls. Based on the presence of existing buildings and the active railroad, the construction of a continuous barrier would present significant implementation challenges, and would likely not be effective at preventing groundwater flow to and from areas containing MGP-related impacts. However, a barrier wall could be constructed along the shore line, or a series of barrier walls could be constructed near the shoreline and in upland portions of the site, to enhance NAPL collection/recovery and mitigate the potential for further migration of NAPL (i.e., to Peekskill Bay sediment). Additional implementability challenges (including health and safety concerns) associated with installation of a barrier wall are further evaluated in Section 5). Final barrier wall construction details and location would be evaluated as part of a remedial design.

In-Situ Treatment

Remedial technology types associated with this GRA involve addressing impacted groundwater without removal. Remedial technology types evaluated under this GRA consist of biological treatment, chemical treatment and extraction. Technology process options screened under these remedial technology types included:

- Groundwater monitoring, enhanced biodegradation, and biosparging (biological treatment)
- Chemical oxidation and permeable reactive barrier (PRB) (chemical treatment)
- DUS/HPO (Extraction)

Although groundwater monitoring would be easily implemented, without source removal, it will likely not achieve groundwater RAOs as a stand-alone technology. Therefore groundwater monitoring was not retained. Enhanced biodegradation and biosparging were not retained because these technologies would not be a cost-

effective means for addressing impacted groundwater over the long-term (i.e., significant amounts of oxygen to enhance degradation required for treatment).

Based on the presence of subsurface structures and an active railroad, the implementability of a continuous barrier would be limited; consequently, PRB would not be effective at preventing groundwater flow to and from areas containing MGP-related impacts. Coal tar NAPL would inhibit the effectiveness of and could fowl a PRB.

Chemical oxidation and DUS/HPO were not retained as these processes would not be an effective means for treating NAPL (i.e., the source for dissolved phase impacts) or would result in NAPL and/or dissolved plume migration, respectively. Additionally, without a means to address the source for dissolved phase impacts (i.e., NAPL-impacted soil), ongoing treatment of dissolved phase COCs in groundwater (i.e., chemical oxidation and DUS/HPO) would not be a cost-effective means for addressing impacted groundwater over the long-term.

Removal

Remedial technology types associated with this GRA consider removal of groundwater containing MGP-related impacts for treatment and/or disposal. The remedial technology type evaluated under this GRA consisted of hydraulic control. Technology process options screened under this remedial technology type included vertical extraction wells and horizontal extraction wells.

In general, hydraulic control, by means of vertical or horizontal extraction wells would generate water that would require treatment over long periods of time. Equipment and tools necessary to install and operate vertical extraction wells are readily available. However, the site has limited space to construct and operate pump and treat equipment. Installation of horizontal extraction wells includes use of specialized drilling equipment that requires a large amount of space, and subsurface site conditions (e.g., multiple obstructions, subsurface structures, utilities, etc.) are not suitable for the installation of horizontal wells. Additionally, long-term pump-and-treat alternatives would not be an effective means to address dissolved phase impacts. Therefore, vertical and horizontal extraction wells were not retained.

Ex-Situ On-Site Treatment

Remedial technology types associated with this GRA consider the on-site treatment of extracted groundwater. The remedial technology types evaluated under this GRA

consisted of chemical treatment and physical treatment. Technology process options screened under these remedial technology types included:

- ultraviolet (UV) oxidation and chemical oxidation (chemical treatment)
- carbon adsorption, filtration, air stripping, precipitation/coagulation/flocculation, and oil/water separation (physical treatment)

As indicated above, no groundwater extraction technology process options were retained through the technology screening. Therefore, ex-situ on-site treatment technology process options will not be required. Additionally, similar to the ex-situ on-site soil treatment technologies, due to the current and anticipated future uses of the project area (i.e., mixed commercial/residential setting), none of the ex-situ on-site groundwater treatment technology process options are considered practicable given the potential for long-term exposures as a result of the construction and operation of an on-site water treatment system. Note, although not retained, ex-situ on-site treatment technology process options may be used in support of other remedial technology processes (i.e., treatment of groundwater removed during excavation activities).

Off-Site Treatment and/or Disposal

Remedial technology types associated with this GRA consider the off-site treatment/disposal of extracted groundwater. The remedial technology type evaluated under this GRA consisted of groundwater discharge. Technology process options screened under this technology type included: discharge to a local POTW, discharge to surface water, and discharge to a privately-owned and commercially operated treatment facility.

As indicated above, groundwater extraction processes are not considered effective or readily implementable and therefore, were not retained. Potential remedial alternatives will not require an ongoing discharge/disposal of treated/untreated groundwater removed from the subsurface. Similar to ex-situ on-site treatment technology process options, although not retained, off-site treatment disposal technology process options may be used in support of other remedial technology processes (i.e., disposal of groundwater removed during excavation activities).

4.4.3 Sediment

This section describes the basis for retaining representative sediment remedial technology types and technology process options through the technology screening.

No Action

No action would be completed to address impacted sediments in the Peekskill Bay of the Hudson River. The "No Action" alternative is readily implementable and was retained to serve as a baseline against which other alternatives will be compared.

Institutional Controls

The remedial technology types identified under this GRA consist of non-intrusive institutional controls (e.g., restrictions in the form of governmental, proprietary, enforcement, or permit controls and/or informational devices) focused on mitigating potential human exposure and actions that may disturb the impacted sediment. Technology process options for institutional controls include, restrictions on dredging in impacted sediment areas and/or notifications that impacted sediments are present and special procedures are required to conduct dredging could be used as institutional controls. Additionally, signs could be posted (e.g., no anchoring) as additional protection for a capped sediment area. Institutional controls may be able to partly achieve the RAOs by reducing, to the extent practicable, potential human exposure to MGP-related constituents and NAPLs, but would not reduce the potential for biota exposure. Although not able to meet all RAOs alone, institutional controls have been retained because they are readily implementable and could enhance the effectiveness and implementability of other technologies.

In-Situ Containment/Controls

Remedial technology types associated with this GRA include those that could mitigate potential human and ecological exposure to sediment in-situ. The in-situ containment/ controls remedial technology types identified for sediments included natural recovery, and capping.

The technology process option identified for natural recovery is monitored natural recovery (MNR). MNR has the potential to reduce concentrations and/or exposure to sediments containing MGP-related constituents and NAPLs via naturally occurring physical, chemical, and/or biological processes, such as burial, advection, dispersion, dissolution, sorption, photo-oxidation and biodegradation. Under MNR, periodic sampling and/or visual observations of the sediment would be required to monitor the progress of the natural recovery processes over time. MNR is readily implementable and could be implemented as a stand-alone option or as a component of an active remedial measure. MNR would be expected to meet the RAOs by reducing human and

biota exposure to sediment containing MGP-related constituents and NAPLs over time. Therefore, MNR was retained.

The process option identified under the capping remedial technology is the construction of an engineered cap, which would physically isolate sediment containing MGP-related constituents and NAPL. This process option involves covering sediments with one or more of the following materials:

- natural materials (e.g., gravel, sand, clays)
- modified natural materials (e.g., organoclays)
- synthetic materials (e.g., Aquablok™ pellets, geotextile membranes)
- armoring materials

The specific details of the engineered cap (e.g., material type, thicknesses) would be determined during the remedial design. Capping would require sediment removal to minimize and/or prevent an increase in the river bottom elevation due to material placement. Additionally, periodic monitoring and potential maintenance of the cap would be required to maintain cap effectiveness over time. Capping would be an effective means of reducing the potential mobility of MGP-related constituents through isolation and/or sequestration (if reactive material is used) that can be used as a stand-alone option or combined with other GRAs (e.g., removal, institutional controls). If properly designed, constructed, and maintained, capping would eliminate human and biota exposure to sediments containing MGP-related constituents and NAPLs. Therefore, engineered capping was retained.

In-Situ Treatment

Remedial technology types associated with this GRA consist of those that treat or stabilize impacted sediment in-situ (i.e., without removal). These technologies would actively address MGP-related COCs in sediment to achieve the RAOs. The remedial technology type evaluated under this GRA consisted of immobilization and the technology process option included solidification/stabilization. Solidification/stabilization includes adding and mixing a solidification/stabilization agent into impacted sediment to produce a stable material that limits the solubility and mobility of the NAPL and MGP-related constituents. This process option was not retained because, although it has proven to be effective in reducing the mobility and toxicity of impacts in soil, there are limited precedents for successful full-scale application in sediments and would require bench-scale pilot studies. If in-situ stabilization/solidification were performed, partial removal of sediment prior to treatment would likely be required to accommodate the

increase in riverbed elevation resulting from the mixing process and the placement of a habitat layer. In addition, the presence of obstructions (e.g., sunken barges, piling), debris, and rocks/cobbles would be expected to interfere with the mixing process and would require removal before and during the mixing. Given the relatively small area of impacted sediments to be addressed at the site, presence of known obstructions, and the removal necessary to complete the stabilization/solidification, this technology was not retained.

Removal

Dredging is the remedial technology type for the removal of sediments. Dredging would remove and reduce the volume of sediment containing MGP-related constituents and NAPL and could be implemented with other GRAs (e.g., ex-situ treatment/disposal, in-situ containment). Technology process options evaluated included mechanical (in the wet or in the dry) and hydraulic dredging.

Mechanical dredging is an effective, readily implementable technology and would achieve the RAOs for sediments. Mechanical dredging in the wet would require the installation of controls to maintain surface water quality of adjacent areas and mitigate potential migration of sediments containing MGP-related constituents and NAPL beyond the removal area. Mechanical dredging in the dry would require installation of containment (e.g., sheet piles) to separate the removal area from the river to allow the removal area to be dewatered and for work to be conducted in the dry. For the purposes of this AAR, mechanical dredging in the wet was selected as the representative process option for dredging. However, if mechanical dredging was included in the selected remedy, mechanical dredging in both the dry and the wet would be further evaluated to determine which process option was most appropriate to achieve the site-specific RAOs.

Hydraulic dredging is not appropriate considering the relatively small volume of sediment that would be removed and limited upland space available for sediment dewatering and water treatment options. Therefore, it was not retained.

Ex-Situ On-Site Treatment

Remedial technology types associated with this GRA consist of measures to treat impacted sediment on-site after sediment has been removed from the river bottom. The remedial technology types evaluated under this GRA consist of immobilization,

thermal extraction, thermal destruction, chemical destruction, and on-site disposal. Technology process options screened under these remedial technology types include:

- Solidification (immobilization)
- Low-Temperature Thermal Desorption (LTTD) (thermal extraction)
- Incineration (thermal destruction)
- Chemical oxidation (chemical destruction)
- RCRA landfill (on-site disposal)
- Confined Disposal Facility (CDF) (on-site disposal)

Due to the current and anticipated future uses of the site and the surrounding areas (i.e., commercial/residential), only solidification was considered practicable, technically implementable, or administratively feasible given the close proximity to public areas, lack of available space, public acceptance, and potential for exposures during on-site treatment/disposal. Solidification involves adding a material into the sediment as a pre-treatment or pre-disposal process to aid in dewatering and/or stabilizing sediments. Solidification is a common and proven process for solidifying impacted sediments in preparation for transportation over public roads (i.e., pass the paint filter test).

Off-Site Treatment and/or Disposal

Remedial technology types associated with this GRA consist of measures to treat/dispose of sediment at off-site locations after sediment has been removed. The remedial technology types evaluated for this GRA consist of recycle/reuse, extraction, thermal destruction, and off-site disposal. Technology process options screened under these remedial technology types include:

- asphalt concrete batching, brick/concrete manufacturer, and fuel blending/co-burn in utility boiler (recycle/reuse)
- LTTD (extraction)
- incineration (thermal destruction)
- solid waste landfill and RCRA landfill (off-site disposal)

Similarly to the screening conducted for soil, LTTD and off-site disposal at a solid waste landfill were retained. Disposal at an off-site solid waste landfill would be reserved for material that is not appropriate for treatment via LTTD (e.g., concrete,

debris). While each of these process options were retained, the final off-site treatment or disposal of waste materials will be evaluated as part of the remedial design for the selected remedy. This will allow for an evaluation of the costs associated with these potential off-site treatment/disposal processes, which can fluctuate significantly based on season, market conditions, and treatment/disposal facility capacity. In addition, multiple off-site treatment technologies could be utilized to treat or dispose of media with different concentrations of COCs. However, for the purpose of preparing this AAR, LTTD and solid waste landfill are assumed as the off-site treatment/disposal technology process options for hazardous (D018) and non-hazardous materials (respectively) that may be generated during remedial construction.

4.5 Summary of Retained Technologies

As indicated previously, results of the remedial technology screening process for soil, groundwater, and sediment are presented in Tables 4, 5, and 6, respectively. Retained remedial technologies are summarized in the following tables.

Table 4.1 Retained Soil Technologies

GRA	Technology Type	Technology Process Option
No Action	No Action	No Action
Institutional Controls	Institutional Controls	Deed Restrictions, Environmental Land Use Restrictions, Enforcement and Permit Controls, Informational Devices
Removal	Excavation NAPL Removal	Excavation Active Removal, Passive Removal
Off-Site Treatment and/or Disposal	Extraction Disposal	LTTD Solid Waste Landfill

Table 4.2 Retained Groundwater Technologies

GRA	Technology Type	Technology Process Option
No Action	No Action	No Action
In-Situ Containment/ Control	Containment	Sheet Pile, Slurry Wall/Jet Grout Wall
Institutional Controls	Institutional controls	Deed Restrictions, Groundwater Use Restrictions, Enforcement and Permit Controls, Informational Devices

Table 4.3 Retained Sediment Technologies

GRA	Technology Type	Technology Process Option
No Action	No Action	No Action
Institutional Controls/ Engineering Controls	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, and Informational Devices
In-Situ Containment/ Controls	Natural Recovery Capping	Monitored Natural Recovery Engineered Cap
Removal	Dredging	Mechanical
Off-Site Treatment and/or Disposal	Extraction Disposal	LTTD Solid Waste Landfill

4.6 Assembly of Site-Wide Remedial Alternatives

Retained remedial technology types and technology process options were combined into site-wide remedial alternatives that have the potential to achieve or work toward achieving site-specific RAOs. DER-10 requires an evaluation of the following alternatives:

- The “No-Action” alternative
- An alternative that would restore the site to pre-disposal conditions

This AAR; however, does not include a detailed evaluation of a remedial alternative that would remediate OU-1 to unrestricted use/pre-disposal conditions. This alternative would not be feasible based on the following constraints:

- Remediation to 6NYCRR Part 375-6 unrestricted use SCOs would require demolition of numerous building not owned by Con Edison. Based on existing data, MGP impacts may potentially exist beneath existing buildings. Existing buildings overlying the impacted area have been used by multiple commercial businesses, and one is currently occupied by a homeless shelter. In-situ technologies do not exist that could effectively and safely remove NAPL and/or NAPL-impacted soil beneath the buildings given the nature of the subsurface (fill materials, cribbing, potential preferred migration pathways, etc.). To excavate beneath the buildings, the commercial businesses and homeless shelter would need to be re-located.

- Remediation to 6NYCRR Part 375-6 unrestricted use SCOs would require excavation below the railroad. The railroad tracks that transect the site are a mainline for commuter trains that operate between New York City and surrounding Upstate areas. High-speed commuter trains use the railroad multiple times per hour. Excavation of soil below the railroad would require removal of the tracks and would thereby cause a severe disruption to railroad operations. Excavation below the railroad is not considered administratively feasible or technically practicable.

- Remediation to 6NYCRR Part 375-6 unrestricted use SCOs would require excavation below the three large-diameter sanitary sewer force main conveyance pipes present in the subsurface between the train track and the east side of the buildings. These force mains are operated by Westchester County and actively transfer raw sewage for the City of Peekskill to the treatment plant located north of the site along Annsville Creek. Excavation of soil below the force mains would require removal and temporary rerouting of the active sewer pipes. Excavation below the force mains is not considered administratively feasible or technically practicable.

Furthermore, implementing a remedial alternative that would include excavation activities to achieve unrestricted use pre-disposal conditions and the associated relocation of commercial businesses, the railroad and/or sewer mains would provide minimal added benefit to human health and the environment as there is no exposure pathway under the current and intended site use. Such an alternative is not anticipated

to receive public support, and is considered highly impractical from both an administrative and cost standpoint.

Therefore, potential remedial alternatives were developed based on:

- Current, intended and reasonably anticipated future use of the site
- Removal of source area(s) of MGP-related contamination
- Containment of source areas of MGP-related contamination

These remedial considerations require varying levels of remediation but provide protection of public health and the environment by preventing or minimizing exposure to the COCs through the use of institutional controls; removing COCs to the extent possible thereby minimizing the need for long-term management; and treating COCs, but vary in the degree of treatment employed and long-term management needed.

4.6.1 Alternative 1 – No Action

The "No Action" alternative was retained for evaluation as required by DER-10. Under this alternative, no remedial activities would be completed to address site-related impacts. The "No Action" alternative serves as the baseline for comparison of the overall effectiveness of the other remedial alternatives. The "No Action" alternative would not involve implementation of any remedial activities but would rely on the current inaccessibility of impacted media to serve as a barrier against potential casual exposure and the naturally-occurring degradation of MGP-related impacts over time to address the COCs in the environmental site media. The site would be allowed to remain in its current condition and no specific action would be made to change or monitor future site conditions.

4.6.2 Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment

Under this alternative, excavation activities would be conducted in the parcel along the east side of North Water Street in vicinity of the former gas holders (i.e., 30,000 and 100,000 cf gas holders) and the fuel oil tank to remove MGP structure foundations; visually impacted soil; and soil containing total PAHs at concentrations >500 mg/kg. Depending on cooperation by the property owner and physical constraints (e.g., structural integrity of building at 400 Main street, etc.), Con Edison will consider excavation of soil containing COCs at concentrations greater than 6 NYCRR Part 375-6 unrestricted use SCOs to the top of weathered bedrock in this area.

Two arrays of NAPL collection points would be installed to collect potentially mobile NAPL; one between the former MGP and the railroad in OU-1; and the second on the river-side of the railroad in OU-2.

NAPL-impacted sediment would be capped in-place. Prior to capping, debris (including but not limited to wooden piles and submerged barges) and sediment would be addressed (removed or cut down) to accommodate the design thickness of the cap. Long-term cap monitoring would be conducted to confirm that the cap remains in place and effective. This alternative would also include monitoring natural recovery (i.e., visually monitoring) of the surface sediments at and in the immediate vicinity of sediment sampling location SD-34.

Institutional controls (i.e., deed restrictions) would be established to identify protective measures that would be implemented during future development and or intrusive activities at the site. An SMP would be prepared to document procedures and restrictions for conducting future invasive activities at the site to reduce the potential for disturbance of, or damage to, the cap and methods to repair any such disturbances.

4.6.3 Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment

Alternative 3 would include the same upland excavation and institutional control components as Alternative 2. Additionally, Alternative 3 would include the installation of a NAPL barrier in OU-2 along the approximate mean high-water level of Peekskill Bay (to the extent feasible). The NAPL barrier would serve a means to mitigate additional potentially mobile NAPL from migrating into Peekskill Bay sediment and may enhance the collection and recovery of NAPL via the NAPL collection points.

Under Alternative 3, sediment containing MGP-related impacts would be removed to depths up to 5 feet bss and visually impacted sediment in the vicinity of sediment sampling location SD-34 would be removed to a depth up to 2 feet bss. Similar to the capping component of Alternative 2, an engineered cap would be installed above NAPL-impacted sediment (i.e., that would remain at depths from 5 to 18 feet bss). Wooden piles, sunken barges, and other debris would be removed or cut down to the extent necessary to facilitate sediment removal and placement of the engineered cap. The removal area would be backfilled to meet the pre-removal lines and grades. Where NAPL-impacted sediment remains (i.e., below 5 feet bss), a long-term cap monitoring program would be implemented to document the stability of the engineered cap materials. Institutional controls would be established to reduce the potential for

disturbance of, or damage to, the engineered cap placed above remaining NAPL-impacted sediment (i.e., at depths greater than 5 feet bss).

4.6.4 Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment

Alternative 4 would include the same upland excavation, barrier wall, NAPL recovery, and institutional control components as Alternative 3. Alternative 4 would also include removal of shallow and deep NAPL-impacted sediment (i.e., sediment containing NAPL at depths up to 18 feet bss). No long-term sediment monitoring would be necessary as the sediment containing MGP-related impacts would be removed.

5. Detailed Evaluation of Remedial Alternatives

This section presents detailed descriptions of the remedial alternatives developed to address site impacts. Each of the retained remedial alternatives is evaluated with respect to the criteria presented in DER-10. The results of the detailed evaluation of remedial alternatives are used to aid in the recommendation of a preferred remedial alternative for addressing impacted site media.

5.1 Description of Evaluation Criteria

Consistent with DER-10, the detailed evaluation of remedial alternatives presented in this section consists of an evaluation of each assembled alternative (presented in Section 4.6) against the following criteria:

- Short-Term Impacts and Effectiveness
- Long-Term Effectiveness and Permanence
- Land Use
- Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment
- Implementability
- Compliance with SCGs
- Overall Protection of Public Health and the Environment
- Cost Effectiveness

Descriptions of the evaluation criteria are presented in the following sections. Additional criteria, including community acceptance, will be addressed following submittal of this AAR.

Per DER-10, sustainability and green remediation will also be considered in the remedial evaluation with the goal of improving the sustainability of the selected remedy. The evaluation will consider the alternative's ability to minimize energy use; reduce greenhouse gas and other emissions; maximize reuse of land and recycling of materials; and preserve, enhance, or create natural habitats, etc. Sustainability and green remediation will be discussed under the short-term impacts and effectiveness criterion.

5.1.1 Short-Term Impacts and Effectiveness

The short-term effectiveness of the remedial alternative is evaluated relative to its potential effect on public health and the environment during implementation of the

alternative. The evaluation of each alternative with respect to its short-term effectiveness will consider the following:

- Potential short-term adverse impacts and nuisances to which the public and environment may be exposed during implementation of the alternative.
- Potential impacts to workers during implementation of the remedial actions and the effectiveness and reliability of protective measures.
- Amount of time required until protection of public health and the environment is achieved.
- The sustainability and use of green remediation practices utilized during implementation of the remedy.

5.1.2 Long-Term Effectiveness and Permanence

The evaluation of each remedial alternative relative to its long-term effectiveness and permanence is made by considering the risks that may remain following completion of the remedial alternative. The following factors will be assessed in the evaluation of the alternative's long-term effectiveness and permanence:

- Potential impacts to human receptors, ecological receptors, and the environment from untreated waste or treatment residuals remaining at the completion of the remedial alternative.
- The adequacy and reliability of institutional and/or engineering controls (if any) that will be used to manage treatment residuals or remaining untreated impacted media.

5.1.3 Land Use

This criterion evaluates the current and intended future land use of the site when unrestricted use cleanup levels would not be achieved. This evaluation considers local zoning laws, proximity to residential property, accessibility to infrastructure, and proximity to natural resources including groundwater drinking supplies.

5.1.4 Reduction of Toxicity, Mobility, and Volume of Contamination through Treatment

This evaluation criterion addresses the degree to which the remedial alternative will permanently and significantly reduce the toxicity, mobility, or volume of the constituents present in the site media through treatment technologies.

5.1.5 Implementability

This criterion addresses the technical and administrative feasibility of implementing the remedial alternative, including the availability of the various services and materials required for implementation. The following factors will be considered during the implementability evaluation:

- *Technical Feasibility* – This factor considers the remedial alternative's constructability, as well as the ability to monitor the effectiveness of the remedial alternative.

- *Administrative Feasibility* – This factor refers to the availability of necessary personnel and material along with potential difficulties in obtaining approvals for long-term operation of treatment systems, access agreements for construction, and acquiring necessary approvals and permits for remedial construction.

5.1.6 Compliance with SCGs

This criterion evaluates the remedial alternative's ability to comply with SCGs that were identified in Section 2. Compliance with the following items is considered during evaluation of the remedial alternative:

- Chemical-specific SCGs
- Action-specific SCGs
- Location-specific SCGs

Applicable chemical-, action-, and location-specific SCGs are presented in Tables 1, 2 and 3, respectively.

5.1.7 Overall Protection of Public Health and the Environment

This criterion evaluates whether the remedial alternative provides adequate protection of public health and the environment based on a combination of the above-listed

criteria including: long-term effectiveness and permanence; short-term impacts and effectiveness; and compliance with SCGs. This evaluation also considers the ability of the remedial alternative to meet the site-specific RAOs.

5.1.8 Cost Effectiveness

This criterion evaluates the overall cost of the alternative relative to the effectiveness of the alternative (i.e., cost compared to long-term effectiveness and permanence, short-term impacts and effectiveness, and reduction of toxicity, mobility, and volume through treatment).

The estimated total cost to implement the remedial alternative is based on a present worth analysis of the sum of the direct capital costs (materials, equipment, and labor), indirect capital costs (engineering, licenses/permits, and contingency allowances), and operation and maintenance (O&M) costs. O&M costs may include future site management, operating labor, energy, chemicals, and sampling and analysis. These costs will be estimated with an anticipated accuracy between -30% to +50%. A 20% contingency factor is included to cover unforeseen costs incurred during implementation of the remedial alternative. Present-worth costs are calculated for alternatives expected to last more than 2 years. A 4% discount (i.e., interest) rate is used to determine the present-worth factor.

5.2 Detailed Evaluation of Alternatives

This section presents the detailed analysis of each of the site-wide alternatives previously identified in Section 4.

- Alternative 1 – No Action
- Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment
- Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment
- Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment

Each alternative is evaluated against the evaluation criteria described above (as indicated, public acceptance will be evaluated following submittal of this AAR).

5.2.1 Alternative 1 – No Action

The "No Action" alternative was retained for evaluation for each of the environmental media to be addressed at the site as required by DER-10. The "No Action" alternative serves as the baseline for comparison of the overall effectiveness of the other remedial alternatives. The "No Action" alternative would not involve implementation of any remedial activities to address MGP-related impacts in OU-2. OU-2 would be allowed to remain in its current condition and no effort would be made to change or monitor site conditions over time.

Short-Term Impacts and Effectiveness – Alternative 1

No remedial actions would be implemented to address impacted environmental media within the limits of the MGP site. Therefore, neither short-term environmental impacts nor risks associated with remedial activities would be posed to the community.

Long-Term Effectiveness and Permanence – Alternative 1

Under the "No Action" alternative, MGP-related impacts in the site's media would not be actively addressed nor would the potential for on-going releases and/or migration of MGP-related impacts. As a result, this alternative would not meet the RAOs identified for OU-1 and OU-2, and; therefore is not considered effective on a long-term basis.

Based on the presence of NAPL, natural recovery of soil and/or sediment would not be anticipated to occur in a foreseeable time frame.

Land Use – Alternative 1

The current zoning for the site is listed as inland water front development in a mixed commercial and manufacturing area. Areas immediately surrounding the site are zoned for commercial and residential use. The current and foreseeable future use of the area surrounding the site is a mixed commercial/residential setting. Based on the current and anticipated future land use of the site, the potential for exposure to subsurface soil and groundwater containing MGP-related COCs is minimal. The majority of the site is covered with asphalt, concrete, buildings, or vegetated soil, and there is little to no need to conduct subsurface activities at the site. Additionally, drinking water is currently

and will continue to be provided via a public supply. Therefore, groundwater containing MGP-related COCs is not currently and is not anticipated to be used in the future for potable (or other) purposes.

The Hudson River inclusive of Peekskill Bay is classified for use as primary and secondary contact recreation and fishing, and suitable for fish propagation and survival (Class SB). This portion of the bay is not known to be particularly active for recreational use.

No remedial actions would be completed under this alternative and the site would remain in its current condition. As routine site activities do not include exposure to MGP-related impacts in soil and groundwater, the "No Action" alternative would not alter the anticipated future intended use of the site.

Reduction of Toxicity, Mobility or Volume of Contamination through Treatment – Alternative 1

Under the "No Action" alternative, environmental media would not be treated (other than by natural processes), recycled, or destroyed. Therefore, the toxicity, mobility, and volume of environmental media containing MGP-related impacts within the limits of the site would not be reduced.

Implementability – Alternative 1

The "No Action" alternative does not require implementation of any remedial activities, and therefore is technically and administratively implementable.

Compliance with SCGs – Alternative 1

- *Chemical-Specific SCGs* – Because removal or treatment is not included as part of this alternative, the chemical-specific SCGs identified for the site would not be met by this alternative.

- *Action-Specific SCGs* – This alternative does not involve implementation of any remedial activities; therefore, the action-specific SCGs are not applicable.

- *Location-Specific SCGs* – Because no remedial activities would be conducted under this alternative, the location-specific SCGs are not applicable.

Overall Protection of Public Health and the Environment – Alternative 1

The "No Action" alternative does not address the toxicity, mobility, or volume of impacted environmental media at the site and is not effective in the short term or on a long-term basis for eliminating potential migration or potential exposure to impacts. Therefore, the "No Action" alternative would be ineffective and would not meet the RAOs established for the site.

Cost Effectiveness – Alternative 1

The "No Action" alternative does not involve implementation of any active remedial activities or monitoring; therefore, there are no costs associated with this alternative.

5.2.2 Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment

The major components of Alternative 2 are listed in the following table.

Table 5.1 Alternative 2 Components

OU-1	OU-2
• Removing the remnant foundations of former 30,000 cf, 100,000 cf gas holders and 25,000 gallon fuel oil tank and related structures • Excavating NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 • Managing/disposing or treating/ discharging groundwater from the excavation area • Installing NAPL recovery wells • Implementing a NAPL recovery program • Establishing institutional controls and developing an SMP	• Installing NAPL recovery wells • Implementing a NAPL recovery program • Excavating shallow sediments (approximately 2 ft bss) to allow capping in the area identified to contain MGP residuals. • Monitoring natural recovery for potential site-related impacts in the SD-34 area • Conducting long-term cap and sediment monitoring • Establishing institutional controls and developing an SMP

Soil and MGP Structure Removal

Alternative 2 would address accessible NAPL-impacted soil through the removal of the former 30,000 and 100,000 cf gas holders and 25,000 gallon fuel oil tank. Additionally, soil containing total PAHs at concentrations >500 mg/kg would be excavated in Lot 7. Con Edison will consider excavation of soil containing COCs at concentrations greater than 6 NYCRR Part 375-6 unrestricted use SCOs to the top of weathered bedrock in this area. Anticipated soil removal limits are shown on Figure 3. Alternative 2 would include the excavation of up to approximately 2,800 cubic yards of material. As part of the remedial activities, the former battery house may be demolished. Con Edison does not own Lot 7 (Block 5), access agreements would have to be secured with the current property owner in order to access the property to perform the remedial action. Con Edison in concert with the property owner would determine the economic feasibility of demolishing the former battery house structure and conducting soil excavation activities in this area of the property. Excavation activities would be conducted using conventional construction equipment such as backhoes, excavators, front-end loaders, dump trucks, etc. Based on the proposed extent/depth of removal activities, excavation support systems would be required. For the purpose of developing a cost estimate, it has been assumed that excavation support would consist of steel sheet piles installed to the top of weathered bedrock and equipped with tie-backs. The final support system/excavation plan would be developed as part of the remedial design for this alternative.

The water table in this area is encountered at a depth of approximately 5 feet below grade. Dependent upon the water control measures implemented, water may be managed and containerized for off-site disposal or treated and discharged. For the purposes of this FS, we have assumed that water would be containerized and transported for off-site treatment/disposal.

In support of developing a cost estimate, it has been assumed that 25% of excavated material would consist of debris and be transported off-site for disposal as a non-hazardous waste at a solid waste facility and 75% of excavated material would consist of potentially impacted soil and be transported off-site for treatment/disposal via LTTD. Excavation areas would be restored with clean backfill material to match the previously existing lines and grades. Surface restoration details would be developed as part of the remedial design.

NAPL Recovery Wells and NAPL Monitoring

As part of Alternative 2, two arrays of NAPL collection points would be installed to collect potentially mobile NAPL; one between the former MGP and the railroad in OU-1; and the second on the river-side of the railroad in OU-2. For the purpose of developing a cost estimate for this alternative, it has been assumed, that up to 25 stainless steel NAPL recovery wells would be installed to an average depth of 20 feet below grade and the wells would be equipped with sumps for NAPL collection. The final number, location, type, and construction of the NAPL collection points would be determined during the remedial design of this alternative.

Following installation of the wells, a long-term NAPL monitoring and recovery program would be conducted to reduce the volume/mass of NAPL in the upland area and reduce the potential for future migration of NAPL to Peekskill Bay sediments. NAPL recovery may be conducted passively by periodic manual bailing or by periodically pumping (with a portable pump) NAPL from the wells. If warranted based on the rate of NAPL recovery, NAPL could be removed via an automated pumping system. Under an automated pumping scenario, NAPL would be pumped from the wells and stored within a structure(s) that would have to be constructed near the wells (either above or below grade). For the purpose of developing a cost estimate for this alternative, the NAPL recovery activities are assumed to consist of passive NAPL collection with manual recovery conducted for 30 years. NAPL collection wells would be initially monitored on a semi-annual basis. If recoverable quantities of NAPL are not observed during multiple consecutive NAPL monitoring events (e.g., four consecutive semi-annual monitoring events), Con Edison may request to conduct NAPL monitoring/ recovery less frequently or cease NAPL monitoring altogether.

Sediment Capping and Monitoring

Under Alternative 2, sediment containing MGP-related NAPL would be capped in-place to physically isolate the sediment and mitigate potential future exposure to MGP-related impacts. Anticipated capping areas are shown on Figure 3. Based on the presence of the railroad (i.e., limited river access and available land for support areas), it has been assumed that all sediment remedial activities would be performed from the water.

An approximately 34,400 square-foot area would be targeted for cap placement. Prior to capping, debris (including but not limited to wooden piles and submerged barges) and sediment would be removed or cut-off below grade from this area to accommodate

the placement of the design thickness of the cap. It is anticipated that debris would be addressed through removal via a barge-mounted crane or excavator or by cutting piles below the top of sediment surface, with these materials loaded onto scows for transport to an off-site processing and handling facility (e.g., Clean Earth in Jersey City, New Jersey) and final disposition in a permitted non-hazardous waste landfill. For the purposes of developing a cost estimate for this alternative, it is assumed that 2 feet of sediment would be removed prior to placement of the cap. Sediment removal would be performed by mechanical dredging in the wet (e.g., using an excavator or crane positioned on barge). The dredged sediment would be loaded into barges and transported to an off-site facility for processing and handling (e.g., stabilization) with subsequent disposal at an LTTD disposal facility. Off-site facilities for debris and sediment processing and disposal would be evaluated and selected during the remedial design and implementation phases.

Following debris/obstruction removal and dredging, an engineered cap would be placed using a crane operating from a floating work platform. Divers would be used, as necessary, during cap installation to assist with cap placement and positioning activities. The engineered cap would be designed to limit the upward migration of NAPL, provide protection against erosional forces (i.e., scour), to the extent necessary. However, this section of Peekskill Bay is a low energy environment and is not likely to scour. Additionally appropriate fill material will be placed to provide a surface habitat layer to facilitate natural recolonizing by native biota. For the purposes of this AAR, the cap is assumed to consist of (from the bottom up) a reactive core mat (containing 0.25 inches of organoclay) or equivalent, overlain by a 24-inch silt/sand layer. The silt/sand materials would be designed to mimic the existing sediment characteristics; would serve to protect the sorption layer; replace the benthic habitat to facilitate natural recolonization by native biota; and would meet the NYSDEC sediment quality guidelines. Stability of this configuration would be verified during remedial design. If feasible, the use of natural sediment deposition (in lieu of and/or in conjunction with the imported silt/sand layer) would be evaluated as a means to replace the removed sediments. The actual cap thickness, materials, and configuration would be determined during the remedial design of this alternative.

Additionally, MNR would be performed at sediment sampling location SD-34 to qualitatively assess the progress of naturally-occurring physical/chemical processes to degrade the residual visual impacts identified in this area. A long-term monitoring and maintenance program would be implemented to document and maintain the effectiveness of the engineered cap, as well as monitor natural recovery in the vicinity of SD-34. It is anticipated that monitoring activities would consist of visual inspections

(watercraft and/or diver assisted) of the engineered cap and MNR area. Surface sediment samples would also be collected in the vicinity of SD-34 for visual characterization. For the purposes of this AAR, it has been assumed that sediment/cap monitoring would be conducted biennially for the first 5 years (i.e., years 1, 3, and 5) and then once every 5 years (i.e., up to year 30). Inspections of the cap may also be conducted following episodic events (e.g., extreme high flow events). Any disturbance or damage to the cap observed during monitoring activities would be addressed appropriately to maintain the long-term effectiveness of the cap. For the purpose of developing a cost estimate, it has been assumed that approximately 20% of cap materials would require replacement and/or maintenance every 5 years.

Pre-Design Investigation

Pre-design investigation (PDI) activities may be conducted, as deemed necessary to support the remedial design of Alternative 2.

Institutional Controls

Alternative 2 would also include establishing institutional controls in the form of a deed restriction. The deed restriction would identify acceptable site use based on site conditions that would persist after completion of Alternative 2. Specifically, the institutional controls would limit intrusive (i.e., subsurface) activities that could result in potential exposures to remaining soil and groundwater media containing MGP-related impacts at concentrations greater than applicable standards and guidance values. Although potable water is provided by a municipal supply, the institutional controls would also prohibit the use of groundwater from the site. The institutional controls would also prohibit activities that could potentially jeopardize the integrity of the sediment cap. Other potential institutional controls could include placement of signs along the banks to deter future disturbance of the engineered cap (e.g., no dredging or anchoring). An annual report would be submitted to NYSDEC to document that institutional controls are maintained and remain effective.

Site Management Plan

The SMP would be prepared in accordance with DER-10 and would summarize existing site conditions, responsibilities of the owner and Con Edison, including notifications prior to intrusive work, etc..

Short-Term Impacts and Effectiveness – Alternative 2

Implementation of this alternative could result in short-term exposure of the surrounding community and workers to COCs as a result of soil excavation, sediment and debris removal, sediment capping, material handling, and off-site transportation activities, and sediment monitoring/sampling efforts. Potential exposure mechanisms would include ingestion and dermal contact with NAPL, impacted soil, sediment, and/or groundwater; and inhalation of volatile organic vapors or dust containing COCs during remedial construction. Potential exposure of remedial workers would be minimized through the use of appropriately trained field personnel and personal protective equipment (PPE), as specified in a site-specific health and safety plan (HASP) that would be developed as part of the remedial design.

Short-term impacts to the environment could include impacts to the water column from sediment re-suspension and biota due to temporary alteration/destruction of existing habitat in the area targeted for capping. Selected backfill materials would provide a surface habitat layer to facilitate natural recolonizing by native biota. Off-site transportation of excavated soil and importation of clean fill materials would result in approximately 370 truck round trips (assuming 25 tons per truck). Sediment capping activities (i.e., off-site transportation of removed sediment and importation of fill/cap materials) would result in approximately 16 barge trips (assuming 750 tons per barge) on the Hudson River. Specific logistical components, such as alternative disposal, treatment, backfilling would be determined during the remedial design.

For the purpose of evaluating this alternative, it is assumed that soil excavation/ backfilling and NAPL recovery well installation activities could be completed in approximately 4 months. Similarly, it is assumed that sediment capping activities would be completed in approximately 6 months. NAPL monitoring/recovery activities would be conducted over an assumed 30-year period. Actual durations will be assessed during design.

Long-Term Effectiveness and Permanence – Alternative 2

Under Alternative 2, former MGP structures and associated grossly impacted soil in Lot 7 (Block 5) would be excavated and transported off-site for treatment/disposal. However, NAPL and impacted soil would remain beneath paved surfaces and existing buildings (i.e., North Water Street, existing buildings south of North Water Street); below sewer force mains located west of the building; below the railroad; and in upland areas between the railroad and Peekskill Bay, which provide a physical barrier to

subsurface impacts. NAPL recovery would be conducted to reduce the volume of mobile NAPL present at the site (and reduce the potential for migration to Peekskill Bay sediment). Because impacted material would remain in the subsurface soil below the water table, dissolved phase COC concentrations would likely not be significantly reduced following remedial construction activities.

Installation of a cap over sediment in the area identified to contain MGP residuals would reduce the potential for future human and ecological exposures to impacted sediment over the long term. Based on the existing data, the coal tar NAPL is generally located within deeper sediments and appears to be in a stable configuration. This is consistent with the long duration between the end of the MGP operations/release of the coal tar and its historic transport along the top of the ubiquitous low-permeability clay layer that extends from the upland areas to beneath the sediments in Peekskill Bay. This also supports the limited potential for upward migration from the deep to the shallow sediments. Cap materials (e.g., organoclay) would provide a sorptive layer to mitigate potential upward migration of NAPL from the deep to shallow sediments. Cap surface material (i.e., silt and clay) would provide a surface habitat layer to facilitate natural recolonization by native biota. An inspection and maintenance program would be implemented to maintain the effectiveness of the cap following remedial construction.

The long-term effectiveness of Alternative 2 would be dependent on adhering to the institutional controls and following the SMP (to reduce the potential for exposures to remaining impacted soil, groundwater, and sediment). Annual verification of the institutional controls would be completed to document that the controls are maintained and remain effective.

Land Use – Alternative 2

The current zoning for the site is listed as inland water front development in a mixed commercial and manufacturing area. Areas immediately surrounding the site are zoned for commercial and residential use. The current and foreseeable future use of the area surrounding the site is a mixed commercial/residential setting. Based on the current and anticipated future land use of the site, the potential for exposure to subsurface soil and groundwater containing MGP-related COCs is minimal. The majority of the site is covered with asphalt, concrete, buildings, or vegetated soil, and there is little to no need to conduct subsurface activities at the site. Additionally, drinking water is currently and will continue to be provided via a public supply. Therefore, groundwater containing

MGP-related COCs is not currently and is not currently anticipated to be used for potable (or other) purposes.

Implementation of Alternative 2 is not anticipated to alter the current or anticipated future use of the site. Although excavation activities would cause a short-term disruption to the surrounding community, Lot 7 would be restored following remedial construction. Institutional controls would limit invasive upland and sediment activities that could be conducted at the site; however, there is little need to conduct future intrusive activities other than utility maintenance/installation. Recreational activities in the river may also be limited in the cap areas to prevent disturbance of the cap materials through activities such as boat anchoring.

This alternative would provide a clean benthic zone and a cap over impacted sediment that would remain at the site. This would promote future use of the Hudson River in this area for its classified purpose for recreation and fishing, and fish propagation and survival.

Reduction of Toxicity, Mobility or Volume of Contamination through Treatment – Alternative 2

Alternative 2 would include the excavation of up to approximately 2,800 cy of material to address remnant subsurface structures, such as holder foundations and associated NAPL-impacted soil and soil containing total PAHs at concentrations >500 mg/kg in Lot 7 (Block 5).

Alternative 2 also includes installation of NAPL recovery wells and periodic NAPL monitoring/recovery to reduce NAPL mass/volume and the potential for future migration of NAPL to subsurface sediments beneath the area of Peekskill Bay immediately adjacent to the site. NAPL removal would also reduce the volume of material that is serving as a source to dissolved phase groundwater impacts.

Alternative 2 would result in the removal and disposal of approximately 3,800 cy of sediment (i.e., the top 2 feet of sediment) to accommodate placement of the sediment cap. Removed soil, NAPL, and sediment would be transported off-site for treatment using LTTD and/or disposal.

Implementability – Alternative 2

Alternative 2 would be both technically and administratively feasible. Removal and off-site disposal of soil and sediment, cap construction, and monitoring are technically

feasible and remedial contractors capable of performing the activities are readily available. Potential implementation challenges associated with conducting soil excavation and NAPL recovery well installation and monitoring activities include: limited working and laydown areas for remedial construction equipment and materials; maintaining local vehicle traffic on North Water Street; and conducting excavation activities in close proximity to an active road and an active railroad track. Transportation planning, which will include loading constraints, trucking routes, etc., would be performed as part of remedial planning activities.

There are also several potential technical implementation challenges associated with the sediment remediation. As indicated previously, based on the current lack of available work areas and access to potable water at the site, all sediment removal/capping activities would be completed from the bay. In addition, the presence of debris and other potential obstructions located within the target cap area (e.g., wooden piles and submerged barges) would have to be addressed prior to or as part of sediment removal/ capping activities. Dredged material would be barged to an off-site processing and handling location prior to final transportation and disposal and/or treatment. Accessibility issues (e.g., low tide access) and structural considerations (e.g., bank stability) would be evaluated during the design phase.

Administratively, as Con Edison does not own Lot 7 (Block 5), access agreements would have to be secured with the current property owner in order to access the property to perform the remedial action. Con Edison in concert with the property owner would determine the economic feasibility of demolishing the former battery house structure and conducting soil excavation activities in this area of the property. Access agreements with the current property owners, the railroad, Westchester County and the City of Peekskill would likely also be required for the installation and operation of the NAPL recovery wells (between existing buildings and the railroad and in the upland area between the railroad and Peekskill Bay) and to conduct long-term periodic NAPL monitoring/recovery. Additionally, establishing institutional controls in the upland area (i.e., on properties not owned by Con Edison) would require coordination with the current property owners, the railroad, County, City and NYSDEC.

Construction of a sediment cap would require coordination with NYSDEC, NYS Fish and Wildlife, USACE, etc. Coordination would be required to obtain the appropriate access and permits, and to verify that sediment remedial activities would be compatible with local water front development plans. Institutional controls would also be established for the capped sediment areas, requiring coordination with state and/or local agencies.

Compliance with SCGs – Alternative 2

- *Chemical-Specific SCGs* – Potentially applicable chemical-specific SCGs for soil include 6 NYCRR Part 375-6 soil cleanup objectives. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values. Potential chemical-specific SCGs for sediment include sediment screening levels established in the NYSDEC document *Technical Guidance for Screening Contaminated Sediment* (NYSDEC, 1999).

  At a minimum, former MGP structures and soil containing PAHs at concentration greater than 500 mg/kg will be excavated from Lot 7 (Block 5). Con Edison will consider excavation of soil containing COCs at concentrations greater than 6 NYCRR Part 375-6 unrestricted use SCOs to the top of weathered bedrock in this area from Lot 7 (Block 5). A majority of soil remaining in the upland portion of the site would contain MGP-related impacts, but would be located beneath paved surfaces and existing buildings as well as beneath the sewer force mains and railroad tracks located west of the existing buildings. Although this alternative includes NAPL recovery, impacted soil would remain in the upland area and this alternative would likely not achieve groundwater SCGs in the short term.

  Placement of a cap over sediment in the area identified to contain MGP residuals would cover sediment containing site-related COCs. This would provide a clean area of sediment (i.e., above the cap) that would meet the sediment SCGs. Although the cap would include a sorptive layer to mitigate NAPL migration into surface sediment and NAPL recovery would be conducted in the upland area, NAPL remaining in the upland would serve as a potential source for future sediment impacts and the continued achievement of the sediment criteria for shallow sediment would be evaluated through periodic inspection and cap maintenance.

- *Action-Specific SCGs* – Potentially applicable action-specific SCGs include health and safety requirements, regulations associated with handling impacted media, and surface water quality standards. Work activities would be conducted in accordance with OSHA requirements that specify general industry standards, safety equipment and procedures, and record keeping and reporting regulations. Compliance with these action-specific SCGs would be accomplished by following a site-specific HASP.

Excavated soil, removed sediment, and process residuals would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following an NYSDEC-approved remedial design and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), soil and sediment generated from a former MGP site that is characteristically hazardous for benzene only (D018) is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (e.g., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs. Placement of cap materials into the river would also be subject to appropriate USACE and NYSDEC requirements for conducting activities within a water body of the United States/New York State.

- *Location-Specific SCGs* – Potentially applicable location-specific SCGs generally include regulations on conducting construction activities within flood plains, local building/construction codes and ordinances, local water front development plans, and permitting requirements associated with construction in a navigable waterway (i.e., the Hudson River).

  Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and other permits as appropriate, prior to conducting remedial activities. Local permits would be obtained prior to initiating the remedial activities and sediment remediation activities would likely have to be conducted in manner that is compatible with City of Peekskill water front development plans.

Overall Protection of Public Health and the Environment – Alternative 2

Alternative 2 would address grossly impacted soil and former MGP structures in Lot 7 (Block 5) through excavation and off-site treatment/disposal. Potentially mobile NAPL remaining in the upland area would be addressed through the installation of NAPL recovery wells and periodic NAPL monitoring/recovery. The area of sediment identified to contain MGP residuals would be addressed through sediment capping activities, and MNR would be performed to assess the progress of naturally-occurring processes at sediment sampling location SD-34 area.

Alternative 2 would prevent exposures (i.e., direct contact, ingestion, and inhalation) of MGP-related impacts in soil and groundwater (soil/groundwater RAOs #1 and #2) through excavation of soil and former MGP structures in Lot 7 (Block 5), establishing institutional controls, and developing an SMP for the remaining upland areas. Through

installation of NAPL recovery wells (and the associated NAPL monitoring/recovery activities), Alternative 2 would work toward preventing migration of impacts that could result in impacts to groundwater and surface water (soil/groundwater RAO #3). However, NAPL that does not enter the recovery wells could continue to migrate to Peekskill Bay sediment. Alternative 2 would work toward addressing the source of soil and groundwater impacts (soil/groundwater RAO #4) through excavation of grossly impacted soil in Lot 7 (Block 5) and NAPL recovery.

Capping of sediment in the area identified to contain MGP residuals and establishing institutional controls under Alternative 2 would prevent direct contact with impacted sediment as defined in RAO #1 for sediments (Section 3.2). Additionally, the sediment capping component of Alternative 2 would prevent the release of MGP-related impacts that would result in exceedances of ambient surface water quality criteria and prevent impacts to biota from sediment containing MGP-related impacts (sediment RAOs #2 and #3). O&M activities for the sediment would consist of periodic monitoring to verify continued cap effectiveness (within the impacted area) and the natural recovery process in the SD-34 area.

Cost Effectiveness – Alternative 2

The total estimated cost associated with Alternative 2 is presented in Table 10, with upland and sediment costs presented in Tables 7a and 7b, respectively. The total estimated 30-year present worth cost for this alternative is approximately $14,200,000. The estimated capital cost, including costs for conducting soil removal, NAPL recovery well installation, and sediment capping activities, is approximately $9,800,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting long-term periodic NAPL monitoring/recovery and sediment cap inspection/maintenance, is approximately $4,400,000.

5.2.3 Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment

The major components of Alternative 3 are listed in the following table.

Table 5.2 Alternative 3 Components

OU-1	OU-2
• Removing the remnant foundations of former 30,000 cf, 100,000 cf gas holders and 25,000 gallon fuel oil tank and related structures • Excavating NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 • Managing/disposing or treating/ discharging groundwater from the excavation area • Installing NAPL recovery wells • Implementing a NAPL recovery program • Establishing institutional controls and developing an SMP	• Installing a NAPL barrier wall • Installing NAPL recovery wells • Implementing a NAPL recovery program • Removing shallow sediment (i.e., up to 5 feet below sediment surface in the area identified to contain MGP residuals. • Capping remnant NAPL-impacted deep sediment • Removing surface sediment containing visible impacts in the SD-34 area • Conducting long-term sediment monitoring • Establishing institutional controls and developing an SMP

Soil and MGP Structure Removal

Alternative 3 would include the same soil and MGP structure removal activities as Alternative 2. Anticipated soil removal limits are shown on Figure 4. Alternative 3 would include the excavation of up to 2,800 cubic-yards of material.

NAPL Recovery Wells and NAPL Monitoring

Alternative 3 would include the installation of the same NAPL recovery wells and conducting similar NAPL monitoring/recovery as Alternative 2. For the purpose of developing a cost estimate for this alternative, it has been assumed that up to 25 NAPL recovery wells would be installed. NAPL recovery activities are assumed to consist of passive NAPL collection with manual recovery conducted for 30 years. NAPL recovery wells would be initially monitored on a semi-annual basis. If recoverable quantities of NAPL are not observed during multiple consecutive NAPL monitoring events (e.g., four consecutive semi-annual monitoring events), Con Edison may request to conduct NAPL monitoring/recovery less frequently at a given well or wells or cease NAPL monitoring altogether.

NAPL Barrier Wall

Under Alternative 3, a NAPL barrier wall would be installed to prevent potentially mobile NAPL from migrating from the upland portion of the site into Peekskill Bay sediment. Additionally, the NAPL barrier wall would enhance the collection and recovery of NAPL by the NAPL recovery wells (described above). Potential NAPL barrier options could include a passive barrier wall (i.e., trench filled with gravel), sheet pile, solidified soil, or a combination of these options. Alternative 3 has been developed assuming the NAPL barrier wall would consist of permanent steel sheet pile installed to an average depth of 40 feet below grade.

The approximate NAPL barrier alignment is shown on Figure 4. Where feasible, the NAPL barrier would be installed along the approximately mean high-water mark of Peekskill Bay. Due to the proximity of the railroad (and associated restrictions for conducting construction activities in close proximity to an active railroad), it has been assumed that the northern portion of the NAPL barrier wall would be constructed approximately 50 feet west of the center line of the western most railroad tracks (i.e., in Peekskill Bay, below/beyond the high-watermark). Access to a number of the NAPL recovery wells installed behind the wall in this area would not be feasible by land under the current conditions (i.e., due to the proximity of the rail line). Therefore, the remedial design would include means for recovering NAPL from this area (e.g., NAPL recovery by boat, provisions for transporting NAPL to an area that is accessible for recovery, creating new land behind the NAPL barrier). If new land were proposed behind the wall (i.e., between the railroad tracks and the wall), this would result in less than 0.1 acres of additional upland area. Based on limited site access, NAPL barrier wall construction activities would like be conducted from Peekskill Bay (i.e., via a barge-mounted cranes and/or excavators). Details regarding NAPL barrier wall construction and location would be evaluated as part of the remedial design of this alternative.

Sediment Removal, Capping, and Monitoring

Under Alternative 3, visually impacted material within the 0- to 5-foot bss depth interval would be removed from the area identified to contain MGP residuals. Additionally, visually impacted sediment in the vicinity of sediment sampling location SD-34 would be removed to a depth up to 2 feet bss. Following removal, an engineered cap would be constructed over areas where NAPL-related impacts remain in the area identified to contain MGP residuals at depths greater than 5 feet bss. Where all NAPL-impacted sediments have been removed (i.e., no MGP-related impacts at depths greater than 5 feet bss), those areas would be backfilled with imported fill material to restore the sediment surface to pre-existing lines and grades.

As described under Alternative 2, all work will be performed from the water, including off-site transportation of removed materials (e.g., debris, sediments) due to limited access and available space in the upland area.

The remediation areas to be dredged and/or capped under Alternative 3 are shown on Figure 4. Sediment remediation areas were estimated using Theissen polygons that were generated using the 2007 sediment sampling locations within the area containing MGP-related impacts (i.e., SD-1, SD-3, SD-8, SD-9, SD-10, SD-11/SD-24, SD-13, SD-14, SD-16, SD-20, and SD-21). These sediment sampling locations are inclusive of the area containing MGP residuals.

Under Alternative 3, debris/obstruction removal would be required prior to, or in conjunction, with dredging activities. Debris/obstructions (e.g., submerged barges, historical wooden pilings) removal (or cut down), dredging, and removed material management would be performed to depths up to approximately 5 feet bss. Approximately 6,600 cy of sediment would be removed by the dredging activities under Alternative 3. Sediment removal limits and depths would be further evaluated and refined, as necessary, during the preparation of the remedial design including development of a dredge prism showing the design removal depths based on the available sediment data. Prior to in-river activities, turbidity controls including turbidity curtains and/or sheet pile would be installed to mitigate potential migration of suspended solids from the work areas. For the purposes of this AAR, it has been assumed that turbidity curtains would be installed around the SD-34 remediation area and temporary sheet pile would be installed around the area containing MGP-related impacts.

Following debris/obstruction removal and dredging, the dredged areas would be capped and/or backfilled as indicated on Figure 4. Where MGP-related impacts would remain at depths below the excavation limits an engineered cap would be constructed similar to Alternative 2. Where the extent of MGP-related impacts would be addressed by the sediment removal, the area would be backfilled to the approximate pre-existing lines and grades. General backfill materials placed below/outside the engineered cap would consist of similar materials (i.e., sand and silt) and gradation to native sediment. If feasible, the use of natural sediment deposition (in lieu of and/or in conjunction with the imported silt/sand layer) would be evaluated as a means to replace the removed sediments.

A long-term monitoring and maintenance program would be implemented to document and maintain the effectiveness of the engineered cap (similar to Alternative 2). Any

disturbance or damage to the cap observed during monitoring activities would be addressed appropriately to maintain the long-term effectiveness of the cap.

Pre-Design Investigation

A PDI would be conducted, as necessary, to support the remedial design of Alternative 3.

Institutional Controls

Alternative 3 would also include establishing institutional controls in the form of deed restrictions for the affected properties, as appropriate. The institutional control components established under Alternative 3 would be consistent with those described under Alternative 2.

Site Management Plan

The SMP would be prepared in accordance with DER-10 and would summarize existing site conditions, responsibilities of the owner and Con Edison, including notifications prior to intrusive work, etc.

Short-Term Impacts and Effectiveness – Alternative 3

Implementation of this alternative could result in short-term exposure of the surrounding community and workers to COCs as a result of soil excavation, sediment and debris removal, sediment capping, material handling, and off-site transportation activities. Potential exposure mechanisms would include ingestion and dermal contact with NAPL, impacted soil, sediment, and/or groundwater; and inhalation of volatile organic vapors or dust containing COCs during remedial construction. Potential exposure of remediation workers would be minimized through the use of appropriately trained field personnel and personal PPE, as specified in a site-specific HASP that would be developed by the selected Remediation Contractor.

Short-term impacts to the environment could include impacts to the water column from sediment re-suspension and biota due to the temporary alteration/destruction of existing habitat in the area targeted for removal. Selected backfill materials would provide a surface habitat layer to facilitate natural recolonizing by native biota. Off-site transportation of excavated soil and importation of clean fill materials would result in approximately 470 truck round trips (assuming 25 tons per truck). Sediment removal

and capping activities (i.e., off-site transportation of removed sediment and importation of fill/cap materials) would result in approximately 30 barge trips (assuming 750 tons per barge) on the Hudson River.

For the purpose of this AAR, it is assumed that soil excavation/ backfilling, NAPL barrier wall installation, and NAPL recovery well installation activities could be completed in approximately 5 months. Similarly, it is assumed that sediment removal/backfilling activities would be completed in approximately 9 months. NAPL monitoring/recovery activities would be conducted over an assumed 30-year period. Actual durations will be assessed during the remedial design.

Long-Term Effectiveness and Permanence – Alternative 3

Under Alternative 3, former MGP structures and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 (Block 5) would be excavated and transported off-site for treatment/disposal. However, MGP-impacted soil may remain beneath Lot 7 and would remain beneath paved surfaces and existing buildings (i.e., North Water Street, existing buildings along the west side of North Water Street, below the sanitary force mains, rail-bed, and in upland areas between the railroad and Peekskill Bay), which provide a physical vertical barrier to subsurface impacts. Construction of a NAPL barrier wall would prevent further lateral migration of NAPL to Peekskill Bay sediment and NAPL recovery would be conducted to reduce the volume of mobile NAPL present at the site. Because impacted material would remain in the subsurface below the water table, dissolved phase COC concentrations would likely not be significantly reduced following remedial construction activities.

Removal of shallow impacted sediment (i.e., up to 5 feet bss) and installation of a cap over sediments in the area identified to contain MGP residuals would reduce the potential for future human and ecological exposures to the deeper sediments containing residual impacts. Cap materials (e.g., organoclay) would provide a sorptive layer to mitigate the potential for upward migration of residual NAPL in subsurface sediment. Cap surface material (i.e., silt and clay) would provide a surface habitat layer to facilitate natural recolonizing by native biota. An inspection and maintenance program would be implemented to promote the continued maintenance and effectiveness of the cap following remedial construction. Construction of the NAPL barrier wall will effectively isolate residual NAPL in the upland areas from the adjacent off-shore sediments. This would eliminate the potential for deep off-shore sediment to be re-impacted.

Annual verification of the institutional controls would be completed to document that the institutional controls are maintained and remain effective.

Land Use – Alternative 3

The current zoning for the site is listed as inland water front development in a mixed commercial and manufacturing area. Areas immediately surrounding the site are zoned for commercial and residential use. The current and foreseeable future use of the area surrounding the site is a mixed commercial/residential setting. Based on the current and anticipated future land use of the site, the potential for exposure to subsurface soil and groundwater containing MGP-related COCs is minimal. The majority of the site is covered with asphalt, concrete, buildings, or vegetated soil, and there is little to no need to conduct subsurface activities at the site. Additionally, drinking water is currently and will continue to be provided via a public supply. Therefore, groundwater containing MGP-related COCs is not currently and is not currently anticipated to be used for potable (or other) purposes.

Implementation of Alternative 3 is not anticipated to alter the current or anticipated future use of the site. Although excavation activities may create a short-term disruption to the surrounding community, Lot 7 would be restored following remedial construction. Institutional controls may constrain invasive upland and sediment activities at the site; however, there is little need to conduct future intrusive activities other than for utility maintenance/installation.

Reduction of Toxicity, Mobility or Volume through Treatment – Alternative 3

Alternative 3 would include the excavation of approximately 2,800 cy of material to remove remnant MGP operational structures and address NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 (Block 5).

Alternative 3 also includes installation of a NAPL barrier wall and NAPL recovery wells to reduce the potential for future migration of NAPL from the upland areas to the deep Peekskill Bay sediments. Periodic NAPL monitoring/recovery would be conducted in efforts to remove NAPL from the upland subsurface soils and would reduce the volume of material that is serving as a source for dissolved phase groundwater impacts.

Under Alternative 3, approximately 6,600 cy of shallow sediment containing identified MGP residuals would be removed (i.e., to a depth up to 5 feet bss) to address approximately 1,300 CY of visually impacted sediment. Sediment containing MGP

residues that is known to occur at depths greater than 5 feet bss would remain in Peekskill Bay, but would be isolated under about 5 to 15 feet of non-NAPL impacted sediment and an engineered cap. Removed soil, NAPL and sediment would be transported off-site for treatment and/or disposal.

Implementability – Alternative 3

Alternative 3 would be both technically and administratively feasible. Removal and off-site disposal of soil and sediment and cap construction are technically feasible and remedial contractors capable of performing the activities are readily available. Potential implementation challenges associated with conducting excavation activities include: limited working and laydown areas for remedial construction equipment and materials; maintaining local vehicle traffic on North Water Street and conducting excavation activities in close proximity to an active road. Soil loading conditions from the road would be evaluated as part of the remedial design.

Numerous implementation challenges would be associated with construction of a NAPL barrier wall. As indicated above, based on the proximity of the railroad to the mean high-water mark and the planned barrier wall, portions of the wall would likely have to be constructed within Peekskill Bay. The location of the wall would make recovery of NAPL that collects in the recovery wells challenging and may require creation of additional upland area (i.e., between the railroad and the wall); recovery of the NAPL from the wells from a boat; or means to convey (i.e., automated or gravity driven) collected NAPL from the recovery wells to an area that is currently accessible. Construction of a permanent structure and additional land (if applicable) within Peekskill Bay would require coordination and permitting with NYSDEC and USACE. Based on site access limitations, it is assumed that significant portions, if not all, of the NAPL barrier wall construction activities would need to be completed from the water. The permitting, coordination and construction considerations could pose uncertainties as well cost implications for implementing this alternative.

There are also several potential technical implementation challenges associated with the sediment remediation. As indicated previously, based on the lack of available work areas and access to the water at the site, all sediment removal/capping activities would be completed from the water. In addition, the presence of debris and other potential obstructions located within the target cap area (e.g., wooden piles and submerged barges) would have to be addressed prior to or as part of sediment removal/ capping activities. Dredged material would be barged to an off-site processing and handling location prior to final disposal and/or treatment. Accessibility issues (e.g., low tide

access) and structural considerations (e.g., bank stability) would be evaluated during the design phase.

Administratively, as Con Edison does not own Lot 7 (Block 5), access agreements would have to be secured with the current property owner in order to access the property to perform the remedial action. Con Edison, in concert with the property owner, would determine the economic feasibility of demolishing the former battery house structure and conducting soil excavation activities in this area of the property. Access agreements with the current property owners, the railroad, Westchester County and the City of Peekskill would likely also be required for the installation and operation of the NAPL recovery wells (between existing buildings and the railroad and in the upland area between the railroad and Peekskill Bay) and to conduct long-term periodic NAPL monitoring/recovery. Additionally, establishing institutional controls in the upland area (i.e., on properties not owned by Con Edison) would require coordination with the current property owners, the railroad, County, City and NYSDEC.

Implementation of a sediment removal/capping alternative would require coordination with NYSDEC, NYS Fish and Wildlife and USACE. Coordination would be required to obtain the appropriate access and permits, and to verify that sediment remedial activities would be compatible with local water front development plans. Institutional controls would also be established for the capped sediment areas, requiring coordination with state and/or local agencies.

Compliance with SCGs – Alternative 3

- *Chemical-Specific SCGs* – Potentially applicable chemical-specific SCGs for soil include 6 NYCRR Part 375-6 soil cleanup objectives. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values. Potential chemical-specific SCGs for sediment include sediment screening levels established in the NSYDEC document *Technical Guidance for Screening Contaminated Sediment* (NYSDEC, 1999).

  The majority of subsurface soil remaining in the upland portion of the site would contain MGP-related impacts at concentrations greater than the 6 NYCRR Part 375.6 commercial use SCOs, but are located beneath paved surfaces and existing buildings. Although this alternative includes construction of a NAPL barrier wall and NAPL recovery, impacted soil would remain in the upland area and this alternative would likely not achieve groundwater SCGs within a determinate period of time. Removal of shallow visually impacted sediment (i.e., up to 5 feet bss) and

placement of a cap over remaining visually impacted sediment would cover deeper sediment containing site-related COCs in the area identified as containing MGP-residuals, resulting in achievement of the sediment criteria in the upper 5 feet of the impacted area. The NAPL barrier wall would isolate coal tar NAPL in the subsurface soils of the upland areas of the site from remediated sediments and would eliminate future potential lateral migration of NAPL to Peekskill Bay sediments. The combination of the NAPL barrier wall, sorptive cap layer, and depth of the residual site-related NAPLs (7 to 17 feet bss), would significantly limit the potential for future impacts to surface sediment. Regardless, the continued achievement of the sediment criteria would be evaluated through periodic inspection and cap maintenance.

- *Action-Specific SCGs* – Potentially applicable action-specific SCGs include health and safety requirements, regulations associated with handling impacted media, and surface-water quality standards. *Excavated soil, remo*ved sediment, and process residuals would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following an NYSDEC-approved remedial design and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), soil and sediment generated from a former MGP site that is characteristically hazardous for benzene only (D018) is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (e.g., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

- *Location-Specific SCGs* – Potentially applicable location-specific SCGs generally include regulations on conducting construction activities within a flood plain and local building/construction codes and ordinances. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and other permits as appropriate, prior to conducting remedial activities.

Overall Protection of Public Health and the Environment – Alternative 3

Alternative 3 would address impacted soil and former MGP structures in Lot 7 (Block 5) through excavation. Potentially mobile NAPL remaining in the upland area would be addressed through the construction of a NAPL barrier wall, installation of NAPL recovery wells, and periodic NAPL monitoring/recovery. Sediment containing visual impacts would be addressed through shallow sediment removal (i.e., up to 5 feet bss) and capping activities.

Alternative 3 would prevent exposures (i.e., direct contact, ingestion, and inhalation) of MGP-related impacts in soil and groundwater (soil/groundwater RAOs #1 and #2) through excavation of soil and former MGP structures in Lot 7 (Block 5), establishing institutional controls, and developing an SMP for the remaining upland areas. Through construction of a NAPL barrier wall and installation of NAPL recovery wells (and the associated NAPL monitoring/recovery activities), Alternative 3 would work toward preventing migration of impacts that could result in impacts to groundwater and surface water (soil/groundwater RAO #3). Alternative 3 would work toward addressing the source of soil and groundwater impacts (soil/groundwater RAO #4) through the excavation of up to 2,800 cy of soil and NAPL recovery.

Removal of shallow sediment and capping of remaining sediment that contains visual MGP-related impacts and establishing institutional controls under Alternative 3 would prevent direct contact with sediment containing PAHs at concentrations greater than site-specific background concentrations (sediment RAO #1). Additionally, Alternative 3 would prevent the release of MGP-related impacts that would result in exceedances of ambient surface water quality criteria and would also prevent impacts to biota from sediment containing MGP-related impacts (sediment RAOs #2 and #3) through backfilling sediment removal areas with imported clean fill and capping sediment that is known to contain MGP residuals at depths greater than 5 ft bss. Furthermore, the NAPL barrier wall would isolate coal tar NAPL in subsurface soils located in the areas of the site upland from remediated sediments and would eliminate future potential lateral migration of NAPL to Peekskill Bay sediments.

Cost Effectiveness – Alternative 3

The total estimated cost associated with Alternative 3 is presented in Table 10, with upland and sediment costs presented in Tables 8a and 8b, respectively. The total estimated 30-year present worth cost for this alternative, which includes capital costs for conducting soil removal, NAPL recovery well and NAPL barrier wall installation, and sediment removal and capping activities as well as the estimated 30-year present worth cost of O&M activities associated with this alternative is approximately $19,800,000.

5.2.4 Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment

The major components of Alternative 4 are listed in the following table.

Table 5.4 Alternative 4 Components

OU-1	OU-2
• Removing the remnant foundations of former 30,000 cf, 100,000 cf gas holders and 25,000 gallon fuel oil tank and related structures • Excavating NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 • Managing/disposing or treating/ discharging groundwater from the excavation area • Installing NAPL recovery wells • Implementing a NAPL recovery program • Establishing institutional controls and developing an SMP	• Installing a NAPL barrier wall • Installing NAPL recovery wells • Implementing a NAPL recovery program • Removing shallow and deep (i.e., up to 18 feet bss) NAPL-impacted sediment in the area identified as containing MGP residuals. • Removing surface sediment containing visible impacts in the SD-34 area

Soil and MGP Structure Removal

Alternative 4 would include the same soil and MGP structure removal activities and water management, treatment or disposal components as Alternatives 2 and 3. Anticipated soil removal limits are shown on Figure 5. Alternative 4 would include the excavation of up to 2,800 cubic-yards of material.

NAPL Recovery Wells and NAPL Monitoring

Alternative 4 would include installation of the same NAPL recovery wells and conducting similar NAPL monitoring/recovery as Alternative 3. For the purpose of developing a cost estimate for this alternative, it has been assumed that up to 25 NAPL recovery wells would be installed. NAPL recovery activities are assumed to consist of passive NAPL collection with manual recovery conducted for 30 years. NAPL recovery wells would be initially monitored on a semi-annual basis. If recoverable quantities of NAPL are not observed during multiple consecutive NAPL monitoring events (e.g., four consecutive semi-annual monitoring events), Con Edison may request to conduct NAPL monitoring/recovery less frequently or cease NAPL monitoring altogether.

NAPL Barrier Wall

Alternative 4 would include the same NAPL barrier wall as described under Alternative 3. Alternative 4 has been developed assuming the NAPL barrier wall would consist of permanent steel sheet pile installed to an average depth of 40 feet below grade.

Due to the proximity of the railroad (and associated restrictions for conducting construction activities in close proximity to an active railroad), it has been assumed that the northern portion of the NAPL barrier wall would be constructed approximately 50 feet west of the railroad tracks (i.e., in Peekskill Bay, below/beyond the high-watermark). Access to a number of the NAPL recovery wells installed behind the wall in this area would not be feasible by land under the current conditions (i.e., due to the proximity of the rail line). Therefore, the remedial design would include means for recovering NAPL from this area (e.g., NAPL recovery by boat, provisions for transporting NAPL to an area that is accessible for recovery, creating new land behind the NAPL barrier). If new land were proposed behind the wall (i.e., between the railroad tracks and the wall), this would result in less than 0.1 acres of additional upland area. Based on limited site access, NAPL barrier wall construction activities would like be conducted from Peekskill Bay (i.e., via a barge-mounted cranes and/or excavators).

The approximate NAPL barrier alignment is shown on Figure 5. Details regarding NAPL barrier wall construction and location would be evaluated as part of the remedial design of this alternative.

Sediment Removal

Under Alternative 4, shallow and deep sediment would be removed to address visually impacted sediment within the area containing MGP-related impacts (i.e., currently identified at depths up to 18 feet bss) as well as visually impacted sediment in the vicinity of sediment sampling location SD-34 (i.e., 2 feet bss minimum). The remediation areas to be dredged under Alternative 4 are shown on Figure 5. As described under Alternatives 2 and 3, all work will be performed from the water, including off-site transportation of removed materials (e.g., debris, sediments) by barge due to limited access and available space in the upland area.

Sediment removal areas were estimated using Theissen polygons, consistent with the approach described under Alternative 3. The target area and volume associated with SD-34 is assumed to occur within a 60 foot by 60 foot area.

Under Alternative 4, debris/obstruction removal would be required prior to, or in conjunction, with dredging activities. Debris/obstructions (e.g., submerged barges, historical wooden pilings) removal, dredging, and removed material management would be performed similar to Alternatives 2 and 3. An estimated 12,000 cy of sediment would be removed by the dredging activities under Alternative 4. Sediment removal limits and depths would be further evaluated and refined, as necessary, during the remedial design (including development of a dredge prism showing the design removal depths based on the available sediment data).

Following debris/obstruction removal and dredging, the dredged areas will be backfilled using similar methods discussed under Alternative 3.

Long-term monitoring of sediments would not be required under Alternative 4 because the extent of MGP-related NAPL-impacted sediments would be permanently removed from Peekskill Bay.

Pre-Design Investigation

A PDI would be conducted as necessary to support the remedial design of Alternative 4.

Institutional Controls

Similar to Alternatives 2 and 3, Alternative 4 would also include establishing institutional controls in the form of deed restrictions and/or environmental easements. Specifically the institutional controls would limit intrusive (i.e., subsurface) activities that could result in potential exposures to remaining soil and groundwater media containing MGP-related impacts at concentrations greater than applicable standards and guidance values. Although potable water is provided by a municipal supply, the institutional controls would also prohibit the use of non-treated groundwater from the site. Additionally, the institutional controls would require compliance with the SMP (described below) that would be prepared as part of this alternative. An annual report would be submitted to NYSDEC to document that institutional controls are maintained and remain effective. Based on the sediment removal activities conducted under this alternative, institutional controls would not be established for Peekskill Bay sediment under this alternative.

Short-Term Impacts and Effectiveness – Alternative 4

Implementation of this alternative could result in short-term exposure of the surrounding community and/or workers to COCs as a result of soil excavation, sediment and debris removal, material handling, and off-site transportation activities. Potential exposure mechanisms would include ingestion and dermal contact with NAPL, impacted soil, sediment, and/or groundwater; and inhalation of volatile organic vapors or dust containing COCs during remedial construction. Potential exposure of the local community would be minimized through the use of engineering controls and monitoring. Potential exposure of remedial workers would be minimized through the use of appropriately trained field personnel and personal PPE, as specified in a site-specific HASP that would be developed as part of the remedial design.

Noise generated from operating construction equipment, and increased road and river traffic associated with transportation of material removed from the site and delivery of fill materials would be minimized by using engineering and operational controls and appropriate health and safety practices.

Short-term impacts to the environment could include impacts to the water column from sediment resuspension and biota due to temporary alteration/destruction of existing habitat in the area targeted for removal. Selected backfill materials would provide a surface habitat layer to facilitate natural recolonizing by native biota.

Off-site transportation of excavated soil and importation of clean fill materials would result in increased truck traffic. Sediment removal and backfilling activities (i.e., off-site transportation of removed sediment and importation of fill/cap materials) would result in additional localized barge traffic on the Hudson River. Additional sustainability components (e.g., alternative disposal, treatment, backfilling) components would be considered/ developed during the remedial design.

For the purpose of evaluating this alternative, it is assumed that soil excavation/ backfilling, NAPL barrier wall installation, and NAPL recovery well installation activities could be completed in approximately 5 months. Similarly, it is assumed that sediment removal/backfilling activities would be completed in approximately 13 months. NAPL monitoring/recovery activities would be conducted over an assumed 30-year period. Actual durations will be further assessed during design.

Long-Term Effectiveness and Permanence – Alternative 4

Under Alternative 4, former MGP structures and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 (Block 5) would be excavated and transported off-site for treatment/disposal. However, MGP-impacted soil may remain beneath Lot 7 and would remain beneath paved surfaces and existing buildings (i.e., North Water Street, existing buildings along the west side of North Water Street), below the sanitary force mains, rail-bed, and in upland areas between the railroad and Peekskill Bay), which provide a physical vertical barrier to subsurface impacts. Construction of a NAPL barrier wall would prevent further lateral migration of NAPL to Peekskill Bay sediment and NAPL recovery would be conducted to reduce the volume of mobile NAPL present at the site. Because impacted material would remain in the subsurface below the water table, dissolved phase COC concentrations would likely not be significantly reduced following remedial construction activities.

Removal of visually impacted sediment would eliminate the potential for future human and ecological exposures to impacted sediment. Removed sediment would be permanently transported off-site for treatment/disposal. Through construction of the NAPL barrier wall, the source of potential future sediment impacts is isolated, and sediment/backfill would not be anticipated to be re-impacted by MGP-related residuals.

The long-term effectiveness of the upland components of Alternative 4 would be dependent on adhering to the institutional controls and by following SMP (to reduce the potential for exposures to remaining impacted soil and groundwater). Annual verification of the institutional controls would be completed to document that the institutional controls are maintained and remain effective. Institutional controls would not be required for sediment.

Land Use – Alternative 4

The current zoning for the site is listed as inland water front development in a mixed commercial and manufacturing area. Areas immediately surrounding the site are zoned for commercial and residential use. The current and foreseeable future use of the area surrounding the site is a mixed commercial/residential setting. Based on the current and anticipated future land use of the site, the potential for exposure to subsurface soil and groundwater containing MGP-related COCs is minimal. The majority of the site is covered with asphalt, concrete, buildings, or vegetated soil, and there is little to no need to conduct subsurface activities at the site. Additionally, drinking water is currently and will continue to be provided via a public supply. Therefore, groundwater containing

MGP-related COCs is not currently and is not anticipated to be used for potable (or other) purposes.

Implementation of Alternative 4 is not anticipated to alter the current or anticipated future use of the site. Although excavation activities may create a short-term disruption to the surrounding community, Lot 7 would be restored following remedial construction.

Implementation of Alternative 4 is not anticipated to alter the current or anticipated future use of the site. Although excavation activities may cause a short-term disruption to the surrounding community, Lot 7 would be restored following remedial construction. As NAPL-impacted sediment would be removed, there would be no limitations to future Peekskill Bay activities under Alternative 4.

Reduction of Toxicity, Mobility or Volume of Contamination through Treatment – Alternative 4

Alternative 4 would include the excavation of approximately 2,800 cy of material to remove remnant MGP operational structures and address NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 (Block 5).

Alternative 4 would also include installation of a NAPL barrier wall and NAPL recovery wells to reduce the potential for future migration of NAPL from the upland areas to the deep Peekskill Bay sediments. Periodic NAPL monitoring/recovery would be conducted in efforts to remove NAPL from the upland subsurface soils and would reduce the volume of material that is serving as a source for dissolved phase groundwater impacts.

Under Alternative 4, approximately 12,000 cy of sediment (i.e., up to 18 feet bss) in Peekskill Bay would be removed from the area identified as containing MGP-related impacts to address approximately 2,000 cy of visually impacted sediment. Removed soil, NAPL and sediment would be transported off-site for treatment and/or disposal.

Implementability – Alternative 4

Alternative 4 would be both technically and administratively feasible. Removal and off-site disposal of soil and sediment and cap construction are technically feasible and remedial contractors capable of performing the activities are readily available. Potential implementation challenges associated with conducting excavation activities include: limited working and laydown areas for remedial construction equipment and materials; maintaining local vehicle traffic on North Water Street and conducting excavation

activities in close proximity to an active road. Soil loading conditions from the road would be evaluated as part of the remedial design.

Numerous implementation challenges would be associated with construction of a NAPL barrier wall. As indicated above, based on the proximity of the railroad to the mean high-water mark and the planned barrier wall, portions of the wall would likely have to be constructed within Peekskill Bay. The location of the wall would make recovery of NAPL that collects in the recovery wells challenging and may require creation of additional upland area (i.e., between the railroad and the wall); recovery of the NAPL from the wells from a boat; or means to convey (i.e., automated or gravity driven) collected NAPL from the recovery wells to an area that is currently accessible. Construction of a permanent structure and additional land (if applicable) within Peekskill Bay would require coordination and permitting with NYSDEC and USACE. Based on site access limitations, it is assumed that significant portions, if not all, of the NAPL barrier wall construction activities would need to be completed from the water. The permitting, coordination and construction considerations could pose uncertainties as well cost implications for implementing this alternative.

There are also several potential technical implementation challenges associated with the sediment remediation. As indicated previously, based on the lack of available work areas and access to the water at the site, all sediment removal activities would be completed from the water. Dredged material would be barged to an off-site processing and handling location prior to final disposal and/or treatment. Accessibility issues (e.g., low tide access) and structural considerations (e.g., bank stability) would be evaluated during the design phase.

Administratively, as Con Edison does not own Lot 7 (Block 5), access agreements would have to be secured with the current property owner in order to access the property to perform the remedial action. Con Edison in concert with the property owner would determine the economic feasibility of demolishing the former battery house structure and conducting soil excavation activities in this area of the property. Access agreements with the current property owners, the railroad, Westchester County and the City of Peekskill would likely also be required for the installation and operation of the NAPL recovery wells (between existing buildings and the railroad and in the upland area between the railroad and Peekskill Bay) and to conduct long-term periodic NAPL monitoring/recovery. Additionally, establishing institutional controls in the upland area (i.e., on properties not owned by Con Edison) would require coordination with the current property owners, the railroad, County, City and NYSDEC.

Implementation of a sediment removal/capping alternative would require coordination with NYSDEC, NYS Fish and Wildlife and USACE. Coordination would be required to obtain the appropriate access and permits, and to verify that sediment remedial activities would be compatible with local water front development plans. Institutional controls would also be established for the capped sediment areas, requiring coordination with state and/or local agencies.

Compliance with SCGs – Alternative 4

- *Chemical-Specific SCGs* – Potentially applicable chemical-specific SCGs for soil include 6 NYCRR Part 375-6 soil cleanup objectives. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values. Potential chemical-specific SCGs for sediment include sediment screening levels established in the NSYDEC document *Technical Guidance for Screening Contaminated Sediment* (NYSDEC, 1999).

  The majority of subsurface soil remaining in the upland portion of the site would contain MGP-related impacts at concentrations above the 6 NYCRR Part 375.6 commercial use SCOs, but are located beneath paved surfaces and existing buildings as well as the area west of the building beneath the sewer force mains and railroad tracks. Although this alternative includes construction of a NAPL barrier wall and NAPL recovery, impacted soil would remain in the upland area and this alternative would likely not achieve groundwater SCGs within a determinate period of time.

  Visually impacted sediment would be removed. The NAPL barrier wall would isolate coal tar NAPL in the subsurface soils of the upland areas of the site from remediated sediments and would eliminate future potential lateral migration of NAPL to Peekskill Bay sediments.

- *Action-Specific SCGs* – Potentially applicable action-specific SCGs include health and safety requirements, regulations associated with handling impacted media, and surface-water quality standards. Excavated soil, removed sediment, and process residuals would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following an NYSDEC-approved remedial design and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), soil and sediment generated from a former MGP site that is characteristically hazardous for benzene only (D018) is

conditionally exempt from hazardous waste management requirements when destined for thermal treatment (e.g., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

Location-Specific SCGs – Potentially applicable location-specific SCGs generally include regulations on conducting construction activities within a flood plain and local building/construction codes and ordinances. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and other permits as appropriate, prior to conducting remedial activities.

Overall Protection of Public Health and the Environment – Alternative 4

Alternative 4 would address impacted soil and former MGP structures in Lot 7 (Block 5) through excavation. Potentially mobile NAPL remaining in the upland area would be addressed through the construction of a NAPL barrier wall, installation of NAPL recovery wells, and periodic NAPL monitoring/recovery. Sediment containing visual impacts would be addressed through removal.

Alternative 4 would prevent exposures (i.e., direct contact, ingestion, and inhalation) of MGP-related impacts in soil and groundwater (soil/groundwater RAOs #1 and #2) through excavation soil and former MGP structures in Lot 7 (Block 5), establishing institutional controls, and developing an SMP for the remaining upland areas. Through construction of a NAPL barrier wall and installation of NAPL recovery wells (and the associated NAPL monitoring/recovery activities), Alternative 4 would work toward preventing migration of impacts that could result in impacts to groundwater and surface water (soil/ groundwater RAO #3). Alternative 4 would also work toward addressing the source of soil and groundwater impacts (soil/groundwater RAO #4) through excavation of up to 2,800 cy of soil and NAPL recovery.

Through removal of visually impacted sediment, Alternative 4 would prevent direct contact with sediment containing PAHs at concentrations greater that site-specific background concentrations (sediment RAO #1). Additionally, Alternative 4 would prevent the release of MGP-related impacts that would result in exceedances of ambient surface water quality criteria and prevent impacts to biota from sediment containing MGP-related impacts (sediment RAOs #2 and #3). Furthermore, through construction of NAPL barrier wall, the source of potential impacts to Peekskill Bay sediment would be addressed.

Cost Effectiveness – Alternative 4

The total estimated cost associated with Alternative 4 is presented in Table 10, with upland and sediment costs presented in Tables 9a and 9b, respectively. The total estimated 30-year present worth cost for this alternative is approximately $25,300,000. The estimated capital cost, including costs for conducting soil removal, NAPL recovery well and NAPL barrier wall installation, and sediment removal activities, is approximately $24,500,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting long-term periodic NAPL monitoring/recovery, is approximately $800,000.

6. Comparative Analysis of Alternatives

This section presents the comparative analysis of each remedial alternative using the evaluation criteria identified in Section 5. The comparative analysis identifies the advantages and disadvantages of each alternative relative to each other and with respect to the eight evaluation criteria.

The alternatives evaluated in Section 5 consist of the following:

- Alternative 1 – No Action
- Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment
- Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment
- Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment

The comparative analysis of these site-wide alternatives is presented in the following subsections.

6.1 Short-Term Impacts and Effectiveness

Alternative 1 would not include any active remediation and subsequently would not present potential short-term impacts to remedial workers, the public, or the environment. Alternatives 2, 3 and 4 each include intrusive activities (i.e., soil excavation and sediment removal and/or capping) to address impacted soil and sediment. Each of these alternatives would pose potential short-term risks to remedial workers and the public from potential exposure to impacted soil, sediment, groundwater, and NAPL during soil/sediment removal, off-site transportation of removed material, backfilling/capping, and/or monitoring/sampling efforts. Additionally, the removal activities conducted under these alternatives would pose short-term risks from the operation of construction equipment, conducting remedial activities from water-based platforms, and generation of noise and dust.

Nuisances to the surrounding community would include noise from the operation construction equipment and an increase in local truck and river traffic associated with importing backfill/capping materials and off-site transportation of removed materials.

The potential exposures during remedial construction of these alternatives would be mitigated, to the extent practicable, by using appropriate PPE, air and work space monitoring, implementation of dust control and noise mitigation measures (as appropriate and if necessary based on monitoring results), and proper planning and training of remedial workers.

Short-term impacts to the environment could also include impacts to the water column and benthic community. Selected backfill materials would provide a surface habitat layer to facilitate natural recolonizing by native biota.

It is noted that generation of greenhouse gases would be similar to that generated at a medium sized construction site. Each successive alternative includes the removal of a greater quantity of material and the inherent potential for short-term impacts to the public and remedial workers increases. Compared to the other remedial alternatives, Alternative 4 would be the most disruptive to the surrounding community and environment.

6.2 Long-Term Effectiveness and Permanence

Alternative 1 would not include the implementation of any remedial activities and therefore, would not address potential long-term exposures to or impacts from media that contain site-related impacts except through ongoing naturally occurring processes.

Alternatives 2, 3, and 4 each include excavation of the same volume of impacted soil (and former MGP structures) from Lot 7 (Block 5) and transportation of excavated material for off-site treatment/disposal. Although routine site activities do not include intrusive activities that could result in exposure to soil and groundwater, NAPL and impacted soil would remain beneath paved surfaces and existing buildings (i.e., North Water Street, existing buildings south of North Water Street), west of the building below the sewer force mains and the railroad, and in upland areas between the railroad and Peekskill Bay, which provide physical barriers for exposure to subsurface impacts. Additionally, Alternatives 2, 3, and 4 each include installation of NAPL recovery wells and periodic NAPL monitoring/recovery activities to reduce the volume of mobile NAPL present at the site. Alternatives 3 and 4 also include construction of a NAPL barrier wall to enhance NAPL recovery and prevent future migration of NAPL to Peekskill Bay

sediment. Alternatives 2, 3, and 4 would each rely on institutional controls and an SMP to reduce the potential for exposures to impacted media that would remain in the upland area.

Each of the sediment removal and capping components of Alternatives 2, 3, and 4 would reduce the potential for future human and ecological exposures to impacted sediment. Alternative 2 relies on sediment capping and MNR, and Alternative 3 includes a combination of shallow sediment removal and capping of deep visually impacted sediment to reduce the potential for future exposures. Alternative 4 includes the removal of shallow and deep visually impacted sediment; however, exposures to deep sediments are not likely. Additionally, Alternatives 2 and 3 include periodic site inspection/maintenance to maintain the effectiveness of the alternatives. Under Alternatives 3 and 4, construction of a NAPL barrier wall would prevent potential future impacts to sediment (i.e. via NAPL migration from the upland area).

Alternative 3 would permanently remove the majority of the visually impacted sediments located downgradient of the NAPL barrier wall (i.e., approximately 1,300 cy of 2,000 cy, or 65%, based on neat line volumes), with the remaining visually impacted materials isolated under approximately 5 to 15 feet of non-impacted sediment and an engineered cap. Alternatives 3 and 4 provide similar and significant levels of long-term effectiveness and permanence based on their similar remedial components.

6.3 Land Use

The current zoning for the site is listed as inland water front development in a mixed commercial and manufacturing area. Areas immediately surrounding the site are zoned for commercial and residential use. The current and foreseeable future use of the area surrounding the site is a mixed commercial/residential setting and the upland area between the railroad and Peekskill Bay will have limited access. Based on the current and anticipated future land use of the site, the potential for exposure to subsurface soil and groundwater containing MGP-related COCs is minimal. The majority of the site is covered with asphalt, concrete, buildings, or vegetated soil, and there is little to no need to conduct subsurface activities at the site. Additionally, drinking water is currently and will continue to be provided via a public supply. Therefore, groundwater containing MGP-related COCs is not currently and is not currently anticipated to be used for potable (or other) purposes.

Implementation of Alternatives 1 through 4 is not anticipated to alter current or anticipated future use of the site. Under Alternatives 2, 3, and 4, Lot 7 would be

restored following excavation and backfilling activities. Institutional controls would limit invasive upland activities (i.e., under Alternatives 2, 3, and 4) and Peekskill Bay/sediment activities (i.e., under Alternatives 2 and 3) that could be conducted at the site following remedial construction; however, there is little need to conduct future intrusive activities with the exception of utility maintenance/installation in the roadways of the upland area of the site. There would be no limitations to future Peekskill Bay activities under Alternative 4.

6.4 Reduction of Toxicity, Mobility and Volume of Contamination through Treatment

Alternative 1 would not actively treat, remove, recycle, or destroy impacted media and therefore, is considered the least effective for this criterion. Alternatives 2, 3, and 4 each include the excavation of up to approximately 2,800 cy of material from Lot 7 (Block 5) to address NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg. If it was determined to be feasible based on owner and Con Edison sensitivities regarding existing structures on and adjacent to the property, soil containing MGP-related COCs at concentrations greater than unrestricted use SCO could be excavated in Lot 7 (Block 5). Alternatives 2, 3, and 4 each include installation of NAPL recovery wells and periodic NAPL monitoring/ recovery to reduce the volume of NAPL present in the subsurface. Alternatives 3 and 4 also include construction of a NAPL barrier wall barrier to enhance NAPL collection /recovery and further reduce the potential for future migration of NAPL to Peekskill Bay.

Alternatives 2, 3, and 4 each include measures to address visually impacted sediment. Under Alternative 2, approximately 3,800 cy of sediment would be removed to facilitate construction of a sediment cap and under Alternative 3, approximately 6,600 cy of sediment would be removed to address visually impacted sediment a depths up to 5 feet bss and facilitate construction of a sediment cap over deeper visually impacted sediment (i.e., impacted sediment at a depth of 5 feet or greater bss). Alternative 4 would remove approximately 12,000 cy of sediment to address shallow and deep visually impacted sediment. Alternative 3 would permanently remove approximately 1,300 cy of visually impacted material (i.e., 65% of the estimated total volume of visually impacted sediment). Additionally, remaining visually impacted sediment would be isolated under 5 to 15 feet of clean material and an engineered cap. As indicated above, Alternatives 3 and 4 also include construction of a NAPL barrier wall to reduce the potential for Peekskill Bay sediment to become re-impacted following remedial construction.

6.5 Implementability

No remedial activities would be conducted as part of Alternative 1 and therefore, Alternative 1 is considered the most implementable. Alternatives 2, 3, and 4 would include periodic NAPL monitoring/recovery, preparation of an SMP, and implementation of institutional controls in the upland area. From a technical implementability standpoint, these activities do not require highly specialized equipment or personnel and could be readily implemented. Administratively, access agreements with the current property owners, the railroad, and the City of Peekskill would be required to install the NAPL recovery wells (between existing buildings and the railroad and in the upland area between the railroad and Peekskill Bay) and to conduct long-term periodic NAPL monitoring/recovery. Establishing institutional controls in the upland area (i.e., on properties not owned by Con Edison) would require coordination with the current property owners, the railroad, and NYSDEC.

Alternatives 2, 3, and 4 each include a similar level of removal and off-site treatment/disposal of soil and sediment, which are technically feasible remedial construction activities. Potential implementation challenges associated with conducting upland excavation activities include: limited working and laydown areas for remedial construction equipment and materials; maintaining local vehicle traffic on North Water Street; and conducting excavation activities in close proximity to an active road and roadway weight limitations. Administratively, as it does not own Lot 7 (Block 5), Con Edison, in consultation with the owner would need to determine the feasibility of demolishing the former battery house and conducting an unrestricted use cleanup of Lot 7.

Under Alternatives 2, 3, and 4, based on the lack of available work areas and access to the river, all sediment removal/capping activities would be completed from the water. Wooden piles and submerged barges would have to be addressed prior to or as part of sediment removal/ capping activities. Dredged material would be barged to an off-site processing and handling location prior to final disposal and/or treatment. Accessibility issues (e.g., low tide access) and structural considerations (e.g., bank stability) would be evaluated during the design phase. There would also be a deep excavation (up to 18 feet) required under Alternative 4 that would require additional stability considerations. Administratively, implementation of a sediment removal and/or capping alternatives would require coordination with NYSDEC, NYS Fish and Wildlife, USACE, and any third parties with easements in the Hudson River (e.g., utility crossings). Coordination would be required to obtain the appropriate access and permits, and to verify that sediment remedial activities would be compatible with local

water front development plans. Institutional controls would also be necessary for capped areas under Alternatives 2 and 3 requiring coordination with state and/or local agencies.

Under both Alternatives 3 and 4, numerous implementation challenges would be associated with construction of a NAPL barrier wall. Based on the proximity of the railroad to the mean high-water mark, portions of the wall would likely have to be constructed within Peekskill Bay. Construction of a permanent structure within Peekskill Bay would require significant coordination with NYSDEC and USACE. Based on site access limitations, NAPL barrier wall construction activities would likely need to be completed from the water.

In general, Alternatives 2, 3, and 4 each contain some similar technical challenges. However, due to the installation of NAPL barrier wall, Alternatives 3 and 4 are considered more difficult to technically implement relative to Alternative 2. Further because of the deep sediment dredging in Alternative 4, Alternative 4 is the most difficult alternative to implement.

6.6 Compliance with SCGs

- *Chemical-Specific SCGs* – Potentially applicable chemical-specific SCGs for soil include 6 NYCRR Part 375-6 soil cleanup objectives. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values. Potentially chemical-specific SCGs for sediment include sediment screening levels established in the NSYDEC document *Technical Guidance for Screening Contaminated Sediment* (NYSDEC, 1999).

  Under Alternatives 2, 3, and 4, soil containing COCs at concentrations greater than 6 NYCRR Part 375-6 commercial use SCOs would remain beneath North Water Street, existing buildings south of North Water Street, below the railroad and sanitary force mains, and in upland areas between the railroad and Peekskill Bay. Unrestricted use SCOs may be achieved for Lot 7 (Block 5), if such removal action is determined to be feasible (i.e., through coordination with the current site owner). Although Alternatives 2, 3, and 4 include NAPL recovery, impacted soil would remain in the upland area and none of these alternatives would likely achieve groundwater SCGs within a determinate period of time.

  Under Alternative 2, placement of a cap over sediment containing visual MGP-related impacts would cover sediment containing site-related COCs. This would

require removal of the top approximately two feet of sediment to accommodate placement of the cap, and therefore the sediment SCGs would be achieved within at least the upper two feet of sediment. Alternative 3 includes removal of shallow visually impacted sediment (i.e., up to 5 feet bss) and placement of a cap over remaining deep visually impacted sediment. Alternative 3 would meet the sediment SCGs for the shallow sediment within the impacted area. The cap installed as part of Alternatives 2 and 3 would include a sorptive layer to significantly reduce the potential for NAPL migration into surface sediment and NAPL recovery would be conducted in the upland area to prevent future lateral migration of NAPL from the upland to Peekskill Bay sediment. Under Alternative 4, removal of shallow and deep visually-impacted sediment (i.e., up to 18 feet bss) would address sediment containing site-related COCs, resulting in achievement of the sediment criteria. Additionally, under Alternatives 3 and 4, installation of a NAPL a barrier wall would prevent future lateral migration of NAPL to Peekskill Bay sediments.

- *Action-Specific SCGs* – Potentially applicable action-specific SCGs include health and safety requirements, regulations associated with handling impacted media, and surface water quality standards. Work activities would be conducted in accordance with OSHA requirements that specify general industry standards, safety equipment and procedures, and record keeping and reporting regulations. Compliance with these action-specific SCGs for each of the Alternatives would be accomplished by following a site-specific HASP.

  Under Alternatives 2, 3, and 4, excavated soil, removed sediment, and process residuals would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements for each of the Alternatives would be achieved by following an NYSDEC-approved remedial design and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), soil and sediment generated from a former MGP site that is characteristically hazardous for benzene only (D018) is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (e.g., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

  The Alternatives would be equally effective at meeting the action-specific SCGs assuming proper protocols are followed during the remedial implementation

- *Location-Specific SCGs* – Potentially applicable location-specific SCGs generally include regulations on conducting construction activities within flood plains, local

building/construction codes and ordinances, local water front development plans, permitting requirements associated with construction in a navigable waterway.

Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and other permits as approximate, prior to conducting remedial activities. In support of Alternatives 3 and 4, significant permitting/coordination with NYSDEC and USACE is anticipated to be required to facilitate construction of the NAPL barrier wall below the mean high water mark. Similarly, permitting/ coordination with NYSDEC and USACE is anticipated to be required for sediment capping associated with Alternatives 2 and 3. Local permits would be obtained prior to initiating the remedial activities. Overall compliance with location-specific SCGs would be similarly difficult for each active alternative.

6.7 Overall Protection of Public Health and the Environment

As Alternative 1 does not include any active remedial measures or administrative controls, Alternative 1 is not considered protective of human health and the environment.

Alternatives 2, 3, and 4 would each prevent exposures (i.e., direct contact, ingestion, and inhalation) of MGP-related impacts in soil and groundwater (soil/groundwater RAOs #1 and #2) through excavation of soil and former MGP structures in Lot 7 (Block 5). Additionally, each of the alternatives would include NAPL monitoring/recovery to reduce the volume of potentially mobile NAPL in the upland area, thereby working toward preventing the migration of impacts that could result in impacts to groundwater and surface water (soil/groundwater RAO #3). Alternatives 3 and 4 would further work toward this RAO through the construction of a NAPL barrier wall that would prevent future migration of NAPL to Peekskill Bay sediment. Under each of the alternatives, remaining impacts in the upland area are currently inaccessible (i.e., located beneath roads, buildings, and the railroad) and potential exposures to remaining impacts would be mitigated by establishing institutional controls and following the procedures that would be provided in an SMP. Alternatives 2, 3, and 4 each employ similar aspects of excavation and NAPL recovery to work toward addressing the source of soil and groundwater impacts (soil/groundwater RAO #4). Alternatives 3 and 4 would be more effective at NAPL collection and recovery due to the construction of the NAPL barrier wall.

Alternatives 2, 3, and 4 would each prevent direct contact with sediment containing PAHs at concentrations greater than site-specific background concentrations

(sediment RAO #1). Alternative 2 would utilize a sediment cap and MNR, and Alternative 3 would utilize a combination of shallow sediment removal and capping of deep sediment to prevent exposures. Therefore, Alternatives 2 and 3 would prevent the release of MGP-related impacts that would result in exceedances of ambient surface water quality criteria (sediment RAO #2) and prevent impacts to biota from sediment containing MGP-related impacts (sediment RAO #3). Alternatives 2 and 3 would require periodic sediment cap inspections/monitoring and cap materials and may require periodic replacement to maintain effectiveness and meet the RAOs over the long-term. Alternative 4 would remove both shallow and deep sediment containing site-related impacts and therefore, Alternative 4 would achieve sediment RAOs #2 and #3 without long-term monitoring and potential maintenance. Furthermore, Alternatives 3 and 4 would address the source of potential future impacts to Peekskill Bay sediment through construction of a NAPL barrier wall.

Based on the current and forseeable use of Peekskill Bay and the extent of the area containing MGP impacts, Alternatives 3 and 4 are considered equally protective of public health and the environment.

6.8 Cost Effectiveness

A summary of the capital and O&M costs associated with the upland and sediment remedial components of each alternative is presented in Table 10. The following table summarizes the estimated costs associated with implementing each of the remedial alternatives.

Table 6.2 Estimated Costs

Alternative	Estimated Capital Cost	Estimated Present Worth Cost of O&M[1]	Total Estimated Cost
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment	$9,800,000	$4,400,000	$14,200,000
Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment	$17,300,000	$2,500,000	$19,800,000

Alternative	Estimated Capital Cost	Estimated Present Worth Cost of O&M[1]	Total Estimated Cost
Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment	$24,500,000	$800,000	$25,300,000

Note:
1. Estimated present worth of O&M cost is over an assumed 30-year period.

The increase in capital costs for Alternatives 2, 3, and 4 is associated with construction of a NAPL barrier wall (under Alternatives 3 and 4) and removal of a sequentially larger volume of sediment. Upland O&M costs (associated with NAPL monitoring/ recovery) are equivalent for Alternatives 2, 3, and 4. Alternative 2 has the greatest O&M costs based on periodic inspection and maintenance of a larger sediment cap area, as compared to Alternative 3 (which has a smaller sediment cap area than Alternative 2) and Alternative 4 (which does not include a sediment cap, based on the removal limits).

Alternative 3 would leave an estimated 700 cy of visually impacted (based on neat-line volumes) material isolated under a minimum of 5 feet of clean material and an engineered cap within Peekskill Bay. Additionally, Alternatives 3 and 4 would include construction of a NAPL barrier wall to address potential future migration of NAPL to sediment. As indicated in Table 6.2, the cost to address the remaining 700 cy of material (i.e., cost difference between Alternatives 3 and 4) is approximately $5,500,000.

7. Preferred Remedial Alternative

This section presents a description of the preferred remedial alternative. The results of the comparative analysis conducted in Section 6 were used as a basis for recommending a site-wide remedial alternative. The components of the preferred remedy are presented in the following subsection.

7.1 Summary of Preferred Site-Wide Remedial Alternative

Based on the comparative analysis of the remedial alternatives presented in Section 6, Alternative 3 is the preferred remedial alternative for the site. Alternative 3 would achieve the best balance of the NYSDEC evaluation criteria, while reducing the potential for future exposure to subsurface soil, groundwater, and sediment containing MGP-related impacts. As described in Section 5, the primary components of the Alternative 3 consist of the following:

- Conducting a PDI in support of the remedial design of the soil excavation and sediment removal activities to be conducted under this alternative
- Excavating up to 2,800 cy of soil and former MGP structures to address NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg in Lot 7 (Block 5)
- Transporting excavated material off-site for treatment (via LTTD) and/or disposal as a non-hazardous waste
- Backfilling the excavation area with clean imported fill
- Installing NAPL recovery wells and conducting periodic NAPL monitoring/recovery
- Constructing a NAPL barrier wall to prevent future migration of NAPL to Peekskill Bay
- Addressing debris/obstructions (i.e., wood piles and sunken barges) to facilitate sediment removal
- Removing approximately 6,600 cy of sediment to address approximately 1,300 cy of visually impacted material

- Backfilling sediment removal areas with clean imported fill and constructing a sorptive sediment cap over areas where MGP-related NAPL would remain in subsurface sediment at depths below 5 feet bss.

- Establishing institutional controls (in the form of deed restrictions and/or environmental easements) in the upland and sediment areas. ICs in the upland area would be established to limit intrusive (i.e. subsurface) activities that could result in exposures to soil and groundwater containing site-related impacts, prohibit the use of site groundwater, and require compliance with an SMP. ICs in the sediment would include restrictions on recreational activities within the area of the engineered sediment cap (e.g., anchoring).

- Preparing an SMP to document the following:

    - The institutional controls that have been established and will be maintained for the site

    - Known locations of soil containing COCs at concentrations greater than 6 NYCRR Part 375-6 commercial use SCOs

    - Protocols (including health and safety requirements) for conducting invasive (i.e., subsurface) upland activities and managing potentially impacted material encountered during these activities

    - Protocols and requirements for conducting periodic NAPL monitoring and recovery and ceasing/modifying NAPL monitoring and recovery

    - Reporting requirements and frequency

The total estimated cost associated with implementation of the preferred remedial alternative is summarized in the following table.

Table 7.1 Cost Estimate for Alternative 3

Alternative	Estimated Capital Cost	Estimated Present Worth of O&M Cost[1]	Total Estimated Cost
Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment	$17,300,000	$2,500,000	$19,800,000

Note:
1. Estimated present worth of O&M cost is over an assumed 30-year period.

Potential exposures during remedial construction of this alternative would be mitigated, to the extent practicable, by using appropriate PPE, air and work space monitoring, implementation of dust control and noise mitigation measures (as appropriate and if necessary based on monitoring results), and proper planning and training of remedial workers. Selected backfill materials would provide a surface habitat layer to facilitate natural recolonizing by native biota.

Alternative 3 would prevent exposures (i.e., direct contact, ingestion, and inhalation) of MGP-related impacts in soil and groundwater (soil/groundwater RAOs #1 and #2) through excavation soil and former MGP structures in Lot 7 (Block 5), and establishing institutional controls and developing an SMP for the remaining upland areas. Through construction of a NAPL barrier wall and installation of NAPL recovery wells (and the associated NAPL monitoring/recovery activities), Alternative 3 would work toward preventing migration of impacts that could result in impacts to groundwater and surface water (soil/groundwater RAO #3). As a majority of remaining inaccessible impacted soil and NAPL would be located beneath roads, buildings, and the railroad, through excavation and NAPL recovery, Alternative 3 would work toward addressing the source of soil and groundwater impacts (soil/groundwater RAO #4).

Through removal of a majority of the visually impacted sediment, placement of clean fill material and installation of an engineered cap, Alternative 3 would prevent direct

contact with sediment containing PAHs at concentrations greater that site-specific background concentrations (sediment RAO #1). Additionally, Alternative 3 would prevent the release of MGP-related impacts that would result in exceedances of ambient surface water quality criteria (sediment RAO #2) and prevent impacts to biota from sediment containing MGP-related impacts (sediment RAO #3). Furthermore, through construction of NAPL barrier wall, Alternative 3 would prevent future migration of NAPL to Peekskill Bay sediment.

7.2 Preferred Remedy Selection Rationale

Alternative 3 is preferred over the other remedial alternatives based on the following:

- Accessible upland soil containing MGP-related impacts would be excavated and transported off-site for treatment/disposal.

- Inaccessible NAPL and impacted soil would remain beneath paved surfaces and existing buildings (i.e., North Water Street, existing buildings south of North Water Street, below the railroad, and in upland areas between the railroad and Peekskill Bay) which provide a physical barrier to subsurface impacts. Excavation below existing buildings and the active railroad are not considered technically feasible.

- NAPL recovery wells (and the associated periodic monitoring/recovery) would reduce the volume of mobile NAPL present at the site.

- Construction of a NAPL barrier wall would prevent further migration of NAPL to Peekskill Bay, as well as potentially enhance the effectiveness of the NAPL recovery wells installed in the upland area.

- Removal of shallow sediment containing visual impacts, in combination with the NAPL barrier wall, would permanently address the majority of sediment containing site-related impacts. Relative to Alternative 4, Alternative 3 more cost effectively provides an equivalent level of protection to human health and the environment. Alternative 3 would provide an equivalent remedial alternative for OU-1 and permanently remove the majority of visually impacted sediment while the remaining visually impacted material would be buried beneath 5 to 15 feet of visually clean material and an engineered cap in OU-2 for an estimated cost of more than $5 million less than Alternative 4.

- The remaining visually impacted sediments are not considered to be accessible or likely to be encountered based on the current or anticipated use of Peekskill Bay in this area.

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Tables

Table 1
Summary of Chemical-Specific SCGs

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
National Primary Drinking Water Standards	40 CFR Part 141	S	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water supply systems.	These standards are potentially applicable if an action involves future use of ground water as a public supply source.
RCRA-Regulated Levels for Toxic Characteristics Leaching Procedure (TCLP) Constituents	40 CFR Part 261	S	These regulations specify the TCLP constituent levels for identification of hazardous wastes that exhibit the characteristic of toxicity.	Excavated materials may be sampled and analyzed for TCLP constituents prior to disposal to determine if the materials are hazardous based on the characteristic of toxicity.
Universal Treatment Standards/Land Disposal Restrictions (UTS/LDRs)	40 CFR Part 268	S	Identifies hazardous wastes for which land disposal is restricted and provides a set of numerical constituent concentration criteria at which hazardous waste is restricted from land disposal (without treatment).	Applicable if waste is determined to be hazardous and for remedial alternatives involving off-site land disposal.
Clean Water Act (CWA) - Ambient Water Quality Criteria	40 CFR Part 131; USEPA 440/5-86/001 "Quality Criteria for Water – 1986," superseded by "National Recommended Water Quality Criteria: 2009"	S	Criteria for protection of aquatic life and/or human health depending on designated water use.	Potentially applicable to the evaluation of potential impacts to the Hudson River from site-related constituents.
CWA Section 136	40 CFR 136	G	Identifies guidelines for test procedures for the analysis of pollutants.	Potentially applicable to the evaluation of potential impacts to the Hudson River from site-related constituents.
New York State				
NYSDEC Guidance on Remedial Program Soil Cleanup Objectives	6 NYCRR Part 375	G	Provides an outline for the development and execution of the soil remedial programs. Includes soil cleanup objective tables.	These guidance values are to be considered, as appropriate, in evaluating soil quality.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if materials generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
Soil Cleanup Guidance	CP-51	G	Provides the framework and policies for the selection of soil cleanup levels.	Guidance would be used to develop site-specific soil cleanup objectives (SCOs).
NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	G	Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in the NYSDEC programs.	These standards are to be considered in evaluating groundwater and surface water quality.
New York State Surface Water and Groundwater Quality Standards	6 NYCRR Part 700-705	S	Establishes quality standards for surface water and groundwater.	Potentially applicable for assessing water quality at the site during remedial activities.
Technical Guidance for Screening Contaminated Sediments	Division of Fish, Wildlife, and Marine Resources (January 1999)	G	Describes the methodology for establishing numeric sediment cleanup standards. It also provides guidance when evaluating risk management options for contaminated sediment and when determining final contaminant concentrations that will be achieved through remedial efforts.	This guidance is potentially applicable for developing sediment cleanup goals.

Table 2
Summary of Action-Specific SCGs

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
Occupational Safety and Health Act (OSHA) - General Industry Standards	29 CFR Part 1910	S	These regulations specify the 8-hour time-weighted average concentration for worker exposure to various compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	Proper respiratory equipment will be worn if it is not possible to maintain the work atmosphere below required concentrations. Appropriate training requirements will be met for remedial workers.
OSHA - Safety and Health Standards	29 CFR Part 1926	S	These regulations specify the type of safety equipment and procedures to be followed during site remediation.	Appropriate safety equipment will be on-site and appropriate procedures will be followed during remedial activities.
OSHA - Record-keeping, Reporting and Related Regulations	29 CFR Part 1904	S	These regulations outline record-keeping and reporting requirements for an employer under OSHA.	These regulations apply to the company(s) contracted to install, operate and maintain remedial actions at hazardous waste sites.
RCRA - Preparedness and Prevention	40 CFR Part 264.30 - 264.31	S	These regulations outline requirements for safety equipment and spill control when treating, handling and/or storing hazardous wastes.	Safety and communication equipment will be installed at the site as necessary. Local authorities will be familiarized with the site.
RCRA - Contingency Plan and Emergency Procedures	40 CFR Part 264.50 - 264.56	S	Provides requirements for outlining emergency procedures to be used following explosions, fires, etc. when storing hazardous wastes.	Emergency and contingency plans will be developed and implemented during remedial design. Copies of the plan will be kept on-site.
90 Day Accumulation Rule for Hazardous Waste	40 CFR Part 262.34	S	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers and containment buildings without having to obtain a RCRA hazardous waste permit.	Potentially applicable to remedial alternatives that involve the storing or treating of hazardous materials on-site.
Land Disposal Facility Notice in Deed	40 CFR Parts 264 and 265 Sections 116-119(b)(1)	S	Establishes provisions for a deed notation for closed hazardous waste disposal units, to prevent land disturbance by future owners.	The regulations are potentially applicable because closed areas may be similar to closed RCRA units.
RCRA - General Standards	40 CFR Part 264.111	S	General performance standards requiring minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products. Also requires decontamination or disposal of contaminated equipment, structures and soils.	Decontamination actions and facilities will be constructed for remedial activities and disassembled after completion.
Standards Applicable to Transporters of Applicable Hazardous Waste - RCRA Section 3003	40 CFR Parts 170-179, 262, and 263	S	Establishes the responsibility of off-site transporters of hazardous waste in the handling, transportation and management of the waste. Requires manifesting, recordkeeping and immediate action in the event of a discharge.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
United States Department of Transportation (USDOT) Rules for Transportation of Hazardous Materials	49 CFR Parts 107 and 171.1 - 172.558	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous materials.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Clean Air Act-National Ambient Air Quality Standards	40 CFR Part 60	S	Establishes ambient air quality standards for protection of public health.	Remedial operations will be performed in a manner that minimizes the production of benzene and particulate matter.
USEPA-Administered Permit Program: The Hazardous Waste Permit Program	RCRA Section 3005; 40 CFR Part 270.124	S	Covers the basic permitting, application, monitoring and reporting requirements for off-site hazardous waste management facilities.	Any off-site facility accepting hazardous waste from the site must be properly permitted. Implementation of the site remedy will include consideration of these requirements.
Land Disposal Restrictions	40 CFR Part 368	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous waste must be treated prior to land disposal.	Excavated materials that display the characteristic of hazardous waste or that are decharacterized after generation must be treated to 90% constituent concentration reduction capped at 10 times the UTS.
RCRA Subtitle C	40 U.S.C. Section 6901 et seq.; 40 CFR Part 268	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes UTSs to which hazardous wastes must be treated prior to land disposal.	Potentially applicable to remedial activities that include the dredging and disposal waste material from the site.

Table 2
Summary of Action-Specific SCGs

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
CWA - Discharge to Waters of the U.S., and Section 404	40 CFR Parts 403, and 230 Section 404 (b) (1); 33 USC 1344	S	Establishes site-specific pollutant limitations and performance standards which are designed to protect surface water quality. Types of discharges regulated under CWA include: indirect discharge to a POTW, and discharge of dredged or fill material into U.S. waters.	Potentially applicable to remedial activities within and/or adjacent to the Hudson River
CWA Section 401	33 USC 1341	S	Requires that 401 Water Quality Certification permit be provided to federal permitting agency (USACE) for any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into jurisdictional waters of the U.S. and/or state.	Potentially applicable to remedial activities within and/or adjacent to the Hudson River.
Rivers and Harbors Act, Sections 9 & 10	33 USC 401 and 403; 33 CFR Parts 320- 330	S	Prohibits unauthorized obstruction or alteration of navigable waters of the U.S. (dredging, fill, cofferdams, piers, etc.). Requirements for permits affecting navigable waters of the U.S.	Potentially applicable to remedial activities within and/or adjacent to the Hudson River.
New York State				
NYSDEC's Monitoring Well Decommissioning Guidelines	NPL Site Monitoring Well Decommissioning dated May 1995	G	This guidance presents procedure for abandonment of monitoring wells at remediation sites.	This guidance is applicable for soil or groundwater alternatives that require the decommissioning of monitoring wells onsite.
Guidelines for the Control of Toxic Ambient Air Contaminants	DAR-1 (Air Guide 1)	G	Provides guidance for the control of toxic ambient air contaminants in New York State and outlines the procedures for evaluating sources of air pollution.	This guidance may be applicable for soil or groundwater alternatives that results in certain air emissions.
New York Permits and Certificates	6 NYCRR Part 201	G	Provides instructions and regulations for obtaining a permit to operate air emission source.	Permits are not required for remedial actions taken at hazardous waste sites; however, documentation for relevant and appropriate permit conditions would be provided to NYSDEC prior to and during implementation of this alternative.
New York State Air Quality Classification System	6 NYCRR Part 256	G	Outlines the air quality classifications for different land uses and population densities.	Air quality classification system will be referenced during the treatment process design.
New York Air Quality Standards	6 NYCRR Part 257	G	Provides air quality standards for different chemicals (including those found at the site), particles, and processes.	Emissions from the treatment process will meet the air quality standards.
Discharges to Public Waters	New York State Environmental Conservation Law, Section 71-3503	S	Provides that a person who deposits gas tar, or the refuse of a gas house or gas factory, or offal, refuse, or any other noxious, offensive, or poisonous substances into any public waters, or into any sewer or stream running or entering into such public waters, is guilty of a misdemeanor.	During the remedial activities, MGP-impacted materials will not be deposited into public waters or sewers.
New York Hazardous Waste Management System - General	6 NYCRR Part 370	S	Provides definitions of terms and general instructions for the Part 370 series of hazardous waste management.	Hazardous waste is to be managed according to this regulation.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if solid waste generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities	6 NYCRR Part 372	S	Provides guidelines relating to the use of the manifest system and its recordkeeping requirements. It applies to generators, transporters and facilities in New York State.	This regulation will be applicable to any company(s) contracted to do treatment work at the site or to transport or manage hazardous material generated at the site.
New York Regulations for Transportation of Hazardous Waste	6 NYCRR Part 372.3 a-d	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous waste.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Waste Transporter Permits	6 NYCRR Part 364	S	Governs the collection, transport and delivery of regulated waste within New York State.	Properly permitted haulers will be used if any waste materials are transported off-site.
New York Regulations for Hazardous Waste Management Facilities	6 NYCRR Part 373.1.1 - 373.1.8	S	Provides requirements and procedures for obtaining a permit to operate a hazardous waste treatment, storage and disposal facility. Also lists contents and conditions of permits.	Any off-site facility accepting waste from the site must be properly permitted.

Table 2
Summary of Action-Specific SCGs

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Land Disposal of a Hazardous Waste	6 NYCRR Part 376	S	Restricts land disposal of hazardous wastes that exceed specific criteria.	New York defers to USEPA for UTS/LDR regulations.
NYSDEC Guidance on the Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants	TAGM 4061 (DER-4)	G	Outlines the criteria for conditionally excluding coal tar waste and impacted soils from former MGPs which exhibit the hazardous characteristic of toxicity for benzene (D018) from the hazardous waste requirements of 6 NYCRR Parts 370 - 374 and 376 when destined for thermal treatment.	This guidance will be used as appropriate in the management of MGP-impacted soil and coal tar waste generated during the remedial activities.
National Pollutant Discharge Elimination System (NPDES) Program Requirements, Administered Under New York State Pollution Discharge Elimination System (SPDES)	40 CFR Parts 122 Subpart B, 125, 301, 303, and 307 (Administered under 6 NYCRR 750-758)	S	Establishes permitting requirements for point source discharges; regulates discharge of water into navigable waters including the quantity and quality of discharge.	Removal activities may involve treatment/disposal of water. If so, water generated at the site will be managed in accordance with NYSDEC SPDES permit requirements.
Use and Protection of Waters Program	6 NYCRR Part 608	S	Protection of waters permit program regulates: 1) any disturbance of the bed or banks of a protected stream or water course; 2) construction and maintenance of dams; and 3) excavation or fill in navigable waters of the State.	A permit will be required for the excavation and placement of fill associated with the remediation of MGP impacted sediment on the Hudson River.

Table 3
Summary of Location-Specific SCGs

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
National Environmental Policy Act Executive Orders 11988 and 11990	40 CFR 6.302; 40 CFR Part 6, Appendix A	S	Requires federal agencies, where possible, to avoid or minimize adverse impact of federal actions upon wetlands/floodplains and enhance natural values of such. Establishes the "no-net-loss" of waters/wetland area and/or function policy.	To be considered if remedial activities are conducted within the floodplain or wetlands.
Fish and Wildlife Coordination Act	16 USC 661; 40 CFR 6.302	S	Actions must be taken to protect fish or wildlife when diverting, channeling or otherwise modifying a stream or river.	Potentially applicable to remedial activities within and/or adjacent to the Hudson River.
Historical and Archaeological Data Preservation Act	16 USC 469a-1	S	Provides for the preservation of historical and archaeological data that might otherwise be lost as the result of alteration of the terrain.	The National Register of Historic Places register would be consulted to determine the presence of historical sites in the immediate vicinity of the MGP site.
National Historic and Historical Preservation Act	16 USC 470; 36 CFR Part 65; 36 CFR Part 800	S	Requirements for the preservation of historic properties.	The National Register of Historic Places register would be consulted to determine the presence of historical sites in the immediate vicinity of the MGP site.
Hazardous Waste Facility Located on a Floodplain	40 CFR Part 264.18(b)	S	Requirements for a treatment, storage and disposal (TSD) facility built within a 100-year floodplain.	Hazardous waste TSD activities (if any) will be designed to comply with applicable requirements cited in this regulation.
Endangered Species Act	16 USC 1531 et seq.; 50 CFR Part 200; 50 CFR Part 402	S	Requires federal agencies to confirm that the continued existence of any endangered or threatened species and their habitat will not be jeopardized by a site action.	One candidate (Atlantic sturgeon) and one endangered species (short-nose sturgeon) were identified on the USFWS list of Threatened, Endangered, Sensitive Species.
Floodplains Management and Wetlands Protection	40 CFR 6 Appendix A	S	Activities taking place within floodplains and/or wetlands must be conducted to avoid adverse impacts and preserve beneficial value. Procedures for floodplain management and wetlands protection provided.	To be considered if remedial activities are conducted within the floodplain or wetlands.
CWA Section 401	33 USC 1341	S	Requires that 401 Water Quality Certification permit be provided to federal permitting agency (USACE) for any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into jurisdictional waters of the U.S.	Applicable to remedial activities within and/or adjacent to the Hudson River.
CWA - Discharge to Waters of the U.S., and Section 404	40 CFR Parts 403, and 230 Section 404 (b) (1); 33 USC 1344	S	Establishes site-specific pollutant limitations and performance standards which are designed to protect surface water quality. Types of discharges regulated under CWA include: indirect discharge to a POTW, and discharge of dredged or fill material into U.S. waters.	Discharge of dredge or fill materials into waters of the U.S., including wetlands, are regulated by the USACE.
Rivers and Harbors Act	33 USC 401 and 403; 33 CFR Parts 320- 330	S	Prohibits unauthorized obstruction or alteration of navigable waters of the U.S. (dredging, fill, cofferdams, piers, etc.). Requirements for permits affecting navigable waters of the U.S.	Potentially applicable to remedial activities within and/or adjacent to the Hudson River.
New York State				
New York State Floodplain Management Development Permits	6 NYCRR Part 500	S	Provides conditions necessitating NYSDEC permits and provides definitions and procedures for activities conducted within floodplains.	Potentially applicable to remedial activities within and/or adjacent to the Hudson River 100-year flood plain.
New York State Freshwater Wetlands Act	ECL Article 24 and 71; 6 NYCRR Parts 662-665	S	Activities in wetlands areas must be conducted to preserve and protect wetlands.	Does not appear to be applicable as the site is not located in a wetlands area.
New York State Parks, Recreation, and Historic Preservation Law	New York Executive Law Article 14	S	Requirements for the preservation of historic properties.	The National Register of Historic Places register would be consulted to determine the presence of historical sites in the immediate vicinity of the MGP site.
Endangered & Threatened Species of Fish and Wildlife	6 NYCRR Part 182	S	Identifies endangered and threatened species of fish and wildlife in New York.	The short-nosed sturgeon is a candidate on the List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State.
Floodplain Management Criteria for State Projects	6 NYCRR Part 502	S	Establishes floodplain management practices for projects involving state-owned and state-financed facilities.	Portions of the area to be remediated are located within the floodplain. Activities located in these areas would be performed in accordance with this regulation.
Use and Protection of Waters Program	6 NYCRR Part 608	S	Protection of waters permit program regulates: 1) any disturbance of the bed or banks of a protected stream or water course; 2) construction and maintenance of dams; and 3) excavation or fill in navigable waters of the State.	A permit will be required for the excavation and placement of fill associated with the remediation of MGP impacted sediment on the Hudson River.
New York State Coastal Management Program	Significant Fish and Wildlife Habitat Policies 7 and 8	S	Requires that a Consistency Determination to be obtained for activities proposed within Significant Fish and Wildlife Habitats	The Peekskill Bay portion of the Hudson River adjacent to the Project Area is not designated as a Significant Fish and Wildlife Habitat.

Table 3
Summary of Location-Specific SCGs

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Local				
Local Building Permits	N/A	S	Local authorities may require a building permit for any permanent or semi-permanent structure, such as an on-site water treatment system building or a retaining wall.	Substantive provisions are potentially applicable to remedial activities that require construction of permanent or semi-permanent structures.
Local Street Work Permits	N/A	S	Local authorities will require a permits for conducting work within and closing local roadways.	Street work permits will be required to conduct remedial activities within public roadways.
Local Waterfront Revitalization Plan	Adopted and approved in accordance with ECL Article 42 and 6 NYCRR 601.	S	Local authorities will be required to review the remedial action for consistency with the Local Waterfront Revitalization Plan.	Applicable to remedial activities within the Coastal Boundary of the City of Peekskill as outlined in the Local Waterfront Revitalization Plan.

Table 4
Remedial Technology Screening Evaluation for Soil

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
No Action	No Action	No Further Action	Alternative would not include any remedial action. A 'No Action' alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a 'No Action' alternative is required by the NYSDEC DER-10.	Implementable.	Would not achieve the RAOs for soil in an acceptable time frame.	Yes
Institutional Controls	Institutional Controls	Deed Restrictions, Environmental Land Use Restrictions, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted soils and/or jeopardize the integrity of a remedy. Examples of potential institutional controls include establishing land use restrictions, health and safety requirements for subsurface activities.	Implementable.	When properly implemented and followed, this technology could reduce potential human exposures, and may be effective when combined with other technology processes. Would help to reduce human exposure to impacted soil.	Yes
In-Situ Containment/ Control	Capping	Soil Cap	Placing and compacting soil/gravel material over impacted soil to provide a physical barrier to human and biota exposure to impacted soil at the site.	Implementable. Equipment and materials necessary to construct the cap are readily available.	Although construction of a cap is readily implementable, the presence of a surface cap would not achieve a majority of the site-specific RAOs.	No
		Asphalt/Concrete Cap	Application of a layer of asphalt or concrete over impacted soils.			No
		Multi-Media Cap	Application of a combination of clay/soils and synthetic membrane(s) over impacted soil.			No
In-Situ Treatment	Immobilization	Solidification/ Stabilization	Addition of material to the impacted soil that limits the solubility and mobility of NAPL and COCs in soil and groundwater. Involves treating soil to produce a stable material with low leachability that physically and chemically locks NAPL and COCs in the solidified matrix.	Potentially implementable. Solidification/ stabilization materials are readily available. The presence of existing structures and active railroad leave little working room to complete solidification/stabilization activities at the site.	Overall effectiveness of this process would need to be evaluated during a bench-scale treatability study. Assuming an effective stabilization mix could be developed, this technology would effectively address each of the RAOs for soil.	No
	Extraction/In-Situ Stripping	Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO)	Steam is injected into the subsurface to mobilize contaminants and NAPLs. The mobilized contaminants are captured and constituents are recondensed, collected, and treated. In addition, HPO can degrade contaminants in subsurface heated zones. In most cases, this technology requires long-term operation and maintenance of on-site injection, collection and/or treatment systems.	Technically implementable. This option would require a pilot scale study to determine effectiveness. Process may result in uncontrolled NAPL migration. Limited space for vapor recovery system and treatment. Not a preferred technology process due to risks and potential technical implementability issues.	Could potentially promote NAPL mobilization. Focused on saturated zone. Alone, this technology would not effectively address the RAO of preventing direct exposure to impacted soil.	No
	Chemical Treatment	Chemical Oxidation	Oxidizing agents are added to oxidize and reduce the mass of organic constituents in-situ chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate or potassium permanganate. A pilot study would be required to evaluate/determine oxidant application requirements. May not effectively oxidize NAPL.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available. May require special provisions for storage of process chemicals.	Would require multiple treatments of chemicals to reduce COCs. Would not be effective at treating NAPL and NAPL-containing soil.	No

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General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
In-Situ Treatment (Cont'd)	Chemical Treatment (cont'd)	Surfactant/Cosolvent Flushing	A surfactant or cosolvent solution is delivered and extracted by a network of injection and extraction wells to flush the NAPL source area. Reduction of the NAPL mass occurs by increasing the dissolution of the NAPL or selected constituents or by increasing the NAPL mobility with reduction of the interfacial tension between the NAPL and groundwater and/or reduction of the NAPL viscosity. A bench scale and treatability study would be required to determine surfactant/cosolvent solution.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available. May require special provisions for storage of process chemicals.	Overall effectiveness of this process would need to be evaluated during a bench and field-scale pilot test to determine the site-specific design. Would not be effective at treating all NAPL and NAPL-containing soil.	No
	Biological Treatment	Biodegradation	Natural biological and physical processes that, under favorable conditions, act without human intervention to reduce the mass, volume, concentration, toxicity, and/or mobility of COCs. This process relies on long-term monitoring to demonstrate the reduction of impacts.	Implementable.	Less effective for PAHs; not effective for NAPLs; would not achieve RAOs in an acceptable time frame.	No
		Enhanced Biodegradation	Addition of amendments (e.g., oxygen, nutrients) and controls to the subsurface to enhance indigenous microbial populations to improve the rate of natural degradation.	Implementable.	May not achieve RAOs for soil. Not effective for NAPLs.	No
		Biosparging	Air/oxygen injection wells are installed within the impacted regions to enhance biodegradation of constituents by increasing oxygen availability. Low-flow injection technology may be incorporated. This technology requires long-term monitoring.	Implementable.	May not achieve RAOs for soil. Not effective for NAPLs.	No
Removal	Excavation	Excavation	Physical removal of impacted soil. Typical excavation equipment would include excavators, backhoes, loaders, and/or dozers. Extraction wells and pumps or other methods may be used to obtain hydraulic control to facilitate use of typical excavation equipment to physically remove soil.	Implementable. Equipment capable of excavating the soil is readily available. However, complete soil removal is not technically practicable given the presence of existing structures and active railroad.	Would achieve RAOs. Proven process for effectively removing impacted soil.	Yes
	NAPL Removal	Active Removal	Process by which automated pumps are utilized to remove DNAPL from recovery wells.	Technically implementable.	May be effective in removing NAPL. Effectiveness could be enhanced through the installation of a collection trench of permeable barrier.	Yes
		Passive Removal	NAPL is passively collected in vertical wells and periodically removed (i.e., via bottom-loading bailers, manually operated pumps, etc.).	Technically implementable.		Yes
		Hot Water/Steam Injection	Process involves the injection of hot water and/or steam to heat groundwater and decrease the viscosity of DNAPL to facilitate mobilization and removal. Used in conjunction with one (or more) of the above recovery technologies.	Technically feasible.	This process may facilitate uncontrolled migration of NAPL.	No

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Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
Ex-Situ On-Site Treatment and/or Disposal	Immobilization	Solidification/ Stabilization	Addition of material to excavated soil that limits the solubility or mobility of the constituents present. Involves treating soil to produce a stable material with low leachability, that physically and chemically locks the constituents within the solidified matrix.	Technically implementable. Limitations of space and public proximity concerns limits the implementability of this technology. Pilot study would be needed to verify implementability.	May achieve RAOs. Proven process for effectively reducing mobility and toxicity of NAPL and organic and inorganic constituents.	No
	Extraction	Low-Temperature Thermal Desorption	Process by which soils containing organics with boiling point temperatures less than 800^{o} Fahrenheit are excavated, conditioned, and heated; the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Treated soils are returned to the subsurface. Treatment is conducted in a thermal treatment unit that is mobilized or constructed on-site.	Not considered implementable due to close proximity of public areas.	Proven process for effectively removing organic constituents from excavated soil. The efficiency of the system and rate of removal of organic constituents would require evaluation during bench-scale and/or pilot-scale testing.	No
	Thermal Destruction	Incineration	Use of a mobile incineration unit installed on-site for high temperature thermal destruction of the organic compounds present in the media. Soils are excavated and conditioned prior to incineration. Treated soils are returned to the subsurface.	Not considered implementable due to close proximity of public areas.	Proven process for effectively addressing organic constituents. The efficiency of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing.	No
	Chemical Treatment	Chemical Oxidation	Addition of oxidizing agents to degrade organic constituents to less-toxic by-products.	Implementable. Equipment and materials necessary to apply oxidizing agents are available. Large amounts of oxidizing agents may be required. Limited space for soil management and application of the chemical oxidation. May require special provisions for storage of process chemicals.	Not known to be effective for NAPL.	No
	On-Site Disposal	RCRA Landfill	Construction of a landfill that would meet RCRA requirements.	Space limitations make on-site landfilling infeasible.	This technology process would be effective at meeting the RAOs for soil. Excavated material would be contained in an appropriately constructed soil management cell. Long-term effectiveness requires ongoing maintenance and	No
		Solid Waste Landfill	Construction of a landfill that would meet NYSDEC solid waste requirements.			No

Table 4
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Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
Off-Site Treatment and/or Disposal	Recycle/ Reuse	Asphalt Concrete Batch Plant	Soil is used as a raw material in asphalt concrete paving mixtures. The impacted soil is transported to an off-site asphalt concrete facility and can replace part of the aggregate and asphalt concrete fraction. The hot-mix process melts asphalt concrete prior to mixing with aggregate. During the cold-mix process, aggregate is mixed at ambient temperature with an asphalt concrete/water emulsion. Organics and inorganics are bound in the asphalt concrete. Some organics may volatilize in the hot-mix.	Permitted facilities and demand are limited.	Effective for treating organics and inorganics through volatilization and/or encapsulation. Thermal pretreatment may be required to prevent leaching. Limited number of projects to support comparison of effectiveness.	No
		Brick/Concrete Manufacture	Soil is used as a raw material in manufacture of bricks or concrete. Heating in ovens during manufacture volatilizes organics and some inorganics. Other inorganics are bound in the product.	The site does not have the adequate space necessary to conduct the amount of screening of the material required to be performed prior to being utilized in brick/concrete manufacture.	Effective for treating organics and inorganics through volatilization and/or vitrification. A bench-scale/pilot study may be necessary to determine effectiveness.	No
		Fuel Blending/Co-Burn in Utility Boiler	Soil is blended with feed coal to fire a utility boiler used to generate steam. Organics are destroyed.	Permitted facilities available for burning MGP soils are limited.	Effective for treating organic constituents. Soil would be blended with coal prior to burning. Overall effectiveness of this process would need to be evaluated during a trial burn.	No
	Extraction	Low-Temperature Thermal Desorption	Process by which soils containing organics with boiling point temperatures less than 800^{o} Fahrenheit are heated and the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Would be used on materials that are determined to be characteristically hazardous based on TCLP analysis.	Implementable. Treatment facilities are available.	Effective means for treatment of materials that are characteristically hazardous due to the presence of organic compounds (i.e., benzene).	Yes
	Thermal Destruction	Incineration	Soils are incinerated off-site for high temperature thermal destruction of the organic compounds present in the media. Soils are excavated and conditioned prior to incineration.	Not implementable. Not a cost effective means for treating impacted soil. Limited number of treatment facilities. LTTD is a more appropriate technology process for thermally treating MGP-impacted media.	Proven process for effectively addressing organic constituents. The efficiency and effectiveness of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing.	No
	Off-Site Disposal	Solid Waste Landfill	Disposal of non-hazardous soil and C&D debris in an existing permitted non-hazardous landfill.	Implementable.	Proven process that, in conjunction with excavation, can effectively achieve the RAOs.	Yes
		RCRA Landfill	Disposal of impacted soil in an existing RCRA permitted landfill facility.	Hazardous materials would not meet New York State LDRs.	Proven process that, in conjunction with excavation, can effectively achieve the RAOs.	No

Note:
1. Shading indicates that technology process has not been retained for development of a remedial alternative

Table 5
Remedial Technology Screening Evaluation for Groundwater

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
No Action	No Action	No Further Action	Alternative would not include any remedial action. A 'No Action' alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a 'No Action' alternative is required by the NYSDEC DER-10.	Implementable.	Would not achieve the RAOs for groundwater in an acceptable time frame.	Yes
Institutional Controls	Institutional Controls	Deed Restrictions, Groundwater Use Restriction, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted materials and/or jeopardize the integrity of a remedy. Examples of potential institutional controls include establishing land use restrictions, health and safety requirements for subsurface activities, and restrictions on groundwater use and/or extraction.	Implementable.	May be effective for reducing the potential for human exposure. This option may be effective when combined with other process options.	Yes
In-Situ Containment/ Control	Containment	Sheet Pile	Steel sheet piles are driven into the subsurface to contain impacted soils, groundwater, and NAPLs. The sheet pile wall is typically keyed into a confining unit and could be permeable or impermeable to groundwater flow.	Presence of existing buildings and active railroad would prevent installation of a continuous barrier, limiting the implementability of this alternative. However, partial barriers could be installed to mitigate further migration of NAPL (i.e., to Peekskill Bay sediment). Hydraulic effects on-site groundwater would have to be evaluated. Equipment and materials required to install slurry walls are readily available, but buildings and railroad present logistical challenges.	Could further reduce mobility of NAPL and dissolved phase COCs in groundwater. In order to control dissolved phase migration, would require areas to be completely surrounded. Groundwater modeling would be recommended to determine the potential effects of a low-permeability wall on the hydrogeology.	Yes
		Slurry Walls/Jet Grout Wall	Involves excavating a trench and adding a slurry (e.g., soil/cement-bentonite mixture) to control migration of groundwater and NAPL from an area. Slurry walls are typically keyed into a low permeability unit (e.g., an underlying silt/clay layer).			Yes
In-Situ Treatment	Biological Treatment	Groundwater Monitoring	Natural biological, chemical, and physical processes that under favorable conditions, act without human intervention to reduce the mass, volume, concentration, toxicity, and mobility of chemical constituents. Long-term monitoring is required to demonstrate the reduction of COCs.	Easily implemented. Would require monitoring to demonstrate reduction of COCs.	Would only achieve RAOs for groundwater (over an extended period of time) if the source of dissolved phase impacts (i.e., NAPL and impacted soil) were addressed.	No
		Enhanced Biodegradation	Addition of amendments (e.g., nutrients, oxygen) to the subsurface to enhance indigenous microbial populations to improve the rate of natural biodegradation of constituents.	Would be difficult to sufficiently oxygenate the soil using amendments due to the thickness of the saturated zone and depth of impacts.	May not be effective if the subsurface conditions cannot be made and maintained aerobic. Would not be effective at restoring groundwater to pre-release/pre-disposal conditions unless MGP source materials are addressed (i.e., through containment, excavation, or stabilization).	No
		Biosparging	Air/oxygen injection wells are installed within the dissolved plume to enhance biodegradation of constituents by increasing oxygen availability. Low-flow injection technology may be incorporated. This technology requires long-term operation, monitoring, and maintenance of air/oxygen delivery system.	Implementable. Equipment for installing wells and injecting air/oxygen is readily available.	Could require a significant amount of oxygen to enhance degradation. Could be effective at addressing dissolved-phase impacts in combination with source material mass reduction.	No
	Chemical Treatment	Chemical Oxidation	Oxidizing agents are added to oxidize and reduce the mass of organic constituents. In-situ chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate, or potassium permanganate. Large amounts of oxidizing agents are needed to oxidize NAPL.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available. May require special provisions for storage of process chemicals.	Assuming removal of source materials, this technology could meet the RAOs for groundwater. However, may not be a cost effective means to achieve the RAOs.	No

Table 5
Remedial Technology Screening Evaluation for Groundwater

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
In-Situ Treatment (cont'd)	Chemical Treatment (cont'd)	Permeable Reactive Barrier (PRB)	PRBs are installed in or down gradient from the flow path of a contaminant plume. The contaminants in the plume react with the media inside the barrier to either break the compound down into harmless products or immobilize contaminants by precipitation or sorption.	Presence of existing structures and active railroad would prevent installation of a continuous barrier, limiting the implementability of this alternative.	NAPL in subsurface would inhibit effectiveness of PRB. Groundwater conditions may potentially encourage biological growth and fouling of PRB. Could be effective when combined with source removal.	No
	Extraction	Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO)	Steam is injected into the subsurface to mobilize contaminants and NAPLs. The mobilized contaminants are captured and constituents are recondensed, collected and treated. In addition, HPO can degrade contaminants in subsurface heated zones. In most cases, this technology requires long-term operation and maintenance of on-site injection, collection, and/or treatment systems.	Technically implementable. This option would require a pilot scale study to determine effectiveness. Process may result in uncontrolled NAPL migration. Not a preferred technology process due to risks and potential technical implementability issues.	This option would require a pilot scale study to determine effectiveness. Process may result in NAPL and/or dissolved plume migration. Not certain in the ability of this alternative to meet the RAOs.	No
Removal	Hydraulic Control	Vertical Extraction Wells	Vertical wells are installed and utilized to recover groundwater for treatment/disposal and containment/migration control. Typically requires extensive design/testing to determine required hydraulic gradients and feasibility of achieving those gradients.	Equipment and tools necessary to install and operate vertical extraction wells are readily available. Would require operation for an extended period of time.	Would not meet RAOs as a stand alone technology. Would likely be used in conjunction with an ex-situ treatment system (i.e., pump and treat). Pumping would be required over a prolonged period of time.	No
		Horizontal Extraction Wells	Horizontal wells are utilized to replace conventional well clusters in soil and containment/migration control.	Requires specialized horizontal drilling equipment. Not implementable.		No
Ex-Situ/On-Site Treatment	Chemical Treatment	Ultra-violet (UV) Oxidation	Oxidation by subjecting groundwater to UV light and ozone. If complete mineralization is achieved, the final products of oxidation are carbon dioxide, water, and salts.	Potentially implementable. Limited space for a full-scale treatment system. Not typically used in MGP-impacted groundwater treatment train. Not effective on NAPL.	Proven process for effectively treating organic compounds. Use of this process may effectively achieve the RAOs. A bench-scale treatability study may be required to evaluate the efficiency of this process and to make project-specific adjustments to the process.	No
		Chemical Oxidation	Addition of oxidizing agents to degrade organic constituents to less-toxic byproducts.	Potentially implementable. Limited space for a full-scale treatment system. Not effective on NAPL.	A bench-scale treatability study may be required to evaluate the efficiency of this process and to make project-specific adjustments to the process. Large amounts of oxidizing agents are needed to oxidize NAPL.	No
	Physical Treatment	Carbon Adsorption	Process by which organic constituents are adsorbed to the carbon as groundwater is passed through carbon units.	Limited space for a full-scale treatment system. Potentially implementable.	Effective at removing organic constituents. Use of this treatment process may effectively achieve the RAOs when combined with groundwater extraction.	No
		Filtration	Extraction of groundwater and treatment using filtration. Process in which the groundwater is passed through a granular media in order to removed suspended solids by interception, straining, flocculation, and sedimentation activity within the filter.	Limited space for a full-scale treatment system. Potentially implementable.	Effective pre-treatment process to reduce suspended solids. Use of this process along with other processes (i.e., that address organic constituents) could effectively achieve the RAOs.	No

Table 5
Remedial Technology Screening Evaluation for Groundwate

Alternatives Analysis Repor
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New Yor

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
Ex-Situ/On-Site Treatment (cont)	Physical Treatment (cont'd)	Air Stripping	A process in which VOCs are removed through volatilization by increasing the contact between the groundwater and air.	Limited space for a full-scale treatment system. Potentially implementable.	This technology process would be effective at removing VOCs from water. Process would potentially be used as part of a treatment train to treat groundwater removed from excavation areas. Has potential to be used as part of a treatment system to meet the RAOs.	No
		Precipitation/ Coagulation/ Flocculation	Process which precipitates dissolved constituents into insoluble solids and improves settling characteristics through the addition of amendments to water to facilitate subsequent removal from the liquid phase by sedimentation/filtration.	Limited space for a full-scale treatment system. Potentially implementable.	Process which transforms dissolved constituents into insoluble solids by adding coagulating agents to facilitate subsequent removal from the liquid phase by sedimentation/filtration. Has potential to be used as part of a treatment system to meet the RAOs.	No
		Oil/Water Separation	Process by which insoluble oils are separated from water via physical separation technologies, including gravity separation, baffled vessels, etc.	Limited space for a full-scale treatment system. Potentially implementable.	Effective at separating insoluble oil from groundwater. This process could be used as part of the groundwater treatment train if needed to address separate-phase liquids. Has potential to be used as part of a treatment system to meet the RAOs.	No
Off-site Treatment and/or Disposal	Groundwater Discharge	Discharge to a local Publicly-Owned Treatment Works (POTW)	Treated or untreated water is discharged to a sanitary sewer and treated at a local POTW facility.	Implementable. Equipment and materials necessary to extract, pretreat (if necessary), and discharge the water to the sewer system are readily available. Discharges to the sewer will require a POTW-issued discharge permit.	Proven process for effectively disposing of groundwater. Typically requires the least amount of pretreatment because the discharged water will be subjected to additional treatment at the POTW. Could be used as a component of an overall remedy to meet the RAOs for groundwater. May be used in conjunction with a containment technology to maintain an inward hydraulic gradient.	No
		Discharge to Surface Water via Storm Sewer	Treated or untreated water is discharged to surface water, provided that the water quality and quantity meet the allowable discharge requirements for surface waters (NYSDEC SPDES compliance).	Discharges to surface water must meet substantive requirements of a SPDES permit. Cleanup objectives and sampling requirements may be restrictive.	This technology process would effectively dispose of groundwater. Impacted groundwater would require treatment to achieve water quality discharge limits. Helps in the management of treated water, but does not directly lend to achieving the RAOs for groundwater.	No
		Discharge to a privately-owned treatment/disposal facility.	Treated or untreated water is collected and transported to a privately-owned treatment facility.	Equipment and materials to pretreat the water at the site are readily available on a commercial basis. Facilities capable of transporting and disposing of the groundwater are available. Treatment may be required prior to discharge.	Proven process for effectively disposing of groundwater. Typically requires the least amount of pretreatment because the discharged water will be subjected to additional treatment at the disposal facility. Could be used as a component of an overall remedy to meet the RAOs for groundwater.	No

Note:
1. Shading indicates that technology process has not been retained for development of a remedial alternative

Table 6
Remedial Technology Screening Evaluation for Sediment

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
No Action	No Action	No Further Action	Alternative would not include any remedial action. A 'No Action' alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a 'No Action' alternative is required by the NYSDEC DER-10.	Implementable.	May not achieve RAOs for potential human and biota exposure to sediments containing MGP-related constituents and NAPL.	Yes
Institutional Controls	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted sediments and/or jeopardize the integrity of a remedy. Examples of potential institutional controls for sediments containing MGP-related constituents and NAPL include posting of signs to mitigate potential exposure and actions that may disturb sediments and/or jeopardize the integrity of the remedy.	Implementable. Would require coordination with third party landowners/lessees, New York State, United States Army Corps of Engineers, and any parties with easements (e.g., utility crossings), as well as cooperation of the users of the Hudson River.	This option could reduce the potential for human exposure, and may be effective when combined with other process options. May not achieve RAOs for potential biota exposure to sediments containing MGP-related constituents and NAPLs.	Yes
In-Situ Containment/ Controls	Natural Recovery	Monitored Natural Recovery	Ongoing, naturally occurring degradation of MGP-related constituents and NAPL in the sediments over time via natural physical/chemical processes of advection, dispersion, burial, dissolution, sorption, photo-oxidation and biodegradation. Periodic sampling and visual observations of the sediment would be required over time.	Implementable. Equipment and contractors are readily available to conduct periodic monitoring of impacted sediments.	May achieve the RAOs over time. Requires monitoring to document changes in the sediment conditions and progress toward achieving the RAOs.	Yes
	Capping	Engineered Cap	Covering or encapsulating sediments with natural material (e.g., gravel, sand, clays), modified natural materials (e.g. organoclays), synthetic materials (Aquablok™ pellet, geotextile membranes), and/or armoring to physically, isolate sediments containing MGP-related constituents and NAPL. The specific details of the cap (i.e., material types and thicknesses) would be determined during the remedial design.	Implementable. Equipment and materials necessary to construct an engineered cap are readily available. May require that sediment removal first be implemented to minimize/prevent increase in river bottom elevation due to material placement.	Would reduce the mobility of MGP-related constituents through isolation and if properly designed and maintained, would eliminate human and biota exposure to MGP-impacted sediments. Would require periodic monitoring and potential maintenance to verify and maintain the cap effectiveness over the long term.	Yes
In-Situ Treatment	Immobilization	Solidification / Stabilization	Addition and mixing of materials (e.g. Portland cement) into sediments containing MGP-related constituents and NAPLs that limits the solubility and mobility of the NAPL and MGP-related constituents in sediment. Involves treating sediment to produce a stable material with low leachability that physically and chemically locks NAPL and MGP-related constituents in the solidified/stabilized matrix.	Has not been successfully implemented full-scale elsewhere for sediments. May require sediment removal to address sediment expansion/bulking during solidification/ stabilization such that there is not net increase in the river bottom elevation. May require cover to provide suitable habitat layer. Implementing this technology in the river would require regulatory permits and approvals.	Overall effectiveness of this process would need to be evaluated during a bench-scale treatability study to identify suitable additive and mixing processes. Presence of rocks/cobbles may interfere with mixing process (most applicable for fine-grained, homogenous sediments). Assuming an effective solidification/stabilization mix/process can be determined, this technology would effectively address the sediment RAOs . Would require a study of the potential influence on site hydrogeology (e.g., change in vertical gradients, change in groundwater flow pathways, change in water table).	No

Table 6
Remedial Technology Screening Evaluation for Sediment

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
Removal	Dredging	Mechanical (in the dry or in the wet)	Physical removal of impacted sediment using dredges (e.g. clamshell) and conventional construction equipment either using excavation equipment positioned along the shoreline and/or on barges within the river. For excavation "in the dry", temporary enclosures using sheet piling or caissons with water management (pumping and treating on-site or off-site) would be required. For excavation in the wet, temporary containment structures and/or silt curtains, other barriers would be required to isolate the sediment removal area from the rest of the river; however, the surface water within the excavation area would not be actively managed to dewater the excavation area.	Implementable. Equipment and materials necessary to excavate sediment are readily available.	Proven process for removing and reducing volume of MGP-impacted sediments.	Yes
		Hydraulic	Sediments are removed in liquid slurry form using pumps, suction hose, horizontal auger and/or cutter-head dredge. Simultaneously removes large quantities of water, which requires handling/treatment.	Implementable; however, significant quantity of upland space needed for sediment dewatering and water treatment facilities. Since Con Edison does not own the adjacent upland parcels, third party access agreements would be required.	Proven process for effectively removing sediment. Effectiveness reduced if debris, larger-grained sediments (i.e., cobbles, boulders, rip-rap), and/or excessive vegetation is present. Not a cost effective means of removal for smaller sediment removal volumes.	No
Ex-situ On-Site Treatment and/or Disposal	Immobilization	Solidification	Addition of material to the removed sediment as a pre-treatment process to aid in the dewatering and/or to stabilize the sediments (i.e., produce a stable, non-leachable material, that physically or chemically locks the constituents within the solidified/stabilized matrix).	Implementable. An upland area to temporarily stage, dewater, and solidify sediment would be required. Since Con Edison does not own the adjacent upland parcels, third party access agreements would be required.	Common and proven process for solidifying MGP-impacted sediments in preparation for subsequent transportation over public roads (i.e., pass the paint filter test) and treatment/disposal.	Yes
	Thermal Extraction	Low-Temperature Thermal Desorption (LTTD)	Process by which material containing organics with boiling point temperatures less than 800^{o} Fahrenheit are excavated, conditioned, and heated; the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Treated materials are returned to the subsurface. Treatment is conducted in a thermal treatment unit that is mobilized or constructed on-site.	Not considered implementable due to close proximity of public areas.	Proven process for effectively removing organic constituents from excavated soil. The efficiency of the system and rate of removal of organic constituents would require evaluation during bench-scale and/or pilot-scale testing.	No
	Thermal Destruction	Incineration	Use of a mobile incineration unit installed on-site for high temperature thermal destruction of the organic compounds present in the media. Sediment is removed and conditioned prior to incineration. Treated sediment are subsequently disposed, unless beneficial reuse endpoint cant be identified.	Not considered implementable due to close proximity of public areas.	Proven process for effectively addressing organic constituents. The efficiency of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing.	No

Table 6
Remedial Technology Screening Evaluation for Sediment

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
Ex-situ On-Site Treatment and/or Disposal (cont'd)	Chemical Destruction	Chemical Oxidation	Sediments are mixed with oxidizing agents to reduce the mass of organic constituents. Chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate or potassium permanganate. Treated sediments are subsequently disposed, unless some beneficial reuse endpoint can be identified such as backfill in the sediment excavation.	Implementable. Equipment and materials necessary to apply oxidizing agents are available. May require special provisions for storage of process chemicals. Due to proximity of public areas, on-site ex-situ chemical oxidation may not be acceptable to the community.	Would require multiple treatments of chemicals to reduce MGP-related constituents. Would not be as effective at treating NAPL-impacted sediment. The efficiency of the oxidizing agent would need to be verified during bench-scale and/or pilot-scale testing. No sites exist where material has been placed back in river bed after chemical treatment; treatment would likely be done in combination with a disposal option.	No
	On-site Disposal	RCRA Landfill	Construction of a landfill that would meet RCRA requirements.	An upland area to construct the landfill would be required. Since Con Edison does not own the adjacent upland parcels, purchase of upland parcels near the site would be necessary. Due to proximity of public areas, on-site landfilling may not be acceptable to the community.	This technology process would be effective at meeting the RAOs for sediments. Excavated material would be contained in an appropriately constructed soil/sediment landfill. Long-term effectiveness requires ongoing maintenance and monitoring.	No
		Confined Disposal Facility (CDF)	Construction of an in-water or upland facility to contain dredged sediments.	Potentially Implementable. Further evaluation of embayments would be required. May not be acceptable due to proximity to existing public areas. Further, this process option is not generally suitable small volumes of sediment.	Effective method for disposing and controlling the release of dredged sediments into the environment.	No
Off-Site Treatment and/or Disposal	Recycle/Reuse	Asphalt Concrete Batch Plant	Sediment is used as a raw material in asphalt concrete paving mixtures. The impacted sediment is transported to an off-site asphalt concrete facility and can replace part of the aggregate and asphalt concrete fraction. The hot-mix process melts asphalt concrete prior to mixing with aggregate. During the cold-mix process, aggregate is mixed at ambient temperature with an asphalt concrete/water emulsion. Organics and inorganics are bound in the asphalt concrete. Some organics may volatilize in the hot-mix.	Permitted facilities and demand are limited.	Effective for treating organics and inorganics through volatilization and/or encapsulation. Thermal pretreatment may be required to prevent leaching. Limited number of projects to support comparison of effectiveness.	No
		Brick/Concrete Manufacture	Sediment is used as a raw material in manufacture of bricks or concrete. Heating in ovens during manufacture volatilizes organics and some inorganics. Other inorganics are bound in the product.	The site does not have the adequate space necessary to conduct the amount of screening of the material required to be performed prior to being utilized in brick/concrete manufacture.	Effective for treating organics and inorganics through volatilization and/or vitrification. A bench-scale/pilot study may be necessary to determine effectiveness.	No
	Extraction	Low-Temperature Thermal Desorption	Process by which sediment containing organics with boiling point temperatures less than 800^{o} Fahrenheit are heated and the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Would be used on materials that are determined to be characteristically hazardous based on TCLP analysis.	Implementable. Treatment facilities are available.	Effective means for treatment of materials that are characteristically hazardous due to the presence of organic compounds (i.e., benzene).	Yes

Table 6
Remedial Technology Screening Evaluation for Sediment

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc. - Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

General Response Action	Remedial Technology Type	Technology Process Option	Description	Implementability	Effectiveness	Retained?
Off-Site Treatment and/or Disposal (cont'd)	Thermal Destruction	Incineration	Sediments are incinerated off-site for high temperature thermal destruction of the organic compounds present in the media. Sediments are excavated and conditioned prior to incineration.	Not implementable. Not a cost effective means for treating impacted sediment. Limited number of treatment facilities. LTTD is a more appropriate technology process for thermally treating MGP-impacted media.	Proven process for effectively addressing organic constituents. The efficiency and effectiveness of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing.	No
	Disposal	RCRA Landfill	Disposal of impacted soil in an existing RCRA permitted landfill facility.	Hazardous materials would not meet New York State LDRs.	Proven process that, in conjunction with excavation, can effectively achieve the RAOs.	No
		Solid Waste Landfill	Disposal of non-impacted soil/debris in an existing permitted non-hazardous landfill.	Implementable. Non-hazardous solid waste landfills are in close proximity to the	Effective alternative for other non-impacted wastes generated during remedial activities.	Yes

Note:

1. Shading indicates that technology process has not been retained for development of a remedial alternative.

Table 7a
Cost Estimate for Alternative 2 Upland Components - MGP Structure Removal and NAPL Recovery Wells

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Capital Costs					
1	Pre-Design Investigation	1	LS	$150,000	$150,000
2	Permitting/Access Agreements	1	LS	$100,000	$100,000
3	Mobilization/Demobilization	1	LS	$100,000	$100,000
4	Traffic Control	17	WK	$10,000	$170,000
5	Construct and Remove Decontamination Pad	1	LS	$10,000	$10,000
6	Utility Markout and Clearance	1	LS	$5,000	$5,000
7	Structure Demolition and Disposal	1	LS	$32,000	$32,000
8	Install and Remove Temporary Excavation Support	4,200	SF	$105	$441,000
9	Soil Excavation and Handling	2,800	CY	$50	$140,000
10	Stabilization Admixture	130	TON	$115	$14,950
11	On-Site Water Handling/Management	17	WK	$2,500	$42,500
12	Community Air Monitoring and Vapor/Odor Control	17	WK	$15,000	$255,000
13	Backfill	2,800	CY	$40	$112,000
14	Liquid Waste Characterization	6	EA	$1,000	$6,000
15	Solid Waste Characterization	9	EA	$1,000	$9,000
16	Liquid Waste Transportation and Disposal	101,000	GAL	$1	$101,000
17	Solid Waste Transportation and Disposal - Non-Hazardous Waste	1,100	TON	$55	$60,500
18	Solid Waste Transportation and Disposal - LTTD	3,200	TON	$90	$288,000
19	Install NAPL Collection Wells	25	EA	$8,000	$200,000
20	Waste Disposal	1	LS	$6,200	$6,200
21	Institutional Controls	1	LS	$100,000	$100,000
				Subtotal Capital Cost	$2,343,150
22				Administration & Engineering (15%)	$351,473
				Construction Management (15%)	$351,473
				Contingency (20%)	$468,630
				Total Capital Cost	$3,514,725
Operation and Maintenance Costs					
23	Annual Permitting/Access Agreements	1	LS	$10,000	$10,000
24	Annual Verification of Institutional Controls	1	LS	$10,000	$10,000
25	Semi-Annual NAPL Monitoring and Reporting	1	LS	$20,000	$20,000
				Subtotal O&M Cost	$40,000
				Contingency (20%)	$8,000
				Total Annual O&M Cost	$48,000
26				30-Year Total Present Worth Cost	$830,018
				Total Estimated Cost:	**$4,344,743**
				Rounded To:	**$4,300,000**

General Notes:

1. Cost estimate is based on ARCADIS of New York's (ARCADIS') past experience and vendor estimates using 2013 dollars.

2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual projected cost. Utilization of this cost estimate information beyond the stated purpose is not recommended.

3. All costs assume construction field work to be conducted by non-unionized labor.

Table 7a
Cost Estimate for Alternative 2 Upland Components - MGP Structure Removal and NAPL Recovery Wells

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Assumptions:

1. Pre-design investigation cost estimate includes all labor and equipment necessary to conduct pre-design investigation (PDI) activities in support of the remedial design of this alternative. PDI activities may include, but are not limited to, completion of soil borings and test pits to refine excavation limits and the collection and chemical/geotechnical analysis of soil samples in support of excavation shoring design and NAPL monitoring.

2. Permitting/access agreements cost estimate includes all costs necessary to obtain appropriate permits and access agreements to complete the remedial construction activities associated with this alternative.

3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment, and materials necessary to conduct the remedial construction activities associated with this alternative. For cost estimating purposes, mobilization/demobilization costs are assumed to be 5% of the capital costs, not including the pre-design investigations, permits and approvals, or waste transportation and disposal.

4. Traffic control cost estimate includes labor, equipment, and materials necessary to manage vehicle traffic on North Water Street (former Pemart Avenue) during excavation activities. Estimate includes costs for two flagmen, cones, and signage.

5. Construct and maintain decontamination pad cost estimate includes all labor, equipment, and materials necessary to construct and remove a 50-foot by 20-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

6. Utility markout and clearance cost estimate includes labor, equipment, and materials necessary to markout and clear utilities within the proposed excavation area. Estimate assumes markout activities will require two days to complete and does not include cost for relocating utilities potentially encountered.

7. Structure demolition and disposal cost estimate includes labor and equipment necessary to demolish the former Battery House and dispose of building material. Estimate includes costs for building material characterization sampling, building demolition, and disposal of building materials as C&D debris at an assumed cost of $40 per square-foot.

8. Install and remove temporary excavation support cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary steel sheet pile. Cost estimate assumes sheet pile will be installed to depths ranging from 8 to 18 feet below grade at assumed cost of $50 per square-foot. Estimate also includes costs for additional tie-backs and/or shoring at a cost of $10 per square-foot. Sheet pile to be removed following site restoration activities. A 2X cost factor was applied for 1,400 vertical square feet for additional excavation support/structural support for the southern portion of the excavation adjacent to the residential home located at 400 North Main St. Additiona support could consist of under pinning of the structure, secant pile wall, etc. Final excavation support system to be determined as part of the remedial design.

9. Soil excavation and handling includes all labor, equipment, and materials necessary to excavate soil and former MGP structures to the top of weathered bedrock (i.e., at depths from 8 to 18 feet below grade). Cost estimate assumes standard construction equipment operating within braced sheetpile excavation support system. Cost estimate is based on in-place soil volume. Estimate assumes excavation production rate of 150 cubic-yards per day.

10. Stabilization admixture cost estimate includes the purchase and importation of stabilizing agents to amend material excavated from the below the water table. Cost estimate assumes stabilization admixture (e.g., Portland cement) will be added at ratio of 10% of the weight of material to be stabilized.

11. On-site water handling/management cost estimate includes labor, equipment, and material necessary to remove and containerize groundwater from excavation areas. Cost estimate includes the rental of up to two 20,000 gallon holding tanks and associated pumps and piping.

12. Community air monitoring and vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities using AirLogics-type monitoring system and applying vapor/odor suppressing foam to open excavations.

13. Backfill cost estimate includes labor, equipment, and materials necessary to import, place, grade and compact general fill in excavation areas to match previously existing surrounding grades. Cost estimate is based on in-place soil volume. Cost estimate assumes 95% compaction based on standard proctor testing and includes survey verification and compaction testing.

14. Liquid waste characterization cost estimate includes laboratory analysis (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals) of water containerized during remedial construction. Cost estimate assumes one sample collected and analyzed per every 20,000 gallons water requiring transportation and off-site disposal.

15. Solid waste characterization cost estimate includes laboratory analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal.

16. Liquid waste transportation and disposal cost estimate includes fees associated transporting and disposing of water collected during remedial construction activities. Volume estimate includes decontamination water and groundwater removed from excavation areas only. Volume estimate based on two saturated pore volumes of the excavation areas. Cost estimate assumes water would be removed from on-site holding tanks and transported for off-site disposal via 5,000-gallon tanker trucks. Cost estimate includes disposal fee; transportation fuel surcharge; and environmental, transportation, and spotting fees.

17. Solid waste transportation and disposal - non-hazardous waste cost estimate includes labor, equipment, and materials necessary to transport and dispose of excavated soil not requiring LTTD treatment at a non-hazardous solid waste landfill. Cost estimate includes transportation and disposal of excavated soil at an assumed density of 1.5 tons per cubic-yard. Cost estimate includes disposal fee, transportation fuel surcharge, and spotting fees.

18. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport and thermally treat excavated soil exhibiting toxicity characteristic for benzene at a thermal treatment facility. Cost assumes excavated soil will be treated/disposed of via LTTD at an estimated density of 1.5 tons per cubic-yard. Cost estimate includes treatment fee, transportation fuel surcharge, and spotting fees. Cost estimate assumes thermally treated soil does not require subsequent treatment or disposal.

19. Install NAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection wells. Cost estimate assumes NAPL collection wells are installed to an average depth of 20 feet below grade and well construction consists of 4 inch diameter stainless steel with sumps. Estimate includes costs for drillers, geologist oversight, and field vehicle and equipment.

20. Waste disposal cost estimate includes fees associated with transporting and disposing of soil generated during installation of NAPL collection wells. Cost estimate assumes that up to 15 cubic yards of solid waste would be generated during installation of NAPL collection wells. Estimate includes delivery, spotting, transportation, and disposal fees for up to 15 cubic yards of non-hazardous waste material in a lined roll-off container.

21. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions for the upland portion of the site to control intrusive activities that could result in exposure to impacted soil and groundwater. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

22. Administration and engineering and construction management costs are based on an assumed 15% of the total capital costs. Administration and engineering cost estimate includes preparation of remedial design, site management plan, and final engineering

23. Annual permitting/access agreements cost estimate includes all costs necessary to obtain appropriate permits and access agreements to conduct periodic NAPL monitoring activities.

24. Annual verification of institutional controls cost estimate includes administrative costs for confirming institutional controls to minimize the potential for human exposure to site soil and groundwater. Annual costs associated with institutional controls include verifying the status of institutional controls and preparing/submitting notification to the NYSDEC to demonstrate that the institutional controls are being maintained and remain effective.

25. Semi-annual NAPL monitoring and reporting cost estimate includes labor, equipment, and materials necessary to conduct semi-annual NAPL monitoring at up to 25 wells. Cost estimate includes monitoring and passive NAPL recovery via manual bailing or a portable peristaltic pump. Cost estimate assumes two workers will require one day to complete monitoring and recovery per event. Estimate includes field vehicle and equipment and assumes two drums of waste are generated and disposed of as non-hazardous waste per event. Estimate includes cost for preparing a semi-annual report to document the NAPL monitoring activities. Semi-annual report to be submitted to NYSDEC.

26. Present worth is estimated based on a 4% beginning-of-year discount rate. It is assumed that "year zero" is 2013.

Table 7b
Cost Estimate for Alternative 2 Sediment Components - Capping of NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Capital Costs					
1	Pre-Design Investigation	1	LS	$250,000	$250,000
2	Permitting/Approvals	1	LS	$100,000	$100,000
3	Mobilization/Demobilization	1	LS	$360,000	$360,000
4	Floating Work Platform	1	LS	$100,000	$100,000
5	Resuspension Controls				
	Turbidity Curtain	600	LF	$70	$42,000
	Absorbent Boom	900	LF	$15	$13,500
6	Water Quality Monitoring	19	WK	$3,000	$57,000
7	Community Air Monitoring and Vapor/Odor Control	19	WK	$15,000	$285,000
8	Debris Removal	1	LS	$200,000	$200,000
9	Sediment Excavation and Handling	3,800	CY	$220	$836,000
10	Engineered Sediment Cap				
	Reactive Core Mat	34,400	SF	$4	$138,000
	Fill	3,800	CY	$95	$361,000
11	Solid Waste Characterization	13	EA	$1,000	$13,000
12	Transportation and Disposal - LTTD (by Barge)	6,300	TON	$230	$1,449,000
13	Post-Construction Survey	1	LS	$15,000	$15,000
14	Institutional Controls	1	LS	$100,000	$100,000
				Subtotal Capital Cost	$4,319,500
15				Administration and Engineering (15%)	$647,925
				Construction Management (15%)	$431,950
				Contingency (25%)	$863,900
				Total Capital Cost	$6,270,000
Operation and Maintenance Costs					
16	Post-Construction Cap Monitoring and Reporting	1	EVENT	$50,000	$50,000
17	Cap Maintenance	1	LS	$735,000	$735,000
18	Annual Verification of Institutional Controls	1	LS	$10,000	$10,000
				Subtotal O&M Cost	$795,000
				Contingency (25%)	$198,750
				Total O&M Cost	$993,750
19				30-Year Total Present Worth Cost of O&M	$3,603,107
				Total Estimated Cost:	**$9,873,107**
				Rounded To:	**$9,900,000**

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2013 dollars.

2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual projected cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.

3. All costs assume field work to be conducted by non-union labor.

Table 7b
Cost Estimate for Alternative 2 Sediment Components - Capping of NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

Assumptions:

1. Pre-design investigation cost estimate includes labor, equipment, and materials to support the design of the remedy including sediment sampling, bathymetric surveys, and debris survey. Cost estimate assumes sediment sampling will be for visual impacts only (no analytical testing) and will be completed via a barge-mounted drill rig, which includes vibracore rig operator and crew.

2. Permitting/approvals cost estimate includes preparation and procurement of the required permits and approvals from federal, state, and local agencies. Access agreement costs not included.

3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment, and materials necessary to conduct the remedial construction activities associated with this alternative. For cost estimating purposes, mobilization/demobilization costs are assumed to be 10% of the capital costs, not including the pre-design investigations or permits and approvals.

4. Floating work platform cost estimate includes labor, equipment, and materials necessary to construct a temporary floating work platform to facilitate the water-based excavation and capping operations. Assumes structure will consist of flexi-floats and spuds.

5. Resuspension control cost estimate includes labor, equipment, and materials necessary to install and maintain turbidity curtain and absorbent booms in the river around the MGP-impact area (including the large submerged barge) during intrusive activities. Assumes that turbidity curtains will be tied into the shoreline and no turbidity controls will be used along the shoreline. Costs assume a 50% change out of absorbent booms during the project. Resuspension controls would be removed following capping activities.

6. Water quality monitoring cost estimate includes labor, equipment, and materials necessary to perform water quality monitoring during intrusive site activities (e.g., dredging, capping). Costs assume that water quality monitoring will include turbidity monitoring of grab samples collected upstream and downstream of the work area and performing visual inspections for sheens.

7. Community air monitoring and vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities using AirLogics-type monitoring system and applying vapor/odor suppressing foam to dredged material.

8. Debris removal includes labor, materials, equipment, disposal, and services necessary for or incidental to handling/removing obstacles and debris (e.g., sunken barges, wood pilings) from the extent of impacts area. Assumed 6 week duration.

9. Sediment excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate targeted sediment via mechanical dredging in the wet, load into scows, and transport scows to the floating work platform for off-loading via a long-reach excavator. Removed material will be transported via barge to an off-site facility for processing and disposal (cost under Item 12). The removal volume incorporates a factor of 1.5 times the neat line volume to account for constructability and implementation constraints per Section 3.4.3 of the Technical Guidelines for Environmental Dredging of Contaminated Sediments, 2008 - ERDC/ELTR-08-29. Duration assumes the use of 1 dredge with a dredging production rate of 100 cubic-yards per day.

10. Engineered sediment cap cost estimate includes labor, materials, and equipment necessary for, or incidental to, the construction and placement of the engineered sediment cap. The cap material will be comprised of the following layers, bottom to top: one layer of organoclay reactive core mat and 24-inch-thick layer of fill material similar to existing material (e.g., silt and sand). Costs assume that the overlap of the reactive core mat will be 2 feet on the sides and 4 feet on the ends. Cap placement is assumed to be completed utilizing general construction equipment from a floating work platform. Duration assumes the use of 1 dredge with a fill placement rate of 200 cubic-yards per day and reactive core mat placement of 14,500 square-feet per day.

11. Solid waste characterization cost estimate includes laboratory analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal. Waste characterization samples will be taken prior to excavation to facilitate direct loading of excavated material.

12. Transportation and Disposal - LTTD (by Barge) cost estimate includes labor, equipment, materials, and services necessary for barge transportation of excavated material to Clean Earth's Jersey City, New Jersey facility for processing, treatment, and disposal. Estimate assumes excavation volume is increased by 10% to account for bulking and material is transported at an estimated density of 1.5 tons per cubic-yard. Estimate assumes stabilization is not required on-site and thermally treated soil does not require subsequent treatment or disposal.

Table 7b
Cost Estimate for Alternative 2 Sediment Components - Capping of NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

13. Post-construction survey cost estimate includes labor and materials to perform a bathymetric survey over the remedial area to verify, confirm, and document that removal areas have been restored to pre-construction conditions.

14. Institutional controls cost estimate includes legal expenses to institute environmental easements and deed restrictions to control the future development adjacent to the river and use of the river.

15. Administration and engineering and construction management costs are based on an assumed 15% of the total capital costs. Administration and engineering cost estimate includes preparation of remedial design, site management plan, and final engineering

16. Post-construction monitoring and reporting cost estimate includes labor, equipment, and materials necessary to conduct visual inspection of the installed cap and sediment around SD-34. As part of the monitored natural recovery process, surface sediment samples will be collected in the vicinity of SD-34 for visual identification of NAPL impacts. Costs also include submittal of a summary report of the post-construction monitoring performed. Cost assumes monitoring will be conducted biennially for the first 5 years (i.e., years 1, 3, and 5) and then once every 5 years until year 30.

17. Cap maintenance cost estimate assumes 20% of the capping costs (Items 3 through 7 and 9 though 13) of this alternative to be performed once every 5 years until year 30. Actual maintenance frequency and requirements will be determined based on post-construction monitoring events.

18. Annual verification of institutional controls cost estimates includes administrative costs associated confirming the status of institutional controls and preparing/submitting notification to NYSDEC to demonstrate that the institutional controls are being maintained and remain effective, annually for 30 years.

19. Present worth is estimated based on a 4% beginning-of-year discount rate. It is assumed that "year zero" is 2013.

Table 8a
Cost Estimate for Alternative 3 Upland Components - MGP Structure Removal and NAPL Barrier

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Capital Costs					
1	Pre-Design Investigation	1	LS	$200,000	$200,000
2	Permitting/Access Agreements	1	LS	$100,000	$100,000
3	Mobilization/Demobilization	1	LS	$150,000	$150,000
4	Traffic Control	17	WK	$10,000	$170,000
5	Construct and Remove Decontamination Pad	1	LS	$10,000	$10,000
6	Utility Markout and Clearance	1	LS	$5,000	$5,000
7	Barrier Wall Alignment Pre-Trenching	400	CY	$150	$60,000
8	Install Permanent Sheet Pile	21,500	SF	$65	$1,397,500
9	Backfill (new upland area)	1,700	CY	$95	$161,500
10	Structure Demolition and Disposal	1	LS	$32,000	$32,000
11	Install and Remove Temporary Excavation Support	4,200	SF	$105	$441,000
12	Soil Excavation and Handling	2,800	CY	$75	$210,000
13	Stabilization Admixture	130	TON	$115	$14,950
14	On-Site Water Handling/Management	17	WK	$2,500	$42,500
15	Community Air Monitoring and Vapor/Odor Control	22	WK	$15,000	$330,000
16	Backfill	2,800	CY	$40	$112,000
17	Liquid Waste Characterization	6	EA	$1,000	$6,000
18	Solid Waste Characterization	9	EA	$1,000	$9,000
19	Liquid Waste Transportation and Disposal	101,000	GAL	$1	$101,000
20	Solid Waste Transportation and Disposal - Non-Hazardous Waste	1,100	TON	$55	$60,500
21	Solid Waste Transportation and Disposal - LTTD	3,200	TON	$85	$272,000
22	Install NAPL Collection Wells	25	EA	$8,000	$200,000
23	Waste Disposal	1	LS	$6,200	$6,200
24	Institutional Controls	1	LS	$100,000	$100,000
				Subtotal Capital Cost	$4,191,150
25				Administration & Engineering (15%)	$628,673
				Construction Management (15%)	$628,673
				Contingency (20%)	$838,230
				Total Capital Cost	$6,286,725
Operation and Maintenance Costs					
26	Annual Permitting/Access Agreements	1	LS	$10,000	$10,000
27	Annual Verification of Institutional Controls	1	LS	$10,000	$10,000
28	Semi-Annual NAPL Monitoring and Reporting	1	LS	$20,000	$20,000
				Subtotal O&M Cost	$40,000
				Contingency (20%)	$8,000
				Total Annual O&M Cost	$48,000
29				30-Year Total Present Worth Cost	$830,018
				Total Estimated Cost:	**$7,116,743**
				Rounded To:	**$7,100,000**

General Notes:

1. Cost estimate is based on ARCADIS of New York's (ARCADIS') past experience and vendor estimates using 2013 dollars.

2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual projected cost. Utilization of this cost estimate information beyond the stated purpose is not recommended.

3. All costs assume construction field work to be conducted by non-unionized labor.

4. This estimate assumes that construction of the NAPL barrier wall would be conducted concurrently with sediment removal activities. Costs for turbidity controls, water quality monitoring, etc. are accounted for in sediment removal cost estimates.

Table 8a
Cost Estimate for Alternative 3 Upland Components - MGP Structure Removal and NAPL Barrier

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Assumptions:

1. Pre-design investigation cost estimate includes all labor and equipment necessary to conduct pre-design investigation (PDI) activities in support of the remedial design of this alternative. PDI activities may include, but are not limited to, completion of soil borings and test pits to refine excavation limits and the collection and chemical/geotechnical analysis of soil samples in support of excavation shoring and NAPL barrier wall design.

2. Permitting/access agreements cost estimate includes all costs necessary to obtain appropriate permits and access agreements to complete the remedial construction activities associated with this alternative.

3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment, and materials necessary to conduct the remedial construction activities associated with this alternative. For cost estimating purposes, mobilization/demobilization costs are assumed to be 5% of the capital costs, not including the pre-design investigations, permits and approvals, or waste transportation and disposal.

4. Traffic control cost estimate includes labor, equipment, and materials necessary to manage vehicle traffic on North Water Street (former Pemart Avenue) during excavation activities. Estimate includes costs for two flagmen, cones, and signage.

5. Construct and maintain decontamination pad cost estimate includes all labor, equipment, and materials necessary to construct and remove a 50-foot by 20-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

6. Utility markout and clearance cost estimate includes labor, equipment, and materials necessary to markout and clear utilities within the proposed excavation area. Estimate assumes markout activities will require two days to complete and does not include cost for relocating utilities potentially encountered.

7. Barrier wall alignment pre-trenching cost estimate include labor and equipment necessary to clear the NAPL barrier wall alignment of potential obstructions. Cost estimate assumes clearing is conducted by a barge-mounted excavator or crane equipped with clamshell within Peekskill Bay and trench measures 5 feet wide by 5 feet deep. Cost includes measures to control turbidity during pre-trenching activities and assumes that no trench support will be required. Excavated material (with the exception of removed obstructions) will be replaced in the trench immediately following excavation.

8. Install permanent sheet pile cost estimate includes labor, equipment, and materials necessary to purchase and install sheet pile to serve as a NAPL barrier wall. Cost estimate assumes sheet pile will be installed to a depth of 40 feet below grade (plus 10 feet of freeboard, 50 feet total length) for 430 linear feet at assumed cost of $40 per square-foot, plus $25 per square-foot for purchase of sheet pile. Estimate assumes that sheet pile would be installed from Peekskill Bay via barge mounted equipment along the mean water level.

9. Backfill (new upland area) cost estimate includes labor, equipment, and materials necessary to import, place, grade and compact general fill behind permanent sheet pile (land side). Cost estimate is based on in-place soil volume. Cost estimate assumes 95% compaction based on standard proctor testing and includes survey verification and compaction testing.

10. Structure demolition and disposal cost estimate includes labor and equipment necessary to demolish the former Battery House and dispose of building material. Estimate includes costs for building material characterization sampling, building demolition, and disposal of building materials as C&D debris at an assumed cost of $40 per square-foot.

11. Install and remove temporary excavation support cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary steel sheet pile. Cost estimate assumes sheet pile will be installed to depths ranging from 8 to 18 feet below grade at assumed cost of $50 per square-foot. Estimate also includes costs for additional tie-backs and/or shoring at a cost of $10 per square-foot. Sheet pile to be removed following site restoration activities. A 2X cost factor was applied for 1,400 vertical square feet for additional excavation support/structural support for the southern portion of the excavation adjacent to the residential home located at 400 North Main St. Additional support could consist of under pinning of the structure, secant pile wall, etc. Final excavation support system to be determined as part of the remedial design.

12. Soil excavation and handling includes all labor, equipment, and materials necessary to excavate soil and former MGP structures to the top of weathered bedrock (i.e., at depths from 8 to 18 feet below grade). Cost estimate assumes standard construction equipment operating within braced sheetpile excavation support system. Cost estimate is based on in-place soil volume. Estimate assumes excavation production rate of 150 cubic-yards per day.

13. Stabilization admixture cost estimate includes the purchase and importation of stabilizing agents to amend material excavated from the below the water table. Cost estimate assumes stabilization admixture (e.g., Portland cement) will be added at ratio of 10% of the weight of material to be stabilized.

14. On-site water handling/management cost estimate includes labor, equipment, and material necessary to remove and containerize groundwater from excavation areas. Cost estimate includes the rental of up to two 20,000 gallon holding tanks and associated pumps and piping.

15. Community air monitoring and vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities using AirLogics-type monitoring system and applying vapor/odor suppressing foam to open excavations.

16. Backfill cost estimate includes labor, equipment, and materials necessary to import, place, grade and compact general fill in excavation areas to match previously existing surrounding grades. Cost estimate is based on in-place soil volume. Cost estimate assumes 95% compaction based on standard proctor testing and includes survey verification and compaction testing.

17. Liquid waste characterization cost estimate includes laboratory analysis (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals) of water containerized during remedial construction. Cost estimate assumes one sample collected and analyzed per every 20,000 gallons water requiring transportation and off-site disposal.

18. Solid waste characterization cost estimate includes laboratory analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal.

19. Liquid waste transportation and disposal cost estimate includes fees associated transporting and disposing of water collected during remedial construction activities. Volume estimate includes decontamination water and groundwater removed from excavation areas only. Volume estimate based on two saturated pore volumes of the excavation areas. Cost estimate assumes water would be removed from on-site holding tanks and transported for off-site disposal via 5,000-gallon tanker trucks. Cost estimate includes disposal fee; transportation fuel surcharge; and environmental, transportation, and spotting fees.

20. Solid waste transportation and disposal - non-hazardous waste cost estimate includes labor, equipment, and materials necessary to transport and dispose of excavated soil not requiring LTTD treatment at a non-hazardous solid waste landfill. Cost estimate includes transportation and disposal of excavated soil at an assumed density of 1.5 tons per cubic-yard. Cost estimate includes disposal fee, transportation fuel surcharge, and spotting fees.

21. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport and thermally treat excavated soil exhibiting toxicity characteristic for benzene at a thermal treatment facility. Cost assumes excavated soil will be treated/disposed of via LTTD at an estimated density of 1.5 tons per cubic-yard. Cost estimate includes treatment fee, transportation fuel surcharge, and spotting fees. Cost estimate assumes thermally treated soil does not require subsequent treatment or disposal.

22. Install NAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection wells. Cost estimate assumes NAPL collection wells are installed to an average depth of 20 feet below grade and well construction consists of 4 inch diameter stainless steel with sumps. Estimate includes costs for drillers, geologist oversight, and field vehicle and equipment.

23. Waste disposal cost estimate includes fees associated with transporting and disposing of soil generated during installation of NAPL collection wells. Cost estimate assumes that up to 15 cubic yards of solid waste would be generated during installation of NAPL collection wells. Estimate includes delivery, spotting, transportation, and disposal fees for up to 15 cubic yards of non-hazardous waste material in a lined roll-off container.

24. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions for the upland portion of the site to control intrusive activities that could result in exposure to impacted soil and groundwater. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

25. Administration and engineering and construction management costs are based on an assumed 15% of the total capital costs. Administration and engineering cost estimate includes preparation of remedial design, site management plan, and final engineering

26. Annual permitting/access agreements cost estimate includes all costs necessary to obtain appropriate permits and access agreements to conduct periodic NAPL monitoring activities.

27. Annual verification of institutional controls cost estimate includes administrative costs for confirming institutional controls to minimize the potential for human exposure to site soil and groundwater. Annual costs associated with institutional controls include verifying the status of institutional controls and preparing/submitting notification to the NYSDEC to demonstrate that the institutional controls are being maintained and remain effective.

27. Semi-annual NAPL monitoring and reporting cost estimate includes labor, equipment, and materials necessary to conduct semi-annual NAPL monitoring at up to 25 wells. Cost estimate includes monitoring and passive NAPL recovery via manual bailing or a portable peristaltic pump. Cost estimate assumes two workers will require one day to complete monitoring and recovery per event. Estimate includes field vehicle and equipment and assumes two drums of waste are generated and disposed of as non-hazardous waste per event. Estimate includes cost for preparing a semi-annual report to document the NAPL monitoring activities. Semi-annual report to be submitted to NYSDEC.

28. Present worth is estimated based on a 4% beginning-of-year discount rate. It is assumed that "year zero" is 2013.

Table 8b
Cost Estimate for Alternative 3 Sediment Components - Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Capital Costs					
1	Pre-Design Investigation	1	LS	$250,000	$250,000
2	Permitting/Approvals	1	LS	$100,000	$100,000
3	Mobilization/Demobilization	1	LS	$660,000	$660,000
4	Floating Work Platform	1	LS	$100,000	$100,000
5	Resuspension Controls				
	Turbidity Curtain	250	LF	$70	$17,500
	Temporary Sheet Pile Wall	18,000	SF	$50	$900,000
	Absorbent Boom	1,300	LF	$15	$19,500
6	Water Quality Monitoring	32	WK	$3,000	$96,000
7	Community Air Monitoring and Vapor/Odor Control	32	WK	$15,000	$480,000
8	Debris Removal	1	LS	$200,000	$200,000
9	Sediment Excavation and Handling	6,600	CY	$220	$1,452,000
10	Backfill	5,300	CY	$95	$503,500
11	Engineered Sediment Cap				
	Reactive Core Mat	12,000	SF	$4	$48,000
	Fill	1,400	CY	$95	$133,000
12	Solid Waste Characterization	22	EA	$1,000	$22,000
13	Transportation and Disposal - LTTD (by Barge)	10,900	TON	$230	$2,507,000
14	Post-Construction Survey	1	LS	$15,000	$15,000
15	Institutional Controls	1	LS	$100,000	$100,000
				Subtotal Capital Cost	$7,603,500
16				Administration and Engineering (15%)	$1,140,525
				Construction Management (15%)	$760,350
				Contingency (25%)	$1,520,700
				Total Capital Cost	$11,030,000
Operation and Maintenance Costs					
17	Post-Construction Monitoring and Reporting	1	EVENT	$30,000	$30,000
18	Cap Maintenance	1	LS	$310,000	$310,000
19	Annual Verification of Institutional Controls	1	LS	$10,000	$10,000
				Subtotal O&M Cost	$350,000
				Contingency (25%)	$87,500
				Total O&M Cost	$437,500
20				30-Year Total Present Worth Cost of O&M	$1,708,087
				Total Estimated Cost:	**$12,738,087**
				Rounded To:	**$12,700,000**

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2013 dollars.

2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual projected cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.

3. All costs assume field work to be conducted by non-union labor.

Table 8b
Cost Estimate for Alternative 3 Sediment Components - Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

Assumptions:

1. Pre-design investigation cost estimate includes labor, equipment, and materials to support the design of the remedy including sediment sampling, bathymetric surveys, debris survey, and geotechnical analyses. Cost estimate assumes sediment sampling will be for visual impacts only (no analytical testing) and will be completed via a barge-mounted drill rig, which includes vibracore rig operator and crew.

2. Permitting/approvals cost estimate includes preparation and procurement of the required permits and approvals from federal, state, and local agencies. Access agreement costs not included.

3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment, and materials necessary to conduct the remedial construction activities associated with this alternative. For cost estimating purposes, mobilization/demobilization costs are assumed to be 10% of the capital costs, not including the pre-design investigations or permits and approvals.

4. Floating work platform cost estimate includes labor, equipment, and materials necessary to construct a temporary floating work platform to facilitate the water-based excavation, backfill, and capping operations. Assumes structure will consist of flexi-floats and piles.

5. Resuspension control cost estimate includes labor, equipment, and materials necessary to install and maintain turbidity curtain around SD-34 and installation of sheet pile in the river around the MGP-impacted sediment (including the large submerged barge). Sheeting costs assume that approximately 600 linear feet of 30-foot-long sheet pile will be installed in-the river. Sheeting costs also assume that in-river sheet pile will be installed from a barge and will tie into the upland barrier wall. Costs assume absorbent booms will be installed around both work areas and that 50% of absorbent booms will require change out during the project. All resuspension controls would be removed following backfill.

6. Water quality monitoring cost estimate includes labor, equipment, and materials necessary to perform water quality monitoring during intrusive site activities (e.g., dredging, capping). Costs assume that water quality monitoring will include turbidity monitoring of grab samples collected upstream and downstream of the work area and performing visual inspections for sheens.

7. Community air monitoring and vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities using AirLogics-type monitoring system and applying vapor/odor suppressing foam to dredged material.

8. Debris removal includes labor, materials, equipment, disposal, and services necessary for or incidental to handling/removing obstacles and debris (e.g., sunken barges, wood pilings) from the extent of impacts area. Assumed 6 week duration.

9. Sediment excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate targeted sediment via mechanical dredging in the wet, load into scows, and transport scows to the floating work platform for off-loading via a long-reach excavator. Removed material will be transported via barge to an off-site facility for processing and disposal (cost under Item 12). The removal volume incorporates a factor of 1.5 times the neat line volume to account for constructability and implementation constraints per Section 3.4.3 of the Technical Guidelines for Environmental Dredging of Contaminated Sediments, 2008 - ERDC/ELTR-08-29. Duration assumes the use of 1 dredge with a dredging production rate of 100 cubic-yards per day. Volume estimate based a consistent removal depth from top of sediment surface to a maximum depth of 5 feet bss (or to depth of visual impacts if shallower than 5 feet bss) at each polygon.

10. Backfill cost estimate includes labor, materials, equipment, and services necessary for, or incidental to, the placement of suitable fill material within the dredged area. The fill material will consist of material similar to existing material to restore the pre-construction elevation. Fill material will be suitable for placement as backfill or capping. Fill placement is assumed to be completed utilizing general construction equipment within containment. No backfill amendments (e.g., organoclay and/or activated carbon) have been assumed. Duration assumes the use of 1 dredge with a fill placement rate of 200 cubic yards per day.

11. Engineered sediment cap cost estimate includes labor, materials, and equipment necessary for, or incidental to, the construction and placement of the engineered sediment cap. The cap material will be comprised of the following layers, bottom to top: one layer of organoclay reactive core mat and 24-inch-thick layer of fill material similar to existing material (e.g., silt and sand). Costs assume that the overlap of the reactive core mat will be 2 feet on the sides and 4 feet on the ends. Cap placement is assumed to be completed utilizing general construction equipment from a floating work platform. Duration assumes the use of 1 dredge with a fill placement rate of 200 cubic-yards per day and reactive core mat placement of 14,500 square-feet per day.

Table 8b
Cost Estimate for Alternative 3 Sediment Components - Removal of Shallow NAPL-Impacted Sediment and Capping of Deep NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

12. Solid waste characterization cost estimate includes laboratory analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal. Waste characterization samples will be taken prior to excavation to facilitate direct loading of excavated material.

13. Transportation and Disposal - LTTD (by Barge) cost estimate includes labor, equipment, materials, and services necessary for barge transportation of excavated material to Clean Earth's Jersey City, New Jersey facility for processing, treatment, and disposal. Estimate assumes excavation volume is increased by 10% to account for bulking and material is transported at an estimated density of 1.5 tons per cubic-yard. Estimate assumes stabilization is not required on-site and thermally treated soil does not require subsequent treatment or disposal.

14. Post-construction survey cost estimate includes labor and materials to perform a bathymetric survey over the remedial area to verify, confirm, and document that removal areas have been restored to pre-construction conditions.

15. Institutional controls cost estimate includes legal expenses to institute environmental easements and deed restrictions to control the future development adjacent to the river and use of the river.

16. Administration and engineering and construction management costs are based on an assumed 15% of the total capital costs. Administration and engineering cost estimate includes preparation of remedial design, site management plan, and final engineering

17. Post-construction monitoring and reporting cost estimate includes labor, equipment, and materials necessary to conduct visual inspection and elevation monitoring via traditional surveying method activities and submittal of a summary report. Assumes monitoring will be conducted biennially for the first 5 years (i.e., years 1, 3, and 5) and then once every 5 years until year 30.

18. Cap maintenance cost estimate are estimated from the Alternative 2 (sediment capping) and assumes 20% of the lump sump costs (Alternative 2 Items 3, 4 and 13) and 20% of the unit price costs (Alternative 2 Items 5 through 7 and 9 through 12) adjusted by area. Costs assume maintenance will be performed once every 5 years until year 30. Actual maintenance frequency and requirements will be determined based on post-construction monitoring events.

19. Annual verification of institutional controls cost estimates includes administrative costs associated confirming the status of institutional controls and preparing/submitting notification to NYSDEC to demonstrate that the institutional controls are being maintained and remain effective, annually for 30 years.

20. Present worth is estimated based on a 4% beginning-of-year discount rate. It is assumed that "year zero" is 2013.

Table 9a
Cost Estimate for Alternative 4 Upland Components - MGP Structure Removal and NAPL Barrier

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Capital Costs					
1	Pre-Design Investigation	1	LS	$200,000	$200,000
2	Permitting/Access Agreements	1	LS	$100,000	$100,000
3	Mobilization/Demobilization	1	LS	$150,000	$150,000
4	Traffic Control	17	WK	$10,000	$170,000
5	Construct and Remove Decontamination Pad	1	LS	$10,000	$10,000
6	Utility Markout and Clearance	1	LS	$5,000	$5,000
7	Barrier Wall Alignment Pre-Trenching	400	CY	$150	$60,000
8	Install Permanent Sheet Pile	21,500	SF	$65	$1,397,500
9	Backfill (new upland area)	1,700	CY	$95	$161,500
10	Structure Demolition and Disposal	1	LS	$32,000	$32,000
11	Install and Remove Temporary Excavation Support	4,200	SF	$105	$441,000
12	Soil Excavation and Handling	2,800	CY	$75	$210,000
13	Stabilization Admixture	130	TON	$115	$14,950
14	On-Site Water Handling/Management	17	WK	$2,500	$42,500
15	Community Air Monitoring and Vapor/Odor Control	22	WK	$15,000	$330,000
16	Backfill	2,800	CY	$40	$112,000
17	Liquid Waste Characterization	6	EA	$1,000	$6,000
18	Solid Waste Characterization	9	EA	$1,000	$9,000
19	Liquid Waste Transportation and Disposal	101,000	GAL	$1	$101,000
20	Solid Waste Transportation and Disposal - Non-Hazardous Waste	1,100	TON	$55	$60,500
21	Solid Waste Transportation and Disposal - LTTD	3,200	TON	$85	$272,000
22	Install NAPL Collection Wells	25	EA	$8,000	$200,000
23	Waste Disposal	1	LS	$6,200	$6,200
24	Institutional Controls	1	LS	$100,000	$100,000
				Subtotal Capital Cost	$4,191,150
25				Administration & Engineering (15%)	$628,673
				Construction Management (15%)	$628,673
				Contingency (20%)	$838,230
				Total Capital Cost	$6,286,725
Operation and Maintenance Costs					
26	Annual Permitting/Access Agreements	1	LS	$10,000	$10,000
27	Annual Verification of Institutional Controls	1	LS	$10,000	$10,000
28	Semi-Annual NAPL Monitoring and Reporting	1	LS	$20,000	$20,000
				Subtotal O&M Cost	$40,000
				Contingency (20%)	$8,000
				Total Annual O&M Cost	$48,000
29				30-Year Total Present Worth Cost	$830,018
				Total Estimated Cost:	**$7,116,743**
				Rounded To:	**$7,100,000**

General Notes:

1. Cost estimate is based on ARCADIS of New York's (ARCADIS') past experience and vendor estimates using 2013 dollars.

2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual projected cost. Utilization of this cost estimate information beyond the stated purpose is not recommended.

3. All costs assume construction field work to be conducted by non-unionized labor.

4. This estimate assumes that construction of the NAPL barrier wall would be conducted concurrently with sediment removal activities. Costs for turbidity controls, water quality monitoring, etc. are accounted for in sediment removal cost estimates.

Table 9a
Cost Estimate for Alternative 4 Upland Components - MGP Structure Removal and NAPL Barrier

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Assumptions:

1. Pre-design investigation cost estimate includes all labor and equipment necessary to conduct pre-design investigation (PDI) activities in support of the remedial design of this alternative. PDI activities may include, but are not limited to, completion of soil borings and test pits to refine excavation limits and the collection and chemical/geotechnical analysis of soil samples in support of excavation shoring and NAPL barrier wall design.

2. Permitting/access agreements cost estimate includes all costs necessary to obtain appropriate permits and access agreements to complete the remedial construction activities associated with this alternative.

3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment, and materials necessary to conduct the remedial construction activities associated with this alternative. For cost estimating purposes, mobilization/demobilization costs are assumed to be 5% of the capital costs, not including the pre-design investigations, permits and approvals, or waste transportation and disposal.

4. Traffic control cost estimate includes labor, equipment, and materials necessary to manage vehicle traffic on North Water Street (former Pemart Avenue) during excavation activities. Estimate includes costs for two flagmen, cones, and signage.

5. Construct and maintain decontamination pad cost estimate includes all labor, equipment, and materials necessary to construct and remove a 50-foot by 20-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

6. Utility markout and clearance cost estimate includes labor, equipment, and materials necessary to markout and clear utilities within the proposed excavation area. Estimate assumes markout activities will require two days to complete and does not include cost for relocating utilities potentially encountered.

7. Barrier wall alignment pre-trenching cost estimate include labor and equipment necessary to clear the NAPL barrier wall alignment of potential obstructions. Cost estimate assumes clearing is conducted by a barge-mounted excavator or crane equipped with clamshell within Peekskill Bay and trench measures 5 feet wide by 5 feet deep. Cost includes measures to control turbidity during pre-trenching activities and assumes that no trench support will be required. Excavated material (with the exeption of removed obstructions) will be replaced in the trench immediately following excavation.

8. Install permanent sheet pile cost estimate includes labor, equipment, and materials necessary to purchase and install sheet pile to serve as a NAPL barrier wall. Cost estimate assumes sheet pile will be installed to a depth of 40 feet below grade (plus 10 feet of freeboard, 50 feet total length) for 430 linear feet at assumed cost of $40 per square-foot, plus $25 per square-foot for purchase of sheet pile. Estimate assumes that sheet pile would be installed from Peekskill Bay via barge mounted equipment along the mean water level.

9. Backfill (new upland area) cost estimate includes labor, equipment, and materials necessary to import, place, grade and compact general fill behind permanent sheet pile (land side). Cost estimate is based on in-place soil volume. Cost estimate assumes 95% compaction based on standard proctor testing and includes survey verification and compaction testing.

10. Structure demolition and disposal cost estimate includes labor and equipment necessary to demolish the former Battery House and dispose of building material. Estimate includes costs for building material characterization sampling, building demolition, and disposal of building materials as C&D debris at an assumed cost of $40 per square-foot.

11. Install and remove temporary excavation support cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary steel sheet pile. Cost estimate assumes sheet pile will be installed to depths ranging from 8 to 18 feet below grade at assumed cost of $50 per square-foot. Estimate also includes costs for additional tie-backs and/or shoring at a cost of $10 per square-foot. Sheet pile to be removed following site restoration activities. A 2X cost factor was applied for 1,400 vertical square feet for additional excavation support/structural support for the southern portion of the excavation adjacent to the residential home located at 400 North Main St. Additional support could consist of under pinning of the structure, secant pile wall, etc. Final excavation support system to be determined as part of the remedial design.

12. Soil excavation and handling includes all labor, equipment, and materials necessary to excavate soil and former MGP structures to the top of weathered bedrock (i.e., at depths from 8 to 18 feet below grade). Cost estimate assumes standard construction equipment operating within braced sheetpile excavation support system. Cost estimate is based on in-place soil volume. Estimate assumes excavation production rate of 150 cubic-yards per day.

13. Stabilization admixture cost estimate includes the purchase and importation of stabilizing agents to amend material excavated from the below the water table. Cost estimate assumes stabilization admixture (e.g., Portland cement) will be added at ratio of 10% of the weight of material to be stabilized.

14. On-site water handling/management cost estimate includes labor, equipment, and material necessary to remove and containerize groundwater from excavation areas. Cost estimate includes the rental of up to two 20,000 gallon holding tanks and associated pumps and piping.

15. Community air monitoring and vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities using AirLogics-type monitoring system and applying vapor/odor suppressing foam to open excavations.

16. Backfill cost estimate includes labor, equipment, and materials necessary to import, place, grade and compact general fill in excavation areas to match previously existing surrounding grades. Cost estimate is based on in-place soil volume. Cost estimate assumes 95% compaction based on standard proctor testing and includes survey verification and compaction testing.

17. Liquid waste characterization cost estimate includes laboratory analysis (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals) of water containerized during remedial construction. Cost estimate assumes one sample collected and analyzed per every 20,000 gallons water requiring transportation and off-site disposal.

18. Solid waste characterization cost estimate includes laboratory analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal.

19. Liquid waste transportation and disposal cost estimate includes fees associated transporting and disposing of water collected during remedial construction activities. Volume estimate includes decontamination water and groundwater removed from excavation areas only. Volume estimate based on two saturated pore volumes of the excavation areas. Cost estimate assumes water would be removed from on-site holding tanks and transported for off-site disposal via 5,000-gallon tanker trucks. Cost estimate includes disposal fee; transportation fuel surcharge; and environmental, transportation, and spotting fees.

20. Solid waste transportation and disposal - non-hazardous waste cost estimate includes labor, equipment, and materials necessary to transport and dispose of excavated soil not requiring LTTD treatment at a non-hazardous solid waste landfill. Cost estimate includes transportation and disposal of excavated soil at an assumed density of 1.5 tons per cubic-yard. Cost estimate includes disposal fee, transportation fuel surcharge, and spotting fees.

21. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport and thermally treat excavated soil exhibiting toxicity characteristic for benzene at a thermal treatment facility. Cost assumes excavated soil will be treated/disposed of via LTTD at an estimated density of 1.5 tons per cubic-yard. Cost estimate includes treatment fee, transportation fuel surcharge, and spotting fees. Cost estimate assumes thermally treated soil does not require subsequent treatment or disposal.

22. Install NAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection wells. Cost estimate assumes NAPL collection wells are installed to an average depth of 20 feet below grade and well construction consists of 4 inch diameter stainless steel with sumps. Estimate includes costs for drillers, geologist oversight, and field vehicle and equipment.

23. Waste disposal cost estimate includes fees associated with transporting and disposing of soil generated during installation of NAPL collection wells. Cost estimate assumes that up to 15 cubic yards of solid waste would be generated during installation of NAPL collection wells. Estimate includes delivery, spotting, transportation, and disposal fees for up to 15 cubic yards of non-hazardous waste material in a lined roll-off container.

Table 9a
Cost Estimate for Alternative 4 Upland Components - MGP Structure Removal and NAPL Barrier

Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

24. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions for the upland portion of the site to control intrusive activities that could result in exposure to impacted soil and groundwater. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

25. Administration and engineering and construction management costs are based on an assumed 15% of the total capital costs. Administration and engineering cost estimate includes preparation of remedial design, site management plan, and final engineering

26. Annual permitting/access agreements cost estimate includes all costs necessary to obtain appropriate permits and access agreements to conduct periodic NAPL monitoring activities.

27. Annual verification of institutional controls cost estimate includes administrative costs for confirming institutional controls to minimize the potential for human exposure to site soil and groundwater. Annual costs associated with institutional controls include verifying the status of institutional controls and preparing/submitting notification to the NYSDEC to demonstrate that the institutional controls are being maintained and remain effective.

27. Semi-annual NAPL monitoring and reporting cost estimate includes labor, equipment, and materials necessary to conduct semi-annual NAPL monitoring at up to 25 wells. Cost estimate includes monitoring and passive NAPL recovery via manual bailing or a portable peristaltic pump. Cost estimate assumes two workers will require one day to complete monitoring and recovery per event. Estimate includes field vehicle and equipment and assumes two drums of waste are generated and disposed of as non-hazardous waste per event. Estimate includes cost for preparing a semi-annual report to document the NAPL monitoring activities. Semi-annual report to be submitted to NYSDEC.

28. Present worth is estimated based on a 4% beginning-of-year discount rate. It is assumed that "year zero" is 2013.

Table 9b
Cost Estimate for Alternative 4 Sediment Components - Removal of Shallow and Deep NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Capital Costs					
1	Pre-Design Investigation	1	LS	$250,000	$250,000
2	Permitting/Approvals	1	LS	$100,000	$100,000
3	Mobilization/Demobilization	1	LS	$1,110,000	$1,110,000
4	Floating Work Platform	1	LS	$100,000	$100,000
5	Resuspension Controls				
	Turbidity Curtain	250	LF	$70	$17,500
	Temporary Sheet Pile Wall	26,000	SF	$50	$1,300,000
	Absorbent Boom	1,300	LF	$15	$19,500
6	Water Quality Monitoring	49	WK	$3,000	$147,000
7	Community Air Monitoring and Vapor/Odor Control	49	WK	$15,000	$735,000
8	Debris Removal	1	LS	$200,000	$200,000
9	Sediment Excavation and Handling	12,400	CY	$220	$2,728,000
10	Backfill	12,400	CY	$95	$1,178,000
11	Solid Waste Characterization	40	EA	$1,000	$40,000
12	Transportation and Disposal - LTTD (by Barge)	20,000	TON	$230	$4,600,000
13	Post-Construction Survey	1	LS	$15,000	$15,000
				Subtotal Capital Cost	$12,540,000
14				Administration and Engineering (15%)	$1,881,000
				Construction Management (15%)	$1,254,000
				Contingency (25%)	$2,508,000
				Total Estimated Cost:	**$18,183,000**
				Rounded To:	**$18,200,000**

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2013 dollars.

2. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual projected cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.

3. All costs assume field work to be conducted by non-union labor.

Assumptions:

1. Pre-design investigation cost estimate includes labor, equipment, and materials to support the design of the remedy including sediment sampling, bathymetric surveys, debris survey, and geotechnical analyses. Cost estimate assumes sediment sampling will be for visual impacts only (no analytical testing) and will be completed via a barge-mounted drill rig, which includes vibracore rig operator and crew.

2. Permitting/approvals cost estimate includes preparation and procurement of the required permits and approvals from federal, state, and local agencies. Access agreement costs not included.

3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment, and materials necessary to conduct the remedial construction activities associated with this alternative. For cost estimating purposes, mobilization/demobilization costs are assumed to be 10% of the capital costs, not including the pre-design investigations or permits and approvals.

4. Floating work platform cost estimate includes labor, equipment, and materials necessary to construct a temporary floating work platform to facilitate the water-based excavation and backfill operations. Assumes structure will consist of flexi-floats and piles.

Table 9b
Cost Estimate for Alternative 4 Sediment Components - Removal of Shallow and Deep NAPL-Impacted Sediment

Alternatives Analysis Report
Consolidated Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site

5. Resuspension control cost estimate includes labor, equipment, and materials necessary to install and maintain turbidity curtain around SD-34 and installation of sheet pile in the river around the MGP-impacted sediment (including the large submerged barge). Sheeting costs assume that approximately 200 linear feet of 30-foot-long sheet pile and 400 linear feet of 50-foot-long sheet pile will be installed in-the river. Sheeting costs also assume that in-river sheet pile will be installed from a barge and will tie into the upland barrier wall. Costs assume absorbent booms will be installed around both work areas and that 50% of absorbent booms will require change out during the project. All resuspension controls would be removed following backfill.

6. Water quality monitoring cost estimate includes labor, equipment, and materials necessary to perform water quality monitoring during intrusive site activities (e.g., dredging, capping). Costs assume that water quality monitoring will include turbidity monitoring of grab samples collected upstream and downstream of the work area and performing visual inspections for sheens.

7. Community air monitoring and vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities using AirLogics-type monitoring system and applying vapor/odor suppressing foam to dredged material.

8. Debris removal includes labor, materials, equipment, disposal, and services necessary for or incidental to handling/removing obstacles and debris (e.g., sunken barges, wood pilings) from the extent of impacts area. Assumed 6 week duration.

9. Sediment excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate targeted sediment via mechanical dredging in the wet, load into scows, and transport scows to the floating work platform for off-loading via a long-reach excavator. Removed material will be transported via barge to an off-site facility for processing and disposal (cost under Item 13). The removal volume incorporates a factor of 1.5 times the neat line volume to account for constructability and implementation constraints per Section 3.4.3 of the Technical Guidelines for Environmental Dredging of Contaminated Sediments, 2008 - ERDC/ELTR-08-29. Duration assumes the use of 1 dredge with a dredging production rate of 100 cubic-yards per day. Volume estimate based a consistent removal depth from top of sediment surface to depth of visual impacts at each polygon.

10. Backfill cost estimate includes labor, materials, equipment, and services necessary for, or incidental to, the placement of suitable fill material within the dredged area. The fill material will consist of material similar to existing material that is backfilled to pre-construction elevation. Fill material will be suitable for placement as backfill or capping. Fill placement is assumed to be completed utilizing general construction equipment within containment. No backfill amendments (e.g., organoclay and/or activated carbon) have been assumed.

11. Solid waste characterization cost estimate includes laboratory analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Cost assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site treatment/disposal. Waste characterization samples will be taken prior to excavation to facilitate direct loading of excavated material.

12. Transportation and Disposal - LTTD (by Barge) cost estimate includes labor, equipment, materials, and services necessary for barge transportation of excavated material to Clean Earth's Jersey City, New Jersey facility for processing, treatment, and disposal. Estimate assumes excavation volume is increased by 10% to account for bulking and material is transported at an estimated density of 1.5 tons per cubic-yard. Estimate assumes stabilization is not required on-site and thermally treated soil does not require subsequent treatment or disposal.

13. Post-construction survey cost estimate includes labor and materials to perform a bathymetric survey over the remedial area to verify, confirm, and document that removal areas have been restored to pre-construction conditions.

14. Administration and engineering and construction management costs are based on an assumed 15% of the total capital costs. Administration and engineering cost estimate includes preparation of remedial design, site management plan, and final engineering report.

Table 10
Remedial Alternative Cost Summary

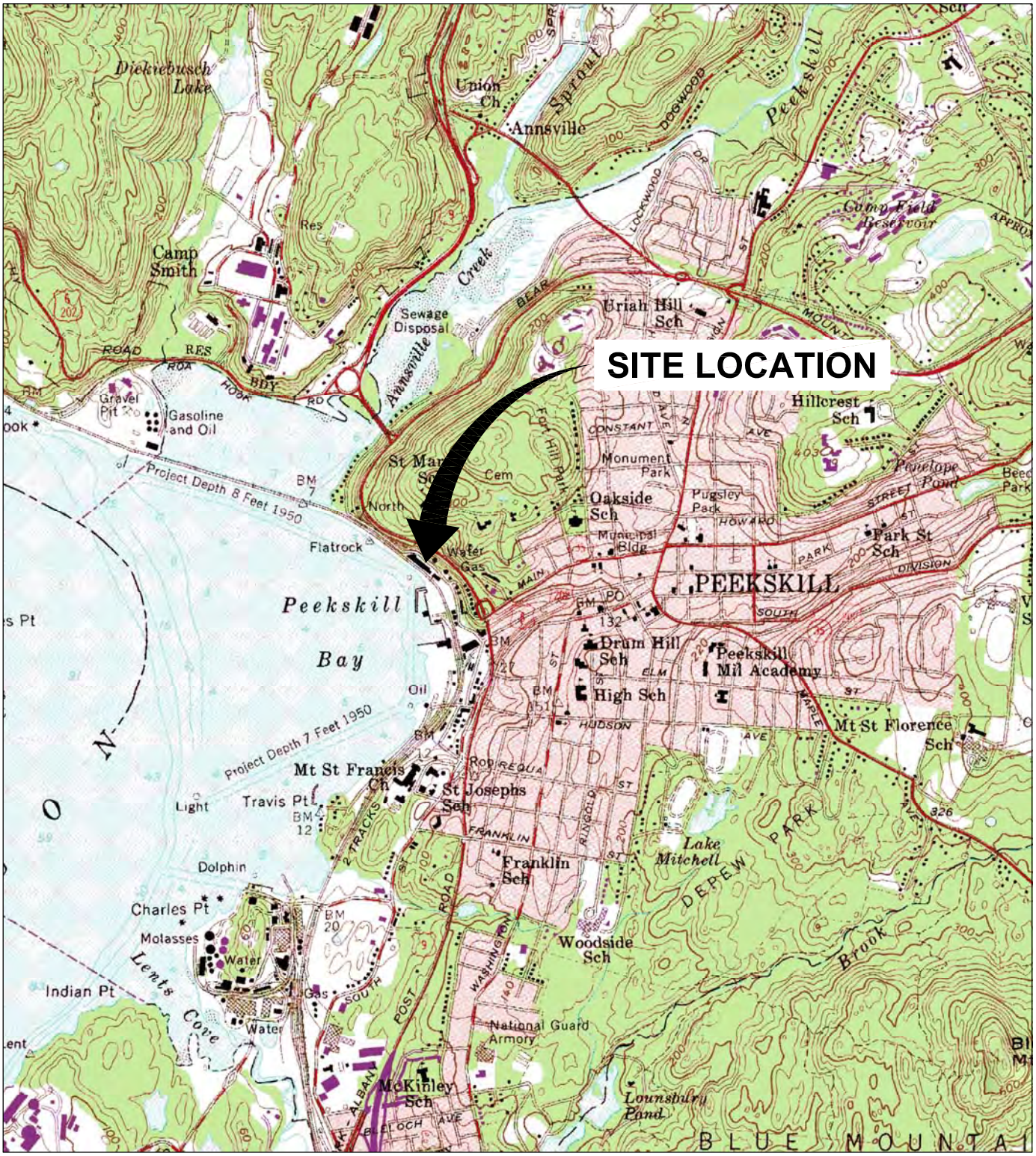
Alternatives Analysis Report
Consolidate Edison Company of New York, Inc.
Former Pemart Avenue Works Manufactured Gas Plant Site - Peekskill, New York

Alternative	Upland Components		Sediment Components		Total Capital Cost	Total O&M Cost[1]	Total Present Worth
	Capital Cost	O&M Cost[1]	Capital Cost	O&M Cost[1]			
Alternative 1 – No Action	$0	$0	$0	$0	$0	$0	$0
Alternative 2 – MGP Structure Removal, NAPL Recovery Wells, Capping of NAPL-Impacted Sediment	$3,500,000	$830,000	$6,300,000	$3,600,000	$9,800,000	$4,400,000	$14,200,000
Alternative 3 – MGP Structure Removal, NAPL Barrier, Removal of Shallow NAPL-Impacted Sediment	$6,300,000	$830,000	$11,000,000	$1,700,000	$17,300,000	$2,500,000	$19,800,000
Alternative 4 – MGP Structure Removal, NAPL Barrier, Removal of Shallow and Deep NAPL-Impacted Sediment	$6,300,000	$830,000	$18,200,000	$0	$24,500,000	$800,000	$25,300,000

Notes:
1. Estimated present worth of O&M cost is over an assumed 30-year period.

ARCADIS

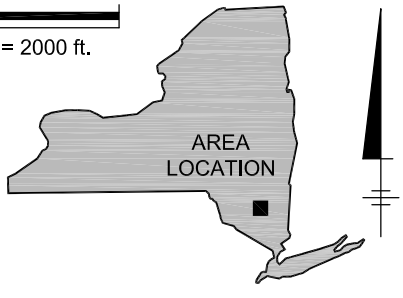
Figures



REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., PEEKSKILL, NEW YORK, 1957, PHOTOREVISED 1981.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.



CON EDISON
FORMER PEMART AVENUE WORKS MGP
PEEKSKILL, NEW YORK
FEASIBILITY STUDY REPORT

SITE LOCATION MAP

ARCADIS

FIGURE
1

CITY:Syracuse DIV/GROUP:EnvCAD DB: D.Howes LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0043029\0001\00001\DWG\43029N01.dwg LAYOUT: 1 SAVED: 2/20/2012 2:39 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/20/2012 2:42 PM BY: HOWES, DAVID
XREFS: IMAGES: PROJECTNAME: --
NY_Peekskill.tiff

LEGEND:

- SD-4 — SUBSURFACE SEDIMENT SAMPLING LOCATION
- SD-35 — SURFACE SEDIMENT INVESTIGATION SAMPLING LOCATIONS
- SB-20 — SOIL BORING
- SB-30 — SOIL BORING AND GRAB GROUNDWATER SAMPLE
- MW-8 — MONITORING WELL
- SB-26/MW-9 — MONITORING WELL (ROCK)
- TEST PIT
- BOUNDARY OF FORMER PEMART AVE MGP
- BOUNDARY OF FORMER ELECTRIC GENERATING PLANT
- FORMER STRUCTURES
- SURFACE TOPOGRAPHY
- APPROXIMATE EXTENT OF IMPACTS

NOTES:

1. BASE MAP CREATED FROM ENSR/AECOM FIGURE ENTITLED PROPOSED SURFACE SEDIMENT SAMPLE LOCATIONS, DATED 3/09.
2. ALL LOCATIONS ASSUMED TO BE APPROXIMATE.

0 40' 80'
GRAPHIC SCALE

CON EDISON
FORMER PEMART AVENUE WORKS MGP SITE
PEEKSKILL, NEW YORK
ALTERNATIVES ANALYSIS REPORT

SITE PLAN

ARCADIS

FIGURE
2

CITY: SYRACUSE, NY DIV/GROUP: ENV/IM-DV DB: R. BASSETT, W. JONES, P. LISTER PM/TM: J. BRIEN TR: J. GOLUBSKI LYR: ON=*; OFF=*REF*
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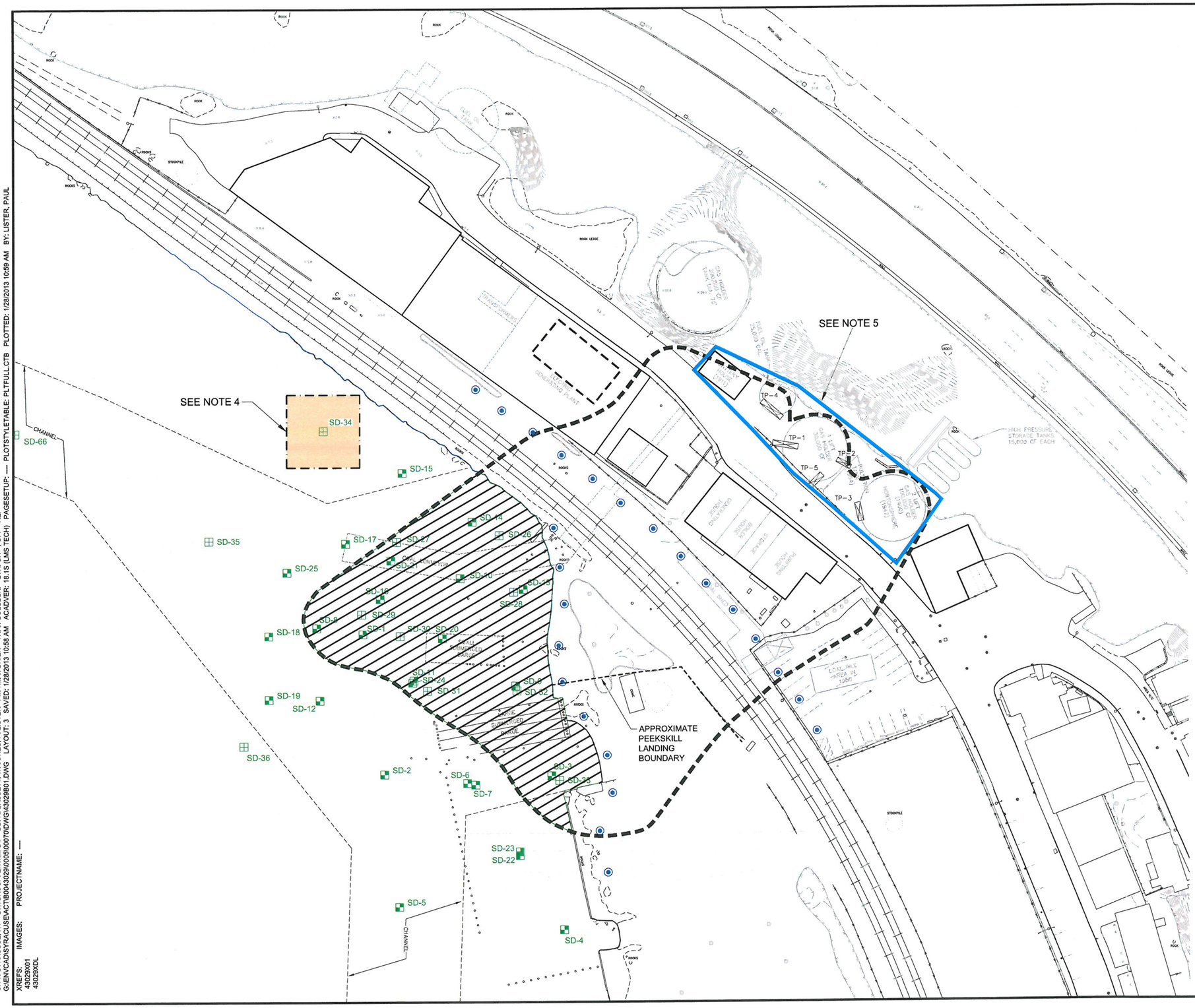
43029X01
43029XDL



LEGEND:

- SD-4 SUBSURFACE SEDIMENT SAMPLING LOCATION
- SD-35 SURFACE SEDIMENT INVESTIGATION SAMPLING LOCATIONS
- FORMER STRUCTURES
- APPROXIMATE EXTENT OF IMPACTS
- APPROXIMATE MONITORED NATURAL RECOVERY LIMITS
- APPROXIMATE CAP LIMITS
- APPROXIMATE EXTENT OF SOIL REMOVAL
- PROPOSED NAPL RECOVERY WELL

NOTES:

1. BASE MAP CREATED FROM ENSR/AECOM FIGURE ENTITLED PROPOSED SURFACE SEDIMENT SAMPLE LOCATIONS, DATED 3/09.
2. ALL LOCATIONS ASSUMED TO BE APPROXIMATE.
3. THE MAIN SEDIMENT REMOVAL AREA IS BOUNDED BY THE EDGE OF WATER AS PRESENTED IN THE 2008 REMEDIAL INVESTIGATION ADDENDUM BY ENSR/AECOM AND THE APPROXIMATE EXTENT OF IMPACT AREA SHOWN. BOUNDARIES FOR THE REMOVAL POLYGONS ARE EXTENDED HALFWAY BETWEEN THE ADJACENT SUBSURFACE SAMPLING LOCATIONS.
4. THE AREA OF IMPACTS AROUND SD-34 IS ASSUMED TO BE 60-FOOT BY 60-FOOT. ADDITIONAL SAMPLING REQUIRED DURING THE PRE-DESIGN INVESTIGATION TO DETERMINE THE ACTUAL EXTENT OF VISUAL IMPACTS.
5. SOIL TO BE REMOVED TO TOP OF WEATHERED BEDROCK. DEPTHS RANGE FROM 8 TO 17 FEET BELOW GRADE.

CON EDISON
FORMER PEMART AVENUE WORKS MGP SITE
PEEKSKILL, NEW YORK
ALTERNATIVES ANALYSIS REPORT

ALTERNATIVE 2

ARCADIS

FIGURE
3

CITY: SYRACUSE, NY DIV/GROUP: ENV/IM-DV DB: R. BASSETT, W. JONES, P. LISTER PM/TM: J. BRIEN TR: J. GOLUBSKI LYR: ON=*; OFF=*REF*
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SEE NOTE 4

SEE NOTE 5

SEE NOTE 6

APPROXIMATE PEEKSKILL LANDING BOUNDARY

SD-34 2'

SD-66

SD-15

SD-14 5'

SD-26

SD-27

SD-17

SD-35

SD-25

SD-21 2.5'

SD-10 3'

SD-13

SD-28 3.5'

SD-16 1.5'

SD-29

SD-6

4'

SD-18

SD-1

SD-30

SD-20

SD-11

SD-24

SD-31

SD-9 3.5'

SD-32

SD-19

SD-12

SD-36

SD-2

SD-6

SD-7

SD-3 4.5'

SD-33

SD-23

SD-22

SD-5

SD-4

TP-4

TP-1

TP-2

TP-5

TP-3

LARGE SUBMERGED BARGE

SMALL SUBMERGED BARGE

CHANNEL

ROCK LEDGE

STOCKPILE

LEGEND:

- SD-4 — SUBSURFACE SEDIMENT SAMPLING LOCATION
- SD-35 — SURFACE SEDIMENT INVESTIGATION SAMPLING LOCATIONS
- FORMER STRUCTURES
- APPROXIMATE EXTENT OF IMPACTS
- APPROXIMATE CAP LIMITS
- APPROXIMATE EXTENT OF SEDIMENT REMOVAL
- APPROXIMATE EXTENT OF SOIL REMOVAL
- 3' — SEDIMENT REMOVAL DEPTH
- PROPOSED NAPL RECOVERY WELL
- NAPL BARRIER WALL

NOTES:

1. BASE MAP CREATED FROM ENSR/AECOM FIGURE ENTITLED PROPOSED SURFACE SEDIMENT SAMPLE LOCATIONS, DATED 3/09.
2. ALL LOCATIONS ASSUMED TO BE APPROXIMATE.
3. THE MAIN SEDIMENT REMOVAL AREA IS BOUNDED BY THE EDGE OF WATER AS PRESENTED IN THE 2008 REMEDIAL INVESTIGATION ADDENDUM BY ENSR/AECOM AND THE APPROXIMATE EXTENT OF IMPACT AREA SHOWN. BOUNDARIES FOR THE REMOVAL POLYGONS ARE EXTENDED HALFWAY BETWEEN THE ADJACENT SUBSURFACE SAMPLING LOCATIONS.
4. THE AREA OF IMPACTS AROUND SD-34 IS ASSUMED TO BE 60-FOOT BY 60-FOOT. ADDITIONAL SAMPLING REQUIRED DURING THE PRE-DESIGN INVESTIGATION TO DETERMINE THE ACTUAL EXTENT OF VISUAL IMPACTS.
5. SOIL TO BE REMOVED TO TOP OF WEATHERED BEDROCK. DEPTHS RANGE FROM 8 TO 17 FEET BELOW GRADE.
6. NAPL BARRIER ALIGNMENT IS APPROXIMATE. FINAL LOCATION TO BE DETERMINED AS PART OF REMEDIAL DESIGN. LOCATION MAY BE LIMITED BY PROXIMITY OF RAILROAD. BARRIER WIDTH NOT TO SCALE.

0 40' 80'
GRAPHIC SCALE

CON EDISON
FORMER PEMART AVENUE WORKS MGP SITE
PEEKSKILL, NEW YORK
ALTERNATIVES ANALYSIS REPORT

ALTERNATIVE 3

ARCADIS

FIGURE
4

SEE NOTE 4

SEE NOTE 5

SEE NOTE 6

APPROXIMATE PEEKSKILL LANDING BOUNDARY

SD-34 2'

SD-15

SD-14 5'

SD-26

SD-27

SD-17

SD-21 2.5'

3'

SD-10

SD-25

SD-16 1.5'

SD-13

SD-28 3.5'

4'

SD-8

SD-29

SD-18

SD-1

SD-30

SD-20

8.5'

10'

SD-11

SD-24

SD-31

3.5'

SD-9

SD-32

SD-19

SD-12

18'

10'

SD-3

SD-33

SD-2

SD-6

SD-7

SD-23

SD-22

SD-5

SD-4

SD-35

SD-36

SD-66

TP-1

TP-2

TP-3

TP-4

TP-5

LEGEND:

- SD-4 SUBSURFACE SEDIMENT SAMPLING LOCATION
- SD-35 SURFACE SEDIMENT INVESTIGATION SAMPLING LOCATIONS
- FORMER STRUCTURES
- APPROXIMATE EXTENT OF IMPACTS
- APPROXIMATE EXTENT OF SEDIMENT REMOVAL
- APPROXIMATE EXTENT OF SOIL REMOVAL
- 3' SEDIMENT REMOVAL DEPTH
- PROPOSED NAPL RECOVERY WELL
- NAPL BARRIER WALL

NOTES:

1. BASE MAP CREATED FROM ENSR/AECOM FIGURE ENTITLED PROPOSED SURFACE SEDIMENT SAMPLE LOCATIONS, DATED 3/09.
2. ALL LOCATIONS ASSUMED TO BE APPROXIMATE.
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6. NAPL BARRIER ALIGNMENT IS APPROXIMATE. FINAL LOCATION TO BE DETERMINED AS PART OF REMEDIAL DESIGN. LOCATION MAY BE LIMITED BY PROXIMITY OF RAILROAD. BARRIER WIDTH NOT TO SCALE.

0 40' 80'
GRAPHIC SCALE

CON EDISON
FORMER PEMART AVENUE WORKS MGP SITE
PEEKSKILL, NEW YORK
ALTERNATIVES ANALYSIS REPORT

ALTERNATIVE 4

ARCADIS

FIGURE 5

CITY: SYRACUSE, NY DIV/GROUP: ENV/IM-DV DB: R. BASSETT, W. JONES, P. LISTER PM/TM: J. BRIEN TR: J. GOLUBSKI LYR: ON=*; OFF=*REF*
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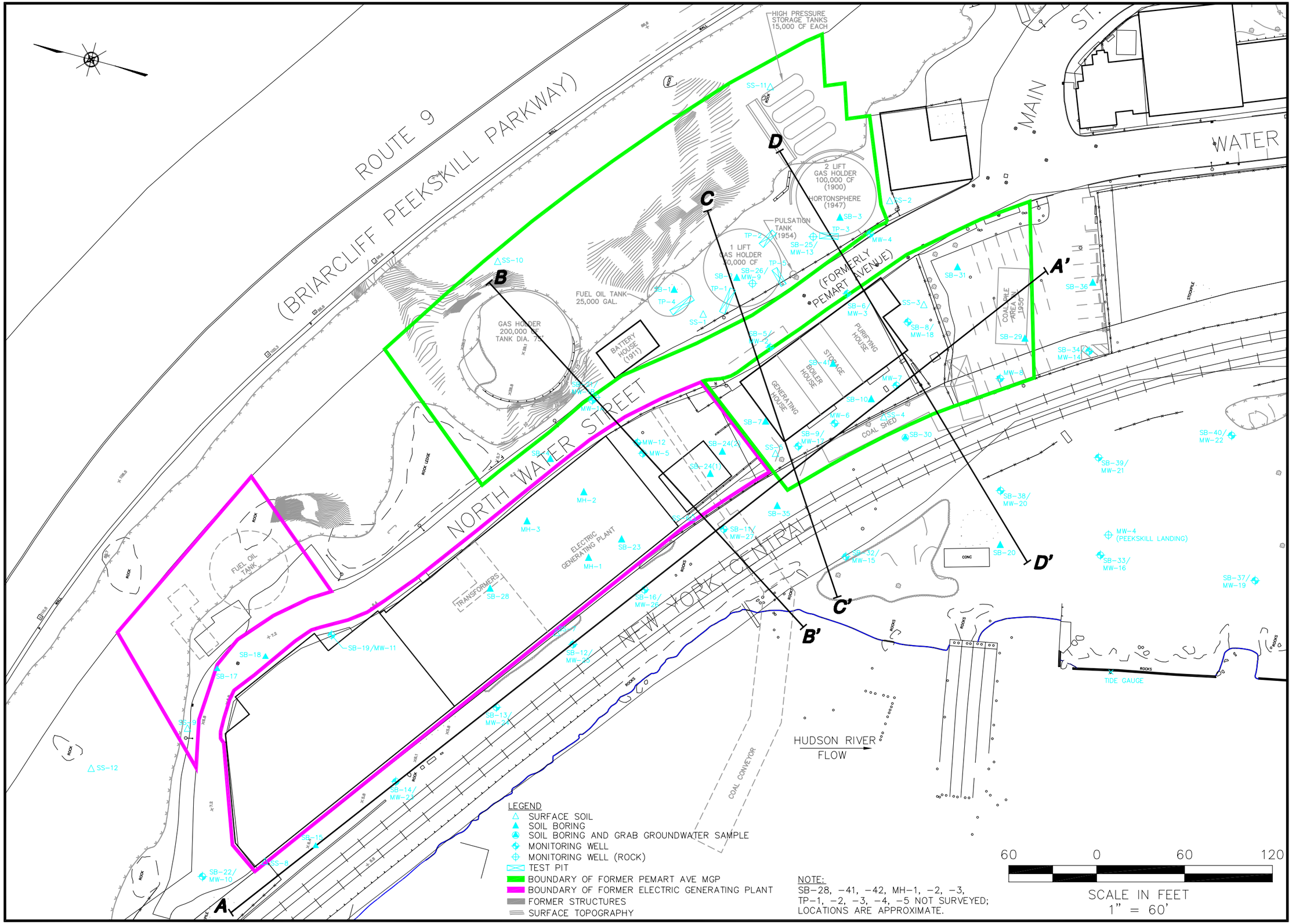
XREFS: IMAGES: PROJECTNAME: ---
43029X01
43029XDL

ARCADIS

Appendix A

Select RI and RI Addendum Figures



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DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
	J.E.B.	B.M.	D.S.

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FAX: (978) 589-3100
WEB: HTTP://WWW.ENSR.AECOM.COM

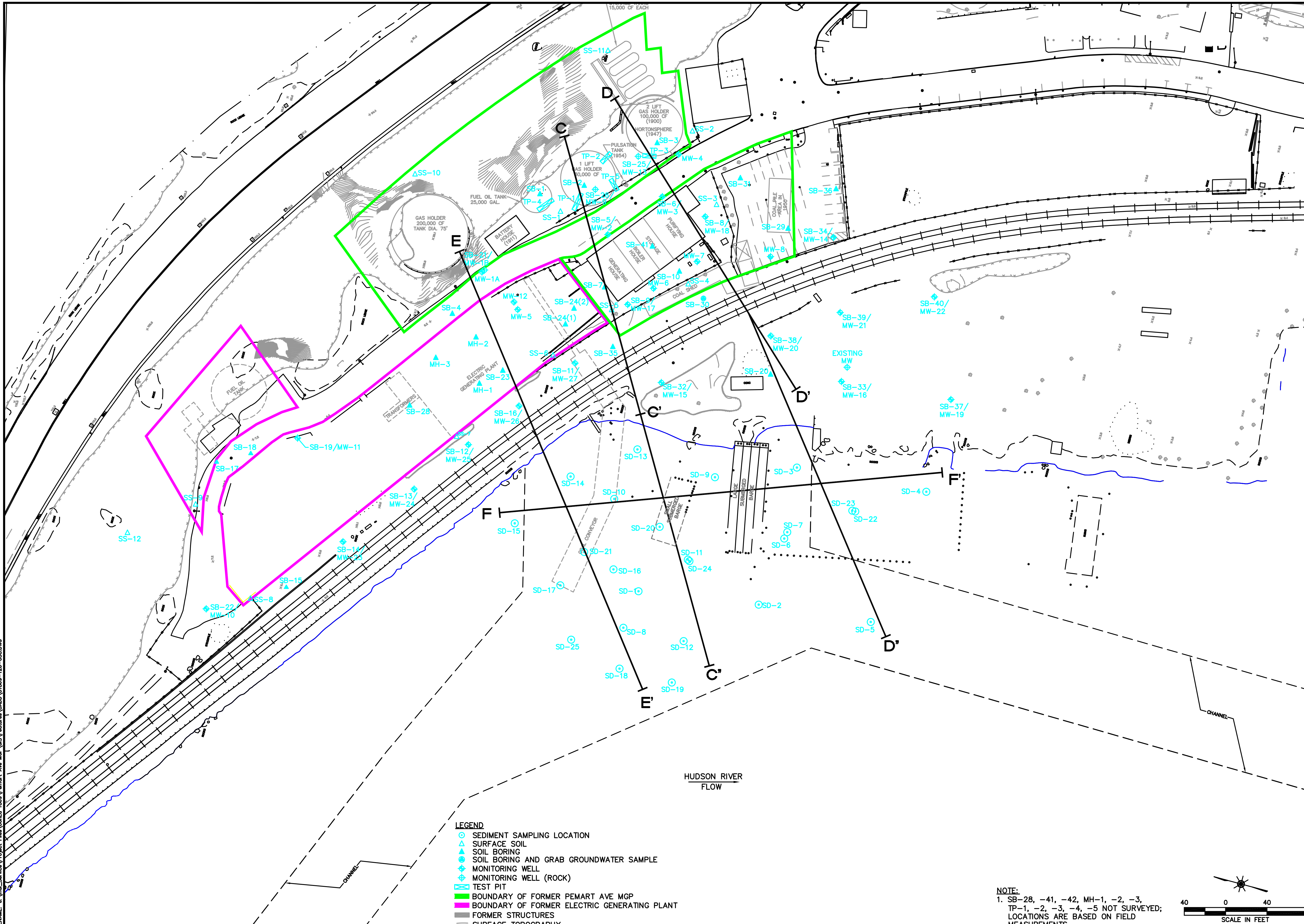
CROSS SECTION AND SAMPLE LOCATION MAP REMEDIAL INVESTIGATION PEMART AVENUE FORMER MGP PEEKSKILL, NEW YORK

PROJECT NUMBER:	DATE:	SCALE:
01869-116	8/06	1" = 60'

FIGURE NUMBER:
2-1

SHEET NUMBER:
1

FILENAME: 01869-116-01B.DWG



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NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:
DRAWN BY: K.P.B.
CHECKED BY: S.O.
APPROVED BY: D.S.

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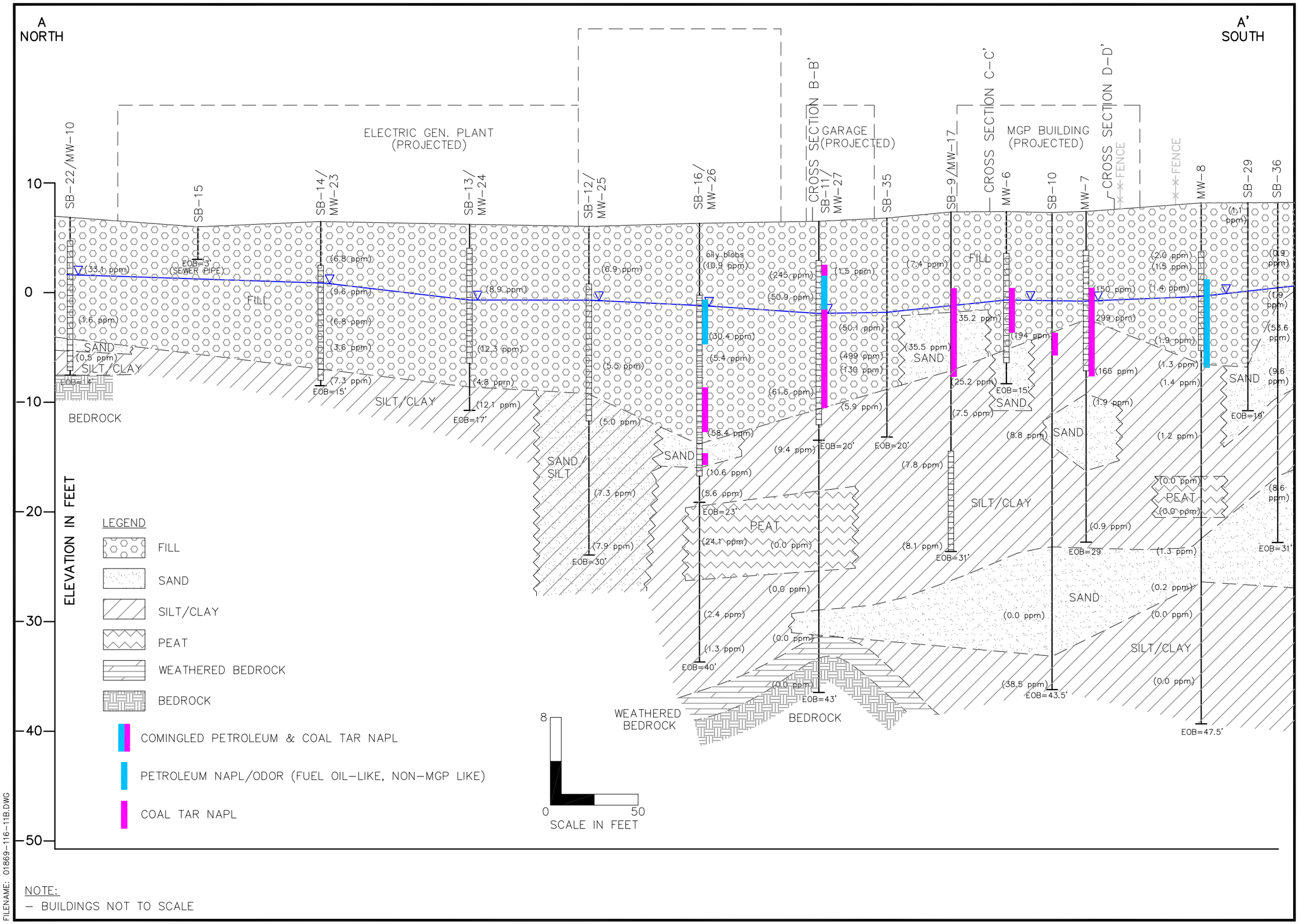
RI SAMPLE LOCATIONS
PEMART AVENUE FORMER MGP
PEEKSKILL, NEW YORK

PROJECT NUMBER: 01869-126-400
DATE: 2/08
SCALE: AS SHOWN

DRAWING NUMBER: 2-1
SHEET NUMBER: 1

FILENAME: J:\Indl_Service\Project Files\ConEd 1869\Pemart Ave MGP\GIS\Features\CADD\01869-126-05C.DWG



NOTE:
– BUILDINGS NOT TO SCALE

FILENAME: 01869–116–11B.DWG

REVISIONS			
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CROSS–SECTION A–A'
REMEDIAL INVESTIGATION
PEMART AVENUE FORMER MGP
PEEKSKILL, NEW YORK

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	2/07	01869–116–0400

FIGURE NUMBER:
3-1

SHEET NUMBER:
1

B
NORTHEAST

B'
SOUTHWEST

ELEVATION IN FEET

30
20
10
0
−10
−20
−30
−40

BEDROCK OUTCROP

200,000 CF GAS HOLDER BASE

BEDROCK OUTCROP

ELECTRIC GEN. PLANT (PROJECTED)

FENCE

SB−21/MW−1B

MW−1A

SB−4

MW−12

MW−5

FENCE

CROSS SECTION A−A'
SB−11/MW−27

MTA/MNRR RR TRACKS

HUDSON RIVER

(1.9 ppm)
(27.8 ppm)
(1.1 ppm)
EOB=5.5'
(0.0 ppm)
EOB=10'
(0.0 ppm)
EOB=9'
(5.1 ppm)
(47.5 ppm)
(35.8 ppm)
(468 ppm)
(95.3 ppm)
(6.8 ppm)
(8.0 ppm)
(0.0 ppm)
EOB=23.5'
EOB=16'
(0.3 ppm)
(245 ppm)
(50.9 ppm)
(61.6 ppm)
(34.8 ppm)
(9.4 ppm)
(0.0 ppm)
(0.0 ppm)
(0.0 ppm)
(0.0 ppm)
EOB=43'

FILL

SILT/SAND

BEDROCK

PEAT

SAND
WEATHERED BEDROCK
BEDROCK

LEGEND

- FILL
- SAND
- SILT/CLAY
- PEAT
- WEATHERED BEDROCK
- BEDROCK
- COMINGLED PETROLEUM & COAL TAR NAPL
- PETROLEUM NAPL/ODOR (FUEL OIL−LIKE, NON−MGP LIKE)
- COAL TAR NAPL

8
0
20
SCALE IN FEET

NOTE:
− BUILDINGS NOT TO SCALE

FILENAME: 01869−116−04Brev.DWG

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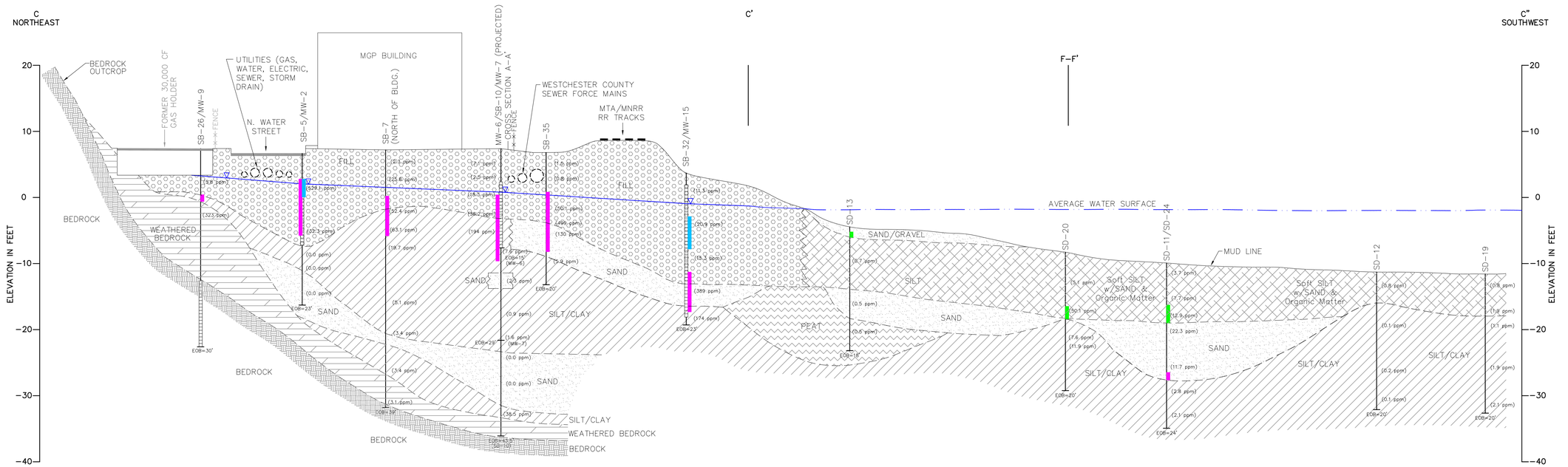
CROSS−SECTION B−B'
REMEDIAL INVESTIGATION
PEMART AVENUE FORMER MGP
PEEKSKILL, NEW YORK

PROJECT NUMBER:	DATE:	SCALE:
01869−116−0400	12/06	AS SHOWN

FIGURE NUMBER:
3−2

SHEET NUMBER:
1



NOTE:
– BUILDINGS NOT TO SCALE

FILENAME: 01869-126-020.DWG

REVISIONS			
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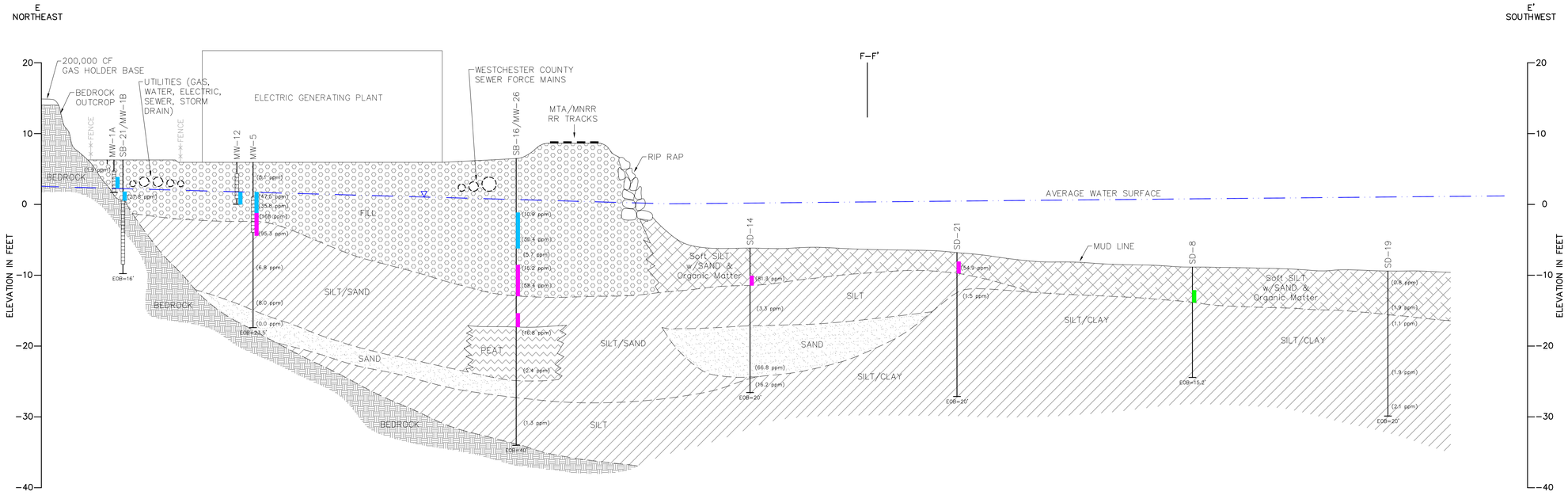
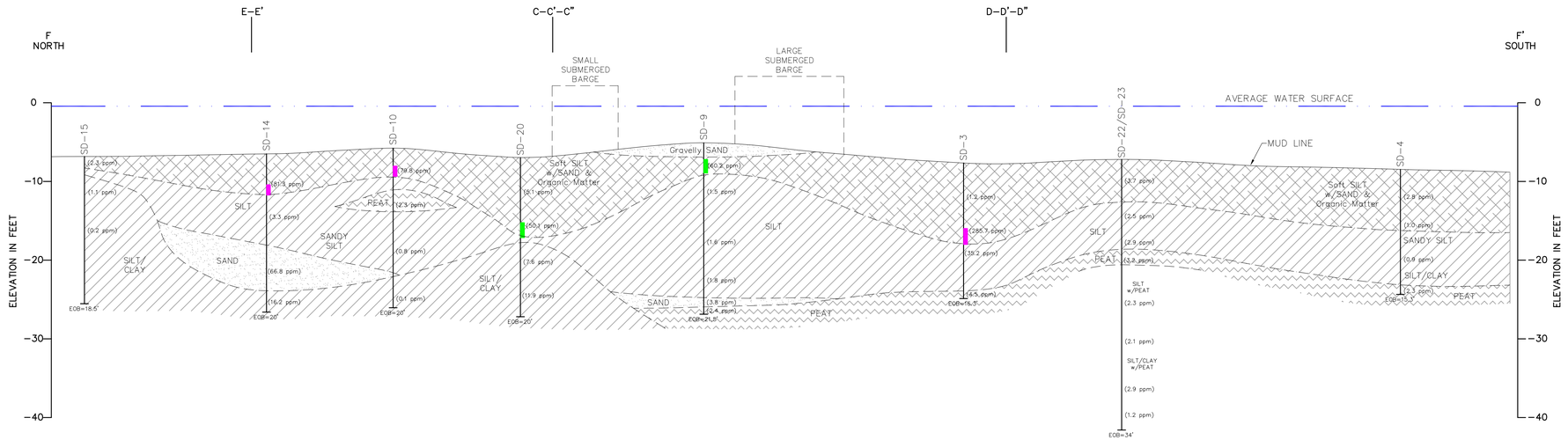
CROSS-SECTION C-C'-C" AND D-D'-D"
REMEDIAL INVESTIGATION
PEMART AVENUE FORMER MGP
PEEKSKILL, NEW YORK

PROJECT NUMBER:	DATE:	SCALE:
01869-126-400	2/08	AS SHOWN

DRAWING NUMBER:
3-1

SHEET NUMBER:
1





LEGEND

- FILL
- SAND
- SILT/CLAY
- GRAVEL
- PEAT
- WEATHERED BEDROCK
- BEDROCK
- SILT
- PETROLEUM NAPL/ODOR (FUEL OIL-LIKE, NON-MGP LIKE)
- COAL TAR NAPL
- COAL TAR GLOBULES

SCALE IN FEET: 0 20 8

REVISIONS			
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DESIGNED BY: X
DRAWN BY: K.P.B.
CHECKED BY: S.O.
APPROVED BY: D.S.

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CROSS-SECTION E-E' AND F-F'
REMEDIAL INVESTIGATION
PEMART AVENUE FORMER MGP
PEEKSKILL, NEW YORK

PROJECT NUMBER: 01869-126-400
DATE: 2/08
SCALE: AS SHOWN

DRAWING NUMBER: 3-2

SHEET NUMBER: 1

FILENAME: 01869-126-03D.DWG

ROUTE 9
(BRIARCLIFF PEEKSKILL PARKWAY)

NORTH WATER STREET

MAIN ST.

WATER

(FORMERLY PEMART AVENUE)

NEW YORK CENTRAL

HIGH PRESSURE STORAGE TANKS 15,000 CF EACH

2 LIFT GAS HOLDER 100,000 CF (1900)

HORTONSPHERE (1947)

PULSATION TANK (1954)

1 LIFT GAS HOLDER 30,000 CF

GAS HOLDER 200,000 CF TANK DIA. 75'

FUEL OIL TANK 25,000 GAL.

BATTERY HOUSE (1911)

PURIFYING HOUSE

STORAGE HOUSE

BOILER HOUSE

GENERATING HOUSE

COAL PILE AREA

CONC

ELECTRIC GENERATING PLANT

TRANSFORMERS

FUEL OIL TANK

COAL CONVEYOR

ROCK LEDGE

ROCKS

HUDSON RIVER FLOW

MW-1A (3.95)
MW-1B
MW-2 (2.02)
MW-3 (1.88)
MW-4 (3.03)
MW-5
MW-6 (1.80)
MW-7 (2.33)
MW-8 (1.86)
MW-9
MW-10 (2.71)
MW-11 (3.75)
MW-12 (1.60)
MW-13
MW-14 (1.64)
MW-15 (1.09)
MW-16 (0.47)
MW-17
MW-18
MW-19 (0.52)
MW-20 (−0.08)
MW-21 (−0.37)
MW-22 (−0.16)
MW-23 (1.55)
MW-24 (1.61)
MW-25 (1.45)
MW-26 (1.36)
MW-27 (1.20)
MW-4 (PEEKSKILL LANDING)

3.5
3.0
2.5
2.0
1.5
1.25
1.0
0.5

LEGEND

- GROUNDWATER CONTOURS
- (1.61) GROUNDWATER ELEVATIONS
- GROUNDWATER FLOW
- MONITORING WELL
- MONITORING WELL (ROCK)
- BOUNDARY OF FORMER PEMART AVE MGP
- BOUNDARY OF FORMER ELECTRIC GENERATING PLANT
- FORMER STRUCTURES
- SURFACE TOPOGRAPHY

NOTE:
MONITORING WELLS IN GRAY WERE NOT USED TO CONTOUR GROUNDWATER ELEVATIONS.

60 0 60 120
SCALE IN FEET
1" = 60'

FILENAME: 01869-116-06B.DWG

REVISIONS			
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GROUNDWATER CONTOUR MAP MAY 2-5, 2006 REMEDIAL INVESTIGATION PEMART AVENUE FORMER MGP PEEKSKILL, NEW YORK

SCALE:	DATE:	PROJECT NUMBER:
1" = 60'	12/06	01869-116

FIGURE NUMBER:
3-5

SHEET NUMBER:
1