**Remedial Action Plan**

# Halesite Former MGP Site

Halesite, Town of Huntington
Suffolk County, Long Island, New York
AOC Index No. D1-0001-98-11

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A. Remedial Alternative Cost Estimates

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# Abbreviations and Acronyms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| BTEX | Benzene, Toluene, Ethylbenzene, Xylene |
| CAMP | Community Air-Monitoring Plan |
| CERCLA | Comprehensive Environmental Response, Cleanup, and Liability Act |
| DNAPL | Dense Non-Aqueous Phase Liquid |
| EC | Engineering Controls |
| FS | Feasiblity Study |
| FWRIA | Fish and Wildlife Resources Impact Analysis |
| HDPE | High Density Polyethylene |
| IC | Institutional Controls |
| LILCO | Long Island Lighting Company |
| LIPA | Long Island Power Authority |
| LNAPL | Light Non-Aqueous Phase Liquid |
| MGP | Manufactured Gas Plant |
| NAPL | Non-aqueous Phase Liquids |
| NCP | National Contingency Plan |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| PAH | Polycyclic Aromatic Hydrocarbon |
| QHEA | Qualitative Human Exposure Assessment |
| RAO | Remedial Action Objectives |
| RAP | Remedial Action Plan |
| RI | Remedial Investigation |
| SCGs | Standards, Criteria, and Guidance |
| SMP | Site Management Plan |
| TAGM | Technical and Administrative Guidance Memorandum |
| TOH | Town of Huntington |
| USEPA | United States Environmental Protection Agency |

**MEASUREMENTS**

| | |
|---|---|
| bgs | Below Ground Surface |
| msl | mean sea level |
| ppbv | Parts Per Billion Volume |
| ug/L | Microgram per liter |

# Executive Summary

This report presents a Remedial Action Plan (RAP) for the KeySpan Corporation (KeySpan) Halesite Former Manufactured Gas Plant (MGP) Site located in Halesite, within the Town of Huntington, Suffolk County, New York (the site). This report has been prepared in accordance with the Order on Consent, Index No. D1-0001-98-11 (the Order), signed by KeySpan and the New York State Department of Environmental Conservation (NYSDEC).

The site is owned by the Long Island Power Authority (LIPA), and a portion of the site is used by LIPA as an electric system substation, currently operated and maintained by KeySpan for LIPA. The remainder of the site is steeply sloped, heavily vegetated, and vacant.

This RAP was prepared in accordance with the NYSDEC-approved Remedial Investigation/ Feasibility Study (RI/FS) Work Plan and in a manner consistent with the Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA), the National Contingency Plan (NCP), and the United States Environmental Protection Agency (USEPA) guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988)*, and appropriate USEPA and NYSDEC technical and administrative guidance documents, including *Draft DER-10, Technical Guidance for Site Investigation and Remediation (NYSDEC, 2002)*.

Consistent with the Order, an RI, and an assessment of potential impacts on human health and ecological conditions were previously conducted and reported in the *Halesite Former Manufactured Gas Plant Site Final Remedial Investigation Report, Town of Huntington, New York (Vanasse Hangen Brustlin, Inc., 2004)*. There are site-related chemical constituents present in the soil and groundwater beneath the site, and there are existing and potential pathways of exposure to these constituents. Groundwater is shallow, and there are potential exposures to chemicals in indoor air at third party-owned properties outside of the main boundaries of the former MGP operations that have volatilized from groundwater. Other potential exposure pathways include direct contact with soil or groundwater during site construction and utility work.

The regulations and guidance provide a methodical, step-wise process to establish remedial objectives for the site, identify and screen potential remedial technologies applicable to the site, develop a range of comprehensive remedial alternatives, evaluate and compare the alternatives, and recommend a remedy. The application of this process to the site is presented in the body of the document, including presentation of the alternatives considered and their evaluation against regulatory-defined criteria.

Taking into account the RI findings, the current and future exposure scenarios, the requirements of the Order, and the applicable regulatory requirements, the following remedy, out of five alternatives considered, is recommended for the site.

- Excavate shallow/unsaturated soils in the two dense non-aqueous phase liquid (DNAPL) tar source areas in the Upland Area and excavate shallow soils below the water table in two DNAPL source areas in the Lowland Area, including any structures that may remain in place, with off-site thermal treatment of soils.
- Construct an engineered cap in the unsaturated zone across the two DNAPL tar source areas in the Upland Area.
- Construct an engineered treatment barrier/zone along the Eastern and the Western property boundaries of the Lowland Area.
- Establish Institutional controls to prevent use of groundwater in the area impacted by MGP-related contaminants and to prevent any disturbance of the engineered caps.
- Recover DNAPL tar where feasible.
- Monitor groundwater for potential effects from MGP-related contaminants in the Downgradient Area and on the office building property south of the site.

This remedial alternative is identified as Alternative 3 in the body of this report. The estimated cost to implement this remedy is $5.3 million.

Implementation of this proposed remedial alternative will achieve the following Remedial Action Objectives (RAOs) developed for the site in accordance with regulatory requirements.

### Groundwater

- Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.
- Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.
- Remove, to the extent practicable, the source of groundwater contamination.

### Soil

- Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.
- Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.

### Soil Vapor

- Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.

This alternative will achieve the RAOs developed for the site. The alternative significantly reduces the existing contaminant mass. This mass reduction reduces the potential for future exposure to site-related contaminants in soil and groundwater. The flux of contaminants into groundwater is reduced by removal and destruction of source material. The treatment barrier/zone and NAPL recovery mitigate the potential migration of residual contamination from the site. These measures significantly reduce the contribution of contaminants to the Downgradient Area.

The alternative will allow and support a variety of future site uses; however, it is anticipated that a portion of the site will continue to be used indefinitely as a substation, and the remainder of the site is not suitable for development. Institutional controls will be required to prevent and control potential exposure to remaining contaminants. However, these controls are readily implemented and future disturbance of remaining zones of contamination will be infrequent.

This alternative involves intensive remedial construction activities that could affect the operation of the substation currently owned by LIPA. Significant design and engineering is required prior to implementing the remedy, including selection of a final location and alignment of the treatment barrier/zone and pilot-scale testing of the treatment barrier/zone technology to minimize disturbance to the LIPA substation. The design and engineering phase will consider ways to prevent or minimize disruption to the operation of the substation. Maintenance of uninterrupted electric power to the residences in the vicinity of the site will be critical to community acceptance of the selected remedy.

Considering all of the criteria and the strong probability that the site will continue in its current uses, Alternative 3 was selected as the remedy for the site. Alternative 3 achieves all RAOs, provides better reduction in toxicity and mobility of site contaminants than the other alternatives, and offers a reasonably comparable removal of contaminated materials to the other alternatives that include removal as an element. Alternative 3 is at least as implementable as the other alternatives and is the most cost effective.

# 1. Purpose

## 1.1 Introduction

This report presents a Remedial Action Plan (RAP) for the KeySpan Corporation (KeySpan) Halesite Former Manufactured Gas Plant (MGP) Site in Halesite, Town of Huntington, Suffolk County, New York (the site). This report has been prepared in accordance with the Order on Consent, Index No. D1-0001-98-11, (the Order) signed by KeySpan and the New York State Department of Environmental Conservation (NYSDEC).

The former MGP site is located east of New York Avenue, south of the Halesite Post office, and north of an office building property and a Town of Huntington Nature Preserve. A site location map is shown on Figure 1-1.

From 1995 to 2004, a series of investigations at the site have identified impacts associated with the former MGP operations. The Remedial Investigation (RI) reports, including the April 2004 *Halesite Former Manufactured Gas Plant Site Final Remedial Investigation Report*, *Town of Huntington, New York (Vanasse Hangen Brustlin, Inc. [VHB], 2004)* and the December 2002, *Halesite Former Manufactured Gas Plant Site Remedial Investigation Report (Dvirka and Bartilucci [D&B], 2002)*, summarize the findings of all the investigations and recommend further remedial action to eliminate migration pathways and/or eliminate potential exposure to MGP-related impacts.

## 1.2 Scope of Remedial Action Plan

This RAP was developed to meet the requirements of a "Remedial Plan" in accordance with the factors set forth in 6 NYCRR 375-1.10(c), *NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4030 Selection of Remedial Actions at Inactive Hazardous Waste Sites*, and NYSDEC Draft DER-10 Technical Guidance For Site Investigation and Remediation. This RAP is intended to identify Remedial Action Objectives (RAOs) for the site and develop and select an appropriate Remedial Alternative for the site.

To efficiently manage the RI of the site, it was divided into three separate remedial areas, the Upland Area, the Lowland Area, and the Downgradient Area. Development of remedial alternatives is also discussed in relation to these three areas. The Upland Area is defined as the eastern two-thirds of the site consisting of an uneven vegetated slope that rises approximately 70 feet. The Lowland Area is defined as the western third of the site and includes the active Long Island Power Authority (LIPA) substation. The Downgradient Area is defined as the area between the site and Huntington Harbor, including New York Avenue. The site layout including the remedial area boundaries is shown on Figure 1-2.

In August 2005, a "clean utility corridor" was installed in a portion of the Lowland Area within the substation footprint. This clean utility corridor installation will support the expansion of the LIPA substation and involved the removal of impacted shallow soils to create a "clean" corridor for workers. Approximately 450 cubic yards of impacted soils was removed from an area of approximately 40 feet by 80 feet to a depth of about 4 feet below ground surface (bgs). A visual excavation barrier was placed at 4 feet bgs and the area was backfilled with clean fill. The clean utility corridor installation will not be discussed in this RAP; however, impacted soils left in place below the clean utility corridor area will be addressed in this RAP.

There is an area of tar-saturated soil on an adjoining property containing an office building and associated parking areas (the Office Building property) located south of the Lowland Area. It is unclear if these impacts are the result of direct migration and are interconnected to the impacts observed at similar depths in the Lowland Area or are the result of discrete placement. For the purposes of development of the site conceptual model and potential remedial actions, it was assumed that the impacts are interconnected. A remedy for this area is recommended in this RAP; however, the final remedy for this area may be adjusted based on the final distribution of impacts and negotiated access to the property.

The results of this RAP will be used for selection of a final remedial response for the site. In accordance with the Order, the NYSDEC, in consultation with KeySpan, shall select a remedial response for the site that eliminates or mitigates all significant threats to the environment or public health that hazardous materials constitute. Once a remedy is agreed to, KeySpan will prepare a Remediation Work Plan and a Remedial Design, if necessary, for submittal to the NYSDEC, as described in the Order on Consent.

## 1.3 Report Organization

This document has been organized in accordance with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation Section 4.3(b) and includes the following sections:

- Executive Summary
- Purpose
- Site Description and History
- Summary of Remedial Investigation and Exposure Assessment
- Remedial Goals and Remedial Action Objectives
- General Response Actions

- Identification and Screening of Technologies
- Development and Analysis of Alternatives
- Recommended Remedy

KeySpan and the NYSDEC agreed to expand the presentation of alternatives in this RAP beyond what would normally be required for a Voluntary Cleanup site (DER-10 section 4.3(d)), where only the proposed alternative need be described. Given the circumstances particular to this site, presenting and evaluating other alternatives gives added support to the proposed remedy. By documenting the consideration given to other, less suitable, approaches, potential questions of project stakeholders regarding alternatives to the proposed remedy may be answered in advance. Therefore, the organization and content of this report follows more closely that required for a Feasibility Study.

# 2. Site Description and History

This section presents a summary description of the site, its operating history, previous investigations, and interim remedial measures. Refer to the RI Reports for more complete descriptions of the site and its history.

## 2.1 Site Description

The Halesite former MGP site is located in Halesite, which is located in the Town of Huntington, in northwestern Suffolk County, New York. The site is about 1-acre in size and is located along North New York Avenue, approximately 200 feet east of Huntington Harbor. An active LIPA electric substation is located on the western third, or Lowland Area, of the site. The remaining eastern two thirds of the property, or Upland Area, is undeveloped land that is characterized by a steep slope that is heavily vegetated. The substation and Upland portion of the site are fully enclosed and secured by a chain link fence. The surrounding area is primarily residential with a mixture of commercial properties along New York Avenue. The topography of the site is relatively flat in the area of the existing electric substation in the Lowland Area. The undeveloped Upland portion of the site rises sharply eastward from approximately 20 feet to 60 feet above mean sea level (msl) and continues to slope upward to a highpoint near the northeast corner of the property. The elevation of the site ranges from about 16 feet above msl near the western boundary of the site in the Lowland Area to approximately 86 feet above msl at the eastern boundary of the site in the Upland Area.

Surrounding properties include:

- ***North -*** Halesite Post Office and residential properties farther north of the post office property.
- ***East -*** Residential properties.
- ***South -*** Office Building property, Town of Huntington (TOH) Nature Preserve, and commercial businesses farther south.
- ***West -*** New York Avenue and Downgradient Area, including Halesite Fire Department, TOH Marina and associated parking lot, and Huntington Harbor.

## 2.2 Site History

The Halesite former MGP (also known as the Huntington MGP) is believed to have initiated operations around 1892 and continued to operate through approximately 1918. The water gas/carbureted gas or carbureted water gas process and an oil gas process were used on site to manufacture gas (Eng, 1985). The plant was owned by the Standard Gas and Electric Light Company during the years 1892 to 1893. The Huntington Gas Company took over the site in

1900, followed by the Long Island Lighting Company (LILCO) in 1919. Structures that had been used for the manufacture of gas were later dismantled and removed from the site. Following the merger between LILCO and the Brooklyn Union Gas Company, the Halesite former MGP site became the property of LIPA due to the presence of the electric substation facility. Additional details regarding the history of the site are provided in the December 2002 RI Report.

## 2.3 Future Site Use

The Lowland Area of the site is currently used as an electric substation owned by LIPA. The Upland Area is vacant. The off-site areas are primarily commercial, office, and residential. In addition, the TOH Nature Preserve is located immediately adjacent to the southeast portion of the site. All of these uses are expected to continue. As a consequence, the current exposure scenarios also hold for future use of the site and surrounding areas. A future on-site residential land use scenario is included in the exposure assessment (see Section 3.2); however, given the site's anticipated continued use as an electric substation, site access, and topography issues associated with the currently undeveloped eastern portion of the site, future residential use of the site is unlikely. Additional future human populations considered in the exposure assessment include on-site and off-site construction workers, on-site commercial workers, on-site adult and child visitors to commercial establishments, and nearby off-site adult utility workers. Although future redevelopment of the site is unlikely, the construction worker is considered in the event that construction activity in the vicinity of the substation takes place. The possibility, although unlikely, exists that the site may be used in the future for commercial purposes. Thus, exposures for adult on-site commercial workers and adult and child visitors to future on-site commercial establishments may occur. Chemical exposure for nearby off-site utility workers could be expected because of the presence of subsurface utility lines in areas adjacent to the site. Off-site construction worker exposure to areas surrounding the site is possible in the event of future off-site redevelopment.

# 3. Summary of Remedial Investigation and Exposure Assessment

A Final RI Report was submitted to the NYSDEC by KeySpan in April 2004 and approved in 2004. The following summary of findings is adapted from the RI Report. Refer to Figure 1-2 for locations of specific areas of the site referenced below.

## 3.1 Site Geology and Hydrogeology

### *3.1.1 Site Geology*

There are four primary stratigraphic units identified at the site. These units are in descending order: topsoil/fill material, shallow sand unit, fine-grained unit, and glacial sand unit. The fine-grained unit primarily consists of silty sands and clay-rich silts with lesser amounts of clay. As shown on Figures 3-1 and 3-2, this unit is fairly continuous and encountered throughout the Lowland and Upland portions of the site. The unit is encountered between 8 and 10 feet bgs in the Lowland Area, and given the variable topography of the Upland Area, at depths ranging from approximately 20 to 70 feet bgs. The unit is generally less than 5-feet thick, but grades to a thickness of up to 8 feet in areas of the Upland Area. Geotechnical samples were collected from this material during the RI. The results of these samples indicate that the fine-grained unit acts as a partial confining unit, and where present, this unit has inhibited the vertical migration of MGP-related material released to the shallow subsurface environment.

### *3.1.2 Site Hydrogeology*

Investigations conducted at the site have been limited to the Upper Glacial aquifer, which is shallow, exists under unconfined conditions, and has a total saturated thickness of approximately 400 to 500 feet in the area of the site (N.E. McClymonds and O.L. Franke, 1972). Locally, the shallow groundwater in the Downgradient Area appears to be perched above the fine-grained unit, which acts as a partial confining layer.

Groundwater elevations at the site are tidally influenced. The average hydraulic gradient in the shallow water table zone is relatively flat and increases in steepness as groundwater flows across the site from east to west. Gradients were steeper during low tidal stages. Groundwater in the intermediate zone flows towards the west/northwest, consistent with the shallow groundwater zone. The high and low tide horizontal hydraulic gradients for the intermediate groundwater zone increase in steepness as groundwater flows across the site from east to west towards Huntington Harbor, consistent with shallow groundwater. Water level measurements were also obtained from the three deep groundwater monitoring wells screened in the glacial sand unit. Based on the water elevations for the few available data points, the hydraulic gradient for deep groundwater also slopes in the direction of Huntington Harbor indicating a generally westerly groundwater flow direction. The average hydraulic gradients at high and low tides for the deep groundwater zone during the two gauging events indicate that there is very little tidal influence in this portion of the aquifer.

The vertical head differences observed at the site during the RI indicate that groundwater flow transitions from a predominantly horizontal flow regime to one with a strong upward vertical component as groundwater flows across the site from east to west towards Huntington Harbor.

## 3.2 Nature and Extent of Contamination

MGP-related contaminants are present in the subsurface beneath the former site and adjacent properties. The following sections describe the distribution of contaminants in the site area and the adjacent properties.

### *3.2.1 Soil and Non-Aqueous Phase Liquids Source Material*

Three primary source areas of non-aqueous phase liquids (NAPL)-saturated soil were identified at the site:

- Tar Deposit Area 3 in the Upland Area
- Southeast of the former Gas House and MGP process area in the Lowland Area
- The Small Crater/Tar Deposit Area 5 in the Upland Area

Dense non-aqueous phase liquid (DNAPL) tar has not migrated off-site in the Upland Area or north of the site in the Lowland Area. Tar-saturated soil was observed immediately west of the site in the Downgradient Area and immediately south of the site in the Lowland Area. Concentrations of dissolved benzene, toluene, ethylbenzene, and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs) in groundwater at and downgradient of the site are generally decreasing or have remained the same from 1995 to present. The well and basement survey indicates that groundwater is not a potential source of exposure to off-site populations. The potential for adverse ecological impact is minimal.

Tar-saturated soil was observed in subsurface soil above and at the fine-grained unit in the vicinity of the three primary source areas. Additional impacts were identified below the fine-grained unit near two of these primary source areas, the Small Crater/Tar Deposit Area 5 and the former Gas House and MGP process area. Tar-saturated soil was found to depths of approximately 52 feet bgs, 22 feet bgs, and 54 feet bgs in the vicinity of Tar Deposit Area 3, the former Gas House and MGP process area, and the Small Crater/Tar Deposit Area 5, respectively. Within these primary source areas, the majority of the potentially mobile tar impacts (tar-saturated soils) are present in the shallow unsaturated soils near Tar Deposit Area 3, the Small Crater/Tar Deposit Area 5, and in the shallow saturated soils in the vicinity of the active LIPA substation. The remaining tar-saturated soils in these areas are located at or above the fine-grained unit as shown on Figures 3-1 and 3-2. These deeper impacts represent a relatively small proportion of the MGP-related impacts and are distributed in thin, discrete lenses.

Limited tar-saturated soil was found in the Downgradient Area immediately adjacent to the western site boundary, at or beneath the fine-grained unit. This suggests that some tar has migrated along the fine-grained unit from the Lowland portion of the site westward to the Downgradient Area off-site. However, soil borings advanced along the bulkhead of Huntington Harbor showed no significant MGP-related impacts. Sediment probing activities in Huntington Harbor did not indicate any NAPL impacts to harbor sediments. It is unlikely that tar impacts will ever reach Huntington Harbor, given the age of the likely release (over 70 years ago), the lack of any evidence of tar in soil, and groundwater close to the harbor. Groundwater analyses in the Downgradient Area indicated little to no presence of MGP-related chemicals. Therefore, the subsurface soil, groundwater, and harbor sediment probing data indicate that Huntington Harbor has not been and is not likely to be impacted by the former MGP site.

A potential tar migration pathway may exist from the Small Crater/Tar Deposit Area 5 in the Upland Area toward the eastern site boundary. At this location, the fine-grained unit dips slightly to the east and southeast, rising again near the eastern and southern site boundaries. The change in elevation of the surface of the fine-grained unit near the site boundary creates a shallow indentation in the fine-grained unit surface where a small volume of tar has accumulated as shown on Figure 3-1. This indentation and the relatively small volume of tar present at depth have prevented migration off-site.

The data suggest a possible tar migration pathway along the fine-grained unit from Tar Deposit Area 3 in the Upland Area to the Lowland portion of the site. Tar-related impacts were observed at the fine-grained unit at borings located along the southern site boundary between the on-site Upland and Lowland Areas. Forensic analyses also indicate that tar detected in a sample collected near Tar Deposit Area 3 in the Upland Area is similar to that found in a sample collected in the southeast corner of the on-site Lowland Area. However, the impacts do not appear to be continuous from one area to the next, indicating that the pathway is no longer complete or that the volume of mobile tar in Tar Deposit Area 3 is insufficient to maintain migration.

MGP-related impacts to soil are discontinuous in the on-site Lowland Area with the majority of the observed impacts in the southeast, southwest, and northwest corners. Tar appears to extend southward from the site onto the adjoining Office Building property. However, tar-saturated soil was only observed in one soil boring located at the Office Building property and was limited to the 10- to 11-foot interval. Other MGP-related impacts on the Office Building property were limited to depths ranging from approximately 4 to 12 feet bgs. Therefore, MGP-related impacts at this property appear to be limited.

### *3.2.2 Groundwater*

Groundwater impacts are discussed in the RI based on the hydrogeologic setting of the site, according to the following zones: water table, shallow, intermediate, and deep.

The water table groundwater zone includes all data associated with samples collected from the water table to a maximum depth of 14 feet bgs within the Lowland and at depths of 22 to 57 feet bgs in the Downgradient Areas. The shallow groundwater zone includes all well and groundwater probe data collected immediately below the fine-grained unit and within the glacial sand unit. This zone generally corresponds to a 15-foot interval of approximately 0 to 15 feet below the fine-grained unit in these areas. The intermediate groundwater zone includes all groundwater data collected from the glacial sand unit from a depth of 30 to 60 feet bgs within the Lowland and Downgradient Areas. This zone generally corresponds to a 30-foot interval of approximately 15 to 45 feet below the fine-grained unit in these areas. The deep groundwater zone includes all groundwater data collected from the glacial sand unit greater than 60 feet bgs within the Lowland and Downgradient Areas. This zone generally corresponds to depths greater than 45 feet below the fine-grained unit in these areas.

Groundwater monitoring is currently being conducted at the site on a bi-annual basis.

#### Water Table Groundwater

The analytical results indicate that the groundwater samples with the highest concentrations of BTEX and PAHs in the water table groundwater zone above the fine-grained unit were obtained from monitoring wells located in the Lowland Area. These wells are generally located downgradient of Tar Deposit Area 3 and to the south of the former Gas House and MGP process area in the Lowland portion of the site. In addition, the groundwater results indicated non-detect to low concentrations of BTEX and PAHs within the Downgradient Area.

During the April 2005 sampling round, a 0.4-foot thick layer of light non-aqueous phase liquid (LNAPL) was observed in monitoring well HHMW-12 located near the southern boundary of the site in the Upland Area adjacent to the TOH Nature Preserve. Laboratory forensic analysis of this LNAPL indicated that it primarily consisted of diesel or #2 heating oil, and included the presence of a weathered tar product from a separate release.

**Shallow Groundwater**

The analytical results indicate that the groundwater sample with the highest concentrations of BTEX and PAHs in the shallow groundwater zone was obtained from monitoring well HHMW-10, which is located immediately southeast of the former Gas House and MGP process area located in the Lowland portion of the site. Free DNAPL accumulates in monitoring well HHMW-10 and the high concentrations that were detected in the sample may be attributed to residual NAPL in the groundwater sample. With the exception of well HHMW-10, monitoring wells sampled in July 2003 in the shallow zone generally exhibited non-detect to low levels of BTEX and PAHs.

The analytical results of groundwater samples collected from monitoring wells in the Upland Area indicate non-detect to low concentrations of BTEX and PAHs within the on-site and off-site portions of the Upland Area. This indicates that upgradient groundwater in the shallow zone beneath this area has not been significantly impacted.

**Intermediate Groundwater**

BTEX compounds were not detected in intermediate groundwater in the Lowland Area. Concentrations of PAHs were non-detect to low, and Carcinogenic PAHs were not detected in samples collected from the Lowland Area intermediate monitoring wells. In addition, the groundwater results indicated non-detect to low concentrations of BTEX and PAHs within the Upland Area, which indicates that groundwater within the intermediate zone beneath this area has not been significantly impacted.

**Deep Groundwater**

The deep groundwater results indicated non-detect to low concentrations of BTEX and PAHs, which indicates that groundwater within the deep zone beneath the site has not been significantly impacted.

### *3.2.3 Soil Vapor*

Concentrations of total BTEX in soil vapor ranged from non-detect to 30.3 parts per billion volume (ppbv). Naphthalene was not detected in any of the 14-soil vapor samples collected at and in the vicinity of the site. In addition, soil vapor samples collected from the Office Building Property to the south of the site exhibited low total BTEX concentrations ranging from 6.53 ppbv in sample HHSV-11 to 26.7 ppbv in sample HHSV-08. These low level concentrations indicate minimal, if any, impact.

## 3.3 Qualitative Human Exposure Assessment Summary

A Qualitative Human Exposure Assessment (QHEA) is included in the April 2004 RI Report. The QHEA indicated that distinct human populations, both on-site and in the vicinity of the site, could be exposed to site-related chemical compounds. Because the current and future use of the site is a secured LIPA electric substation, the possibility of exposure to site-related chemical compounds on-site is limited to persons authorized to work on the site and unlikely trespassers. The possibility of exposure off-site currently is very unlikely, as is discussed below. Again, as the future use is unlikely to change from the current use, the possibility of exposure on-site exists only for authorized persons and trespassers.

Under current and future site use conditions, potential on-site receptors include possible trespassers and KeySpan workers. Potential current off-site receptors include commercial workers, adult and child visitors to commercial establishments, off-site recreators, and nearby off-site adult and child residents. Potential future off-site receptors include construction workers and nearby off-site utility workers.

The following existing or potential exposure pathways are significant and may require remedial action for their elimination or mitigation:

- **Ingestion, dermal contact, and particulate inhalation of surface soil to trespassers or KeySpan workers.** Unlikely, due to well-built security fencing and 6 to 8 inch base of crushed stone across a significant portion of the Lowland Area. Could be managed through institutional and/or engineering controls.

- **Inhalation, dermal contact, and particulate/vapor inhalation of subsurface soil or groundwater from future on-site and off-site construction, redevelopment, or nearby utility work.** Potential future off-site receptors include construction workers and nearby off-site utility workers.

- **Ingestion, dermal contact, and vapor inhalation of groundwater used for domestic purposes.** The results of the well and basement survey indicate that groundwater is not a current potential source of exposure to off-site populations. The sampling at the single private well identified in the survey did not show MGP-related impacts. The well is located approximately 300 feet northeast of the site.

- **Vapor inhalation exposure from indoor air in current or future structures on or off the property.** On-site and off-site soil vapor sampling results exhibited low concentrations of BTEX and other volatile organic compounds. Although a complete exposure pathway could exist, low concentrations of BTEX detected in soil vapor samples are unlikely to contribute significantly to indoor air concentrations because they are below background concentrations normally found in New York homes (NYSDOH 2005).

Refer to the exposure assessment in the April 2004 RI Report for a more detailed discussion of the potentially exposed populations.

## 3.4 Fish and Wildlife Resources Impact Analysis

The RI and Fish and Wildlife Resources Impact Analysis (FWRIA) have indicated that there are pathways through which wildlife could be exposed to potentially hazardous materials related to former MGP activities. However, because of the level of urbanization in the community and the transient nature of wildlife present, remedial activities specifically directed at wildlife exposure are not required.

## 3.5 Summary of Impacted Media and Contaminants of Concern

Based on the findings of the remedial investigations and exposure assessments, the impacted media requiring remedial action are subsurface soil, NAPL source material, and groundwater. Contaminants of concern are BTEX and PAHs. Potential human exposure to contaminants present in these media at the site requires mitigation via remedial action. There are no potential ecological exposures of significance. The potential exposure to groundwater is only anticipated to occur through infrequent ground intrusive construction-related activities. The information collected in the RI indicates that potential exposures to site-related chemical compounds via inhalation of indoor air in the vicinity of the site are minimal. A very small number of properties have the potential for indoor air exposure. The owners of these properties were contacted regarding this information.

## 3.6 Conceptual Model Development and Discussion

Using the RI findings, a quantitative conceptual model describing the distribution of MGP-related impacts in the subsurface was developed for the site.

### *3.6.1 Model Development*

The site was divided into three distinct geographic areas, the Upland Area, the Lowland Area and the Downgradient Area (west of New York Avenue, adjacent to Huntington Harbor). The subsurface soils under each of these geographic areas were further divided into two discrete depth intervals based on the depth to groundwater, the Unsaturated Zone, and the Saturated Zone. The physical observations from the borings in each of the zones and intervals were used to define the lateral extent of impacts and estimate the potential volume of soil impacted. Within each zone, the observed impacts and laboratory analytical results were used to define areas and depth intervals where remedial actions may be warranted. The analytical results from the soil samples collected in these areas were averaged. In certain intervals, soil samples were not collected. In such intervals, the average analytical results were assumed to be similar to that of adjoining intervals with similar physical impacts. Using the average analytical results and estimated soil volume, the distribution of source material in the soil was calculated. Figure 3-3 illustrates the conceptual model, depicting the distribution of MGP-related impacts.

### 3.6.2 Model Interpretation

The model presents the RI findings in the context of the geographic and stratigraphic setting of the site. This context is of critical importance in developing and evaluating remedial alternatives. From a geographic perspective, site access and existing infrastructure considerations can profoundly affect the implementability of a remedial approach. From a stratigraphic perspective, it becomes more technically difficult and costly to address contaminants at increasing depths. A clear understanding of the relative distribution of contaminant mass within the site provides insight when evaluating the relative merits, costs, and risk-reduction benefits of remedial technologies and alternatives. This insight is also critical in evaluating the need for additional institutional action necessary to support the remediation, such as access to or control of property.

The relative distribution of contaminant mass is shown on Figure 3-3, and summarized as follows:

| Geographic Area - Depth Zone | Portion of Total Site Contaminant Mass |
|---|---|
| Upland Area – Unsaturated Zone | 67 % |
| Upland Area – Saturated Zone | < 1 % |
| Lowland Area – Unsaturated Zone | 14 % |
| Lowland Area – Saturated Zone | 14 % |
| Downgradient Area – Unsaturated Zone including water table smear zone, up to 6 feet deep | 2 % |
| Downgradient Area – Saturated Zone | 2 % |
| Office Building Property – Unsaturated Zone | < 1 % |
| Office Building Property – Saturated Zone | < 1 % |

This distribution of contaminant mass is consistent with the model of contaminant migration presented in the April 2004 Final RI report. The majority of contaminated material was observed on top of the fine-grained unit that is present below the site. This layer is located 8 to 12 feet below grade surface in the Lowland Area and between 50 to 60 feet below grade surface in the Upland Area. Relatively little source material is present at depth at the site. Of the estimated 67% of contaminant mass in the Upland Area Unsaturated Zone, a majority is located above a depth of 25 feet. In addition, the majority of the contaminant mass located in the Lowland Area Saturated Zone is no deeper than 12 to 14 feet below grade surface. Based on the fate and transport mechanisms established, it is likely that denser source material migrated vertically under the influence of gravity until it reached the less-permeable fine-grained unit. The fine-grained layer is relatively flat, accounting for the minimal lateral migration of the impacted materials from the source areas.

Using this model, the three source areas identified during in the April 2004 RI report have been refined into five DNAPL source areas based on depths to impacted materials and proposed remedial approaches. The five source areas are:

- Tar Deposit Area 3 in the Upland Area
- Tar Deposit Area 5 in the Upland Area
- Southeast Corner of the Lowland Area (including a portion of the LIPA substation)
- Southwest Corner of the Lowland Area
- Northwest Corner of the Lowland Area

The model highlights the following site conditions that will significantly affect the consideration and selection of remedial alternatives and technologies:

- Approximately 81% of the estimated contaminant mass is located above the water table within the Upland and Lowland Areas.
- Approximately 4% of the contaminant mass is located between the water table and approximately 13 feet bgs in the Southwest and Northwest Corners of the Lowland Area.
- Approximately 10% of the estimated contaminant mass is located at depths of approximately 10 to 25 feet under the active LIPA substation and associated utility corridor, an important part of the local and regional utility infrastructure.
- Relatively little of the contaminant mass is located below the fine-grained unit.
- Less than 5% of the estimated contaminant mass is located at within the Downgradient Area.
- Less than 1% of the estimated contaminant mass is located on the Office Building property. However, the exact extent of the impacts on the Office Building property are uncertain and will be verified prior to design.
- Access and issues associated with remedial action logistics and infrastructure needs will be addressed during the Remedial Design phase.

# 4. Remedial Goals and Remedial Action Objectives

## 4.1 Remedial Goals

The NYSDEC's Draft DER-10 Technical Guidance for Site Investigation and Remediation – Section 4.1(b) puts forth the following remedial goals for the voluntary cleanup program:

- A remedy shall be protective of public health and the environment, given the intended use of the site.
- Where an identifiable source of contamination exists at a site, it should be removed or mitigated, to the extent feasible, regardless of presumed risk or intended use of the site.

These two goals are the site Remedial Goals that will be applied to the site as the site-specific Standards, Criteria, and Guidance (SCGs), in accordance with DER-10 Section 4.1 Paragraph e2, 6 NYCRR § 375-1.10(c)(1), and TAGM 4030, for determining success of the final remedy.

## 4.2 Remedial Action Objectives

RAOs are medium-specific (e.g. soil, groundwater, air) or area-specific objectives for the protection of public health and the environment. The RAOs for the site support and are consistent with the site Remedial Goals presented above. Based on the findings of the RI, QHEA, and FWRIA, the following RAOs have been developed for the site:

**GROUNDWATER**

- Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.
- Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.
- Remove, to the extent practicable, the source of groundwater contamination.

**SOIL**

- Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.
- Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.

## SOIL VAPOR

- Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.

# 5. General Response Actions

## 5.1 General Response Actions

General response actions describe those actions that will satisfy the RAOs. General response actions are medium-specific. The general response actions are evaluated in the context of the volume or areas of media to which they might be applied. The general response actions described below include No Action, Excavation, Treatment, Containment, and Institutional Controls.

### *5.1.1 No Action*

In many feasibility studies, the no action response is typically identified and carried through the evaluation process as a point of comparison for other actions. As this RAP is directed towards selection of appropriate remedial responses that are more likely to achieve the stated RAOs, no further consideration is given to the no-action response.

### *5.1.2 Excavation*

Excavation is applicable to the soil and contaminant source areas at the site. Excavation of impacted soils, structures, and contaminant source areas in the unsaturated zone would be accomplished using conventional construction equipment and methods. In the active substation area, excavation methods are restricted to hand digging and vacuum soil excavation. Excavation in the saturated zone would require significant earth support and dewatering systems. Given the high hydraulic conductivity, shallow water table in the Lowland Area, the vertical extent of contamination, and the location of the active LIPA substation, excavation of all impacted soils and NAPL is infeasible. However, an estimate for the removal of free NAPL is developed to provide an order of magnitude value for the restoration of the site to a practicable condition resembling pre-release conditions. Soil or source materials removed by excavation would need to be further addressed by disposal or treatment.

### *5.1.3 Treatment*

Treatment is applicable to the soil, groundwater, and source material. Treatment alters the physical and/or chemical nature of the media to cause a change in contaminant mass, mobility, or toxicity. Treatment can be accomplished in situ or ex situ. Examples of in situ treatment include chemical oxidation, stabilization, dynamic underground stripping, soil flushing, treatment trenches/barriers, and injection well treatment zones. Ex situ treatment technologies include thermal desorption and incineration.

### *5.1.4 Containment*

Containment is applicable to the soil, groundwater, and source material. Containment actions involve isolation of contaminants by constructing and maintaining physical barriers that prevent potential continued migration of contamination into groundwater. These include surface caps, sheet pile walls, jet-grout walls, soil-bentonite cutoff walls, active/passive NAPL recovery, and active hydraulic control.

### *5.1.5 Engineering Controls*

Engineering controls are applicable to the soil and source material at the site. These actions include construction and maintenance of physical barriers to prevent potential direct exposures to contamination. These include engineered impermeable surface caps, security fencing, or visual excavation barriers.

### *5.1.6 Institutional Controls*

Institutional controls are applicable to the soil, groundwater, and soil vapor. Institutional controls refer to actions that control the type and nature of potential exposures through legal or administrative procedures or programs. These include access control measures, deed restrictions, well restrictions, and established protocols for managing future excavations including a Health and Safety Plan for on-site work.

### *5.1.7 Monitoring*

Monitoring actions are applicable to soil, source material, groundwater, and soil vapor. Monitoring includes ongoing measurement of contaminant levels as a means of ensuring that potential, but currently incomplete, exposure pathways are not completed. This can include groundwater monitoring, soil vapor sampling, monitored natural attenuation, and NAPL gauging. Monitoring is often used as a means to confirm that natural attenuation of soil and groundwater constituents are occurring or to confirm the success of other remedial actions.

# 6. Identification and Screening of Technologies

## 6.1 Introduction

In this step, the universe of potentially applicable technologies is reduced by evaluating the options with respect to technical implementability. During this step, technologies are eliminated from further consideration on the basis of technical implementability. This is accomplished by using information developed in the remedial investigations on contaminant types and distribution and physical site characteristics to screen out technologies that cannot be effectively implemented at the site.

## 6.2 Technology Identification and Screening

Technology identification and screening involves the following steps:

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

### *6.2.1 Technical Issues*

The primary technical issues affecting the implementability and effectiveness of potential technologies at the site are:

- The physical and chemical nature of the source material and NAPL
- The shallow depth to groundwater in the Lowland Area and highly permeable soil
- The deep vertical extent of contamination in the Upland Area
- The proximity of critical infrastructure (roads, railroad, utilities, LIPA substation)
- Structures and site access limitations
- Excavation method limitations in the active substation
- Potential future uses of the property

MGP-derived NAPLs are complex chemical mixtures. The NAPLs present in the subsurface are not uniform in either their physical or chemical characteristics, likely having origins from different processes over a long time span. The weathering and mixing with soil and groundwater that has occurred over time has made these NAPLs even less of a pure, consistent product. This complexity, and the predominance of relatively “heavy” organics within the NAPL, means that many remedial treatment technologies that have been proven for less complex, or "lighter" contaminants will not be effective on the NAPLs at the site.

The hydrogeologic characteristics of the site pose several challenging issues. The relatively shallow depth to groundwater means that any significant excavation beyond 5 to 10 feet in the Lowland Area will require construction dewatering and earth support systems. However, the substation infrastructure and grounding net located approximately 2 feet below grade prevents the installation of typical earth support structures or the use of standard construction excavation/trench boxes. Dewatering is most readily implementable when a significant stratum of relatively low permeability soil is within a reasonable depth from the surface. However, the dewatering issues will be a significant component in any remedy involving a large excavation area below the water table. Any dewatering will also involve treating the effluent. Significant volumes of water would need to be treated that could exhaust local disposal options.

The remedial investigations have shown that contamination extends vertically to approximately 68 feet below grade surface in the Upland Area. As stated in the April 2004 RI Report, the contamination present at such depths appears to be limited to discontinuous thin (less than 1-foot thick) bands of NAPL impacted soils at the interface of the fine grained unit. Access to these deeper source areas may prove difficult even if the selected remedy is an in situ treatment.

An active LIPA substation is located on the Lowland Area of the site. New York Avenue and Anchorage Lane are busy primary routes adjacent to the harbor. Gas, electric, water, telephone, sanitary sewer, and storm sewer utility systems traverse or abut the Lowland Area. The desire to prevent or minimize disruption to these critical components of the local infrastructure affects the consideration and potential effectiveness of the actions that could potentially be used to remediate the site. Maintenance of uninterrupted electric power to the residences in the vicinity of the site will be critical to community acceptance of any remedy selected.

Impacted materials are located beneath properties that are not currently owned by KeySpan or LIPA (Office Building Property, New York Avenue). All remedial alternatives will require some degree of short-term and/or long-term access to these properties. The degree of access will vary among the alternatives and will be addressed during the Remedial Design phase.

While no specific future use for the site is planned at this time other than the current use, evaluation of remedial technologies and alternatives should consider the potential ramifications on future use. Given that the site cannot be restored to pre-release conditions, it is assumed that some type of institutional controls will be put in place to control future potential exposure to contaminants. Institutional controls will include a Soil Management Plan to address any future invasive work in areas that are currently inaccessible within the substation footprint. These, together with potential removal, treatment, and containment actions, will allow flexibility in redevelopment of the site while ensuring continued protection of human health and the environment.

### *6.2.2 Technology Identification*

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

### *6.2.3 Technology Screening*

Table 6-1 also presents a screening evaluation of the technologies according to the following criteria: effectiveness, implementability, and cost. As shown in Table 6-1, technologies that are not considered implementable or effective will not be retained for further analysis.

## 6.3 Summary of Retained Technologies

The technologies retained for further analysis are:

- Excavation above the Water Table and in Fine-Grained Unit Only
- Excavation to practicable extents
- Off-site low temperature thermal desorption
- Engineered cap and cover system
- Engineered treatment barrier/zone
- DNAPL tar recovery
- Hydraulic control
- Containment barriers
- In situ stabilization
- Institutional controls

In the next section, these technologies are combined into comprehensive site-wide alternatives.

# 7. Development and Analysis of Alternatives

## 7.1 Introduction

This section assembles retained remedial actions and technologies into a list of site-wide remedial alternatives. These alternatives are developed below and defined with respect to the criteria set forth in Section 4.2(a)5(i) of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (Draft DER-10) and the site conceptual model. These alternatives are then evaluated against the seven criteria from Section 4.1 (d) of the NYSDEC Draft DER-10 and a comparative analysis of the alternatives is presented.

Each alternative was developed to address RAOs and reduce the resultant flux of dissolved contaminants from the Lowland Area to the Downgradient Area. To the extent practicable, the remedial alternatives remove, contain, or destroy source material in the subsurface.

Implementation of any of the alternatives will require significant access to the affected properties. Some alternatives will also require temporary disruption to public rights-of-way. These disruptions are driven solely by remedial implementation logistics and not by potential human exposure to contaminants.

The LIPA substation is a critical piece of the local utility infrastructure. As noted in the RI, no change to this land use is anticipated in the future. As such, there will be no change to the current exposure scenarios at the LIPA substation where ingestion/dermal contact was unlikely and could be effectively managed through institutional and/or engineering controls. Therefore, all alternatives will include institutional controls on the LIPA property to limit subsurface disturbance and, when disturbance is necessary, a Soil Management Plan will be put in place to control potential exposure to contaminants. Based on the construction method constraints identified for excavation within the substation footprint and the planned continued use as a substation, direct excavation of soils within the substation footprint is not recommended in any of the remedial alternatives. The Soil Management Plan will address the impacts below the substation by indicating the means and methods required to remove, treat, and dispose of impacted soils.

Similarly, groundwater in the downgradient area is not currently used for domestic drinking water and direct contact/inhalation scenarios are expected only for construction workers and nearby off-site utility workers. Therefore, in the Downgradient Area all alternatives will include institutional controls to prevent use of groundwater in the area impacted by MGP-related contaminants. These controls will include groundwater monitoring for potential MGP-related contaminants in the Downgradient Area and on the office building property south of the site.

## 7.2 Description of Alternatives

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

Some of the alternatives specify the use of an engineered treatment barrier/zone. KeySpan is currently evaluating several technologies, including ozone injection and oxygen injection, at other KeySpan sites. Results of these evaluations may be applicable to this site and may be used to design site-specific tests of potentially applicable technologies.

For the alternatives that specify NAPL recovery where practicable, NAPL will be collected via passive extraction wells. The locations of the extraction wells will be determined during the Remedial Design phase after evaluating data from the ongoing quarterly monitoring program are evaluated. The collection system will be passive in nature, collecting on a periodic basis only free NAPL which readily enters an extraction well. Due to the proximity of Huntington Harbor, no mobility enhancers would be injected into the subsurface to increase the rate and quantity of extraction.

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

The details of the five retained alternatives follow.

### *7.2.1 Alternative 1: Containment and Engineered Cap*

Alternative 1 will include the following actions for each site area:

In the Upland Area, two containment cells will be constructed around the two DNAPL tar source areas (Tar Deposit Area 5 to ~60 feet bgs and Tar Deposit Area 3 to 55 feet bgs). The containment cells will be keyed into the fine-grained layer over an aggregate area of 1,300 square feet and contain approximately 41% of the total mass of source material at the site. Spot excavations in the unsaturated zone will occur in areas where remnant MGP structures in the unsaturated zone may interfere with the installation of the containment cell walls. Soil from these excavations will be transported offsite for thermal desorption. A surface cap will be constructed over each of the containment cells to limit/prevent rainwater infiltration to the cell. Rainwater infiltration is the major pathway for continued groundwater contamination in each of these areas since the impacted material is primarily located above the water table. Containment and capping will reduce rainwater infiltration through the impacted zone and reduce the flux of contaminants to groundwater. A long-term monitoring, operation, and maintenance plan for the containment systems will be instituted to demonstrate continued effectiveness of the remedy.

In the Lowland Area, a visual excavation barrier will be installed in the unsaturated zone across the areas of MGP tar saturation. The top 2 feet of material will be excavated in each area and a chemically resistant permeable High Density Polyethylene (HDPE) visual excavation barrier will be installed. The surface material will then be replaced with clean imported backfill from a NYSDOT-approved burrow source and the surface conditions restored. Confirmation samples will be collected from the borrow source prior to use. A visual excavation barrier was already installed at 4 feet below grade over a portion of the substation footprint during the installation of the clean utility corridor in August 2005. The clean surface material and the visual excavation barrier will be installed to prevent exposure through direct contact to an approximately 5,400 square-foot area, covering approximately 24% of the total mass of source material at the site.

On the Office Building Property, a visual excavation barrier (as described above) will be installed in the unsaturated zone across the areas of MGP tar saturation. This visual excavation barrier will be installed to prevent exposure through direct contact to an approximately 2,200-square-foot area, covering less than 1% of the total mass of source material at the site.

In the Downgradient Area and on the office building property south of the site, groundwater will continue to be monitored for MGP-related contaminants.

Site-wide actions will include the installation of passive DNAPL recovery wells, where feasible, to recover DNAPL and reduce the mass of contaminants in the subsurface. Site-wide groundwater monitoring will continue to assess potential effects from MGP-related contaminants remaining in the subsurface. Finally, institutional controls will be implemented to prevent use of groundwater in the area impacted by MGP-related contaminants and to manage future subsurface disturbance and resultant potential exposures.

With respect to the guidance, the alternative is described as follows:

- ***Size and Configuration.*** Figure 7-1 illustrates the conceptual plans of this alternative. Portions of the site areas will be disturbed to some degree during installation the containment cells, surface caps, and visual excavation barriers. The two containment cells will isolate approximately 2,700 cubic yards of impacted soils. The visual excavation barrier in the Lowland Area and the Office Building property will prevent direct exposure to an approximately 7,600 square foot area. A passive DNAPL recovery program will be used to remove free DNAPL where present.

- ***Time for Remediation.*** The estimated time to complete all construction-related remediation activities, including installation of the containment cells and surface caps, is approximately 5 months. Maintenance of institutional controls will continue indefinitely.

- ***Spatial Requirements.*** The alternative will require substantial room for equipment and material storage, access, logistics, and operation. The site can accommodate these needs, but careful staging and sequencing of the work will be required.

- Ongoing access to properties in the Downgradient Area will be required to monitor progress of remediation.

- Access to adjacent properties will be required during phases of excavation activities adjacent to or on those properties (i.e., Post Office Property, Office Building Property). Access agreements will be required between the owners of these parcels and KeySpan.

- ***Options for Disposal.*** Options for disposal of residual materials are readily available.

- ***Permit Requirements.*** No significant technical permit requirements are anticipated that would limit the effectiveness or implementability of this alternative. Any permits determined necessary after further development of this alternative will be addressed under the voluntary consent order process, and all necessary details will be provided in the remedial work plan.

- ***Limitations.*** Containment wall continuity and integrity at the depths targeted are difficult to control. Chemical compatibility and permanence of the containment cell and surface caps must be addressed in the design phase.

- ***Ecological Impacts.*** This alternative is not anticipated to have any significant beneficial or adverse impacts on fish and wildlife resources.

### 7.2.2 Alternative 2: Deep Source Area Excavation

Alternative 2 will include the excavation of DNAPL tar source areas to the horizontal limits of tar saturation. Specifically, the following actions will be taken for each site area:

In the Upland Area, this alternative will include the excavation of the two DNAPL tar source areas including any structures that may remain in place with off-site thermal treatment of soils. These excavations will extend to the horizontal limits of tar saturation at the fine-grained unit (Tar Deposit Area 5 to ~55 feet bgs, Tar Deposit Area 3 to ~50 feet bgs). Excavations in these two areas will remove approximately 2,200 cubic yards of soil and approximately 41 percent of the total contaminant mass at the site. Excavated areas will be backfilled to existing grades with clean soil materials imported from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use.

In the Lowland Area, this alternative will include the excavation of the two DNAPL source areas including any structures that may remain in place with off-site thermal treatment of soils. Excavations will extend to the horizontal limits of tar saturation at the fine-grained unit or below (Southwest Corner to ~12 feet bgs and Northwest Corner to ~13 feet bgs). Excavations in these two areas will remove approximately 1,100 cubic yards of soil and approximately 4 percent of the total contaminant mass at the site. Excavated areas will be backfilled to existing grades with clean soil materials imported from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use.

On the Office Building Property, this alternative will include excavation of the tar-saturated material in the parking area as part of the Lowland Area Southeast Corner excavation to a depth of approximately 12 feet bgs. Excavation in this area will remove approximately 1,000 cubic yards of soil and less than 1 percent of the total contaminant mass at the site. Soils will be transported to an off-site thermal treatment facility, and the excavation will be backfilled to existing grade with clean imported backfill from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use. The existing asphalt surface and sub grade will be restored to pre-excavation conditions.

Site-wide actions will include the installation of passive DNAPL recovery wells, where feasible, to recover DNAPL and further reduce the mass of contaminants in the subsurface. Site-wide groundwater monitoring will continue to assess potential effects from MGP-related contaminants remaining in the subsurface. Finally, institutional controls will be implemented to prevent use of groundwater in the area impacted by MGP-related contaminants and to manage future subsurface disturbance and resultant potential exposures.

With respect to the guidance, the alternative is described as follows:

- ***Size and Configuration.*** Figure 7-2 illustrates the conceptual plans of this alternative. Excavation of the impacted saturated zone will occur over approximately 5,600 square feet of the site.

- ***Time for Remediation.*** The estimated time to complete all construction-related remediation activities is eight months. Maintenance of institutional controls will continue indefinitely.

- ***Spatial Requirements.*** The alternative will require substantial room for equipment and material storage, access, logistics, and operation. The site can accommodate these needs, but careful staging and sequencing of the work will be required.

  Ongoing access to properties in the Downgradient Area will be required to monitor progress of remediation.

  It will be necessary to control traffic along New York Avenue during phases of the project when excavations occur adjacent to the street.

  Access to adjacent properties will be required during phases of excavation activities adjacent to or on those properties (i.e., Post Office Property, Office Building Property). Access agreements will be required between the owners of these parcels and KeySpan.

- ***Options for Disposal.*** Options for disposal of residual materials are readily available.

- ***Permit Requirements.*** Substantive technical permit requirements will be associated with establishing allowable flow rates and discharge limits for the temporary dewatering system. Dewatering will need to be sustained around the clock for the period of time that excavations are occurring in the saturated zone of the Lowland Area. Local permits will be required for road closures for implementing remedial activities. Any permits determined necessary after further development of this alternative will be addressed under the voluntary consent order process, and all necessary details will be provided in the remedial work plan.

- ***Limitations.*** Further analysis of dewatering and earth support requirements may identify technical or cost barriers to feasibility. These may include difficulty excavating to 50+ feet bgs in the Upland Area with the steep slope and limited access to this area for construction equipment.

- ***Ecological Impacts.*** This alternative is not anticipated to have any significant beneficial or adverse impacts on fish and wildlife resources.

### 7.2.3 Alternative 3: Shallow Source Area Excavation/Engineering Controls/Treatment Zone

Alternative 3 will include the excavation of shallow impacted soils in the DNAPL tar source areas and groundwater treatment. Specifically, the following actions will be taken for each site area:

In the Upland Area, this alternative will include excavation of the shallow unsaturated soils in the two DNAPL tar source areas including any structures that may remain in place with off-site thermal treatment of soils. Excavations will extend to the horizontal limits of shallow tar saturation (Tar Deposit Area 5 to ~22 feet bgs, Tar Deposit Area 3 to ~13 feet bgs). Surface soils that exceed 500 parts per million total PAHs between the two excavation areas (Tar Deposit Area 5 and Tar Deposit Area 3) will be removed and replaced to the extent practicable during excavation activities. An engineered impermeable cap will be installed during backfilling to prevent rainwater infiltration through the deeper source material in the vadose zone, preventing further flux of contaminants to groundwater. Excavations in the two areas will remove approximately 900 cubic yards of soil and approximately 38 percent of the total contaminant mass at the site. The impermeable cap will contain and prevent exposure to an additional 1,800 cubic yards of soil and approximately 3 percent of the total contaminant mass at the site. Excavated areas will be backfilled to existing grades with clean soil materials imported from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use.

In the Lowland Area, this alternative will include the excavation of the two DNAPL source areas including any structures that may remain in place with off-site thermal treatment of soils. Excavations will extend to the horizontal limits of tar saturation at the fine-grained unit or below (Southwest Corner to ~12 feet bgs and Northwest Corner to ~13 feet bgs). Excavations in this alternative will exclude impacted soils located below the active LIPA substation footprint or excavations that will undermine the existing substation facilities and equipment. Excavations in the two areas will remove approximately 1,100 cubic yards of soil and approximately 4 percent of the total contaminant mass at the site. Excavated areas will be backfilled to existing grades with clean soil materials imported from a NYSDOT-approved burrow source. Confirmation samples will be collected from the borrow source prior to use.

On the Office Building Property, this alternative will include excavation of the tar-saturated material in the parking area to a depth of approximately 12 feet bgs. Excavations in this area will remove approximately 1,000 cubic yards of soil. Because this property contains less than 1 percent of the total contaminant mass of the site, reduction of that mass associated with removal from this property will be nominal, but it will significantly reduce the potential for further exposures on the property. Soils will be transported to an off-site thermal treatment facility and the excavation will be backfilled to existing grade with clean imported backfill from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use. Existing asphalt surface and sub grade will be restored to pre-excavation conditions.

In the Downgradient Area and between the Upland and Lowland Area, an engineered treatment barrier/zone will be installed to reduce the concentrations of MGP-related contaminants in site groundwater and to prevent the potential migration of groundwater contaminants to Huntington Harbor. This treatment zone will reduce the dissolved phase flux into the Downgradient Area from impacted material that will remain in the subsurface. Groundwater treatment will be targeted at dissolved phase impacts at depths ranging from the water table to 20 feet bgs. A long-term monitoring, operation, and maintenance plan for the treatment system will be instituted as part of the remedy.

Site-wide actions will include the installation of passive DNAPL recovery wells, where feasible, to recover DNAPL and further reduce the mass of contaminants in the subsurface. Site-wide groundwater monitoring will continue to assess potential effects from MGP-related contaminants remaining in the subsurface. Finally, institutional controls will be implemented to prevent use of groundwater in the area impacted by MGP-related contaminants and to manage future subsurface disturbance and resultant potential exposures.

With respect to the guidance, the alternative is described as follows:

- ***Size and Configuration.*** Figure 7-3 illustrates the conceptual plans of this alternative. No excavations will be conducted in the active LIPA substation or the utility corridor between the substation and New York Avenue. Excavation of the impacted saturated zone will occur in only approximately 2,500 square feet of the site.

- ***Time for Remediation.*** The estimated time to complete all construction-related remediation activities is seven months. Maintenance and monitoring of the containment/treatment system and maintenance of the institutional controls will continue indefinitely.

- ***Spatial Requirements.*** The alternative will require substantial room for equipment and material storage, access, logistics, and operation. The site can accommodate these needs, but careful staging and sequencing of the work will be required as well access to adjacent properties for vehicle staging. Access to properties in the Downgradient Area will be required for installation, operation, and maintenance of the groundwater treatment zone and to monitor progress of remediation.

  It will be necessary to control traffic to accommodate construction equipment along New York Avenue during phases of the project when excavations occur adjacent to the street or during the installation of the treatment zone in the Downgradient Area.

  Access to adjacent properties will be required during phases of excavation activities adjacent to or on those properties (i.e., Post Office Property, Office Building Property). Access agreements will be required between the owners of these parcels and KeySpan.

- ***Options for Disposal.*** Options for disposal of residual materials are readily available.

- ***Permit Requirements.*** Substantive technical permit requirements will be associated with establishing allowable flow rates and discharge limits for the temporary dewatering system. Dewatering will need to be sustained around the clock for the period of time that excavations are occurring in the saturated zone of the Lowland Area. Local permits will be required for road closures for implementing remedial activities.

- ***Limitations.*** The effectiveness of treatment zone at the field scale would need to be demonstrated by a pilot study at the site. Further analysis of earth support requirements may identify technical or cost barriers to feasibility.

  Further analysis of dewatering and earth support requirements may identify technical or cost barriers to feasibility. These may include difficulty excavating in the Upland Area with the steep slope and limited access to this area for construction equipment.

- ***Ecological Impacts.*** This alternative is not anticipated to have any significant beneficial or adverse impacts on fish and wildlife resources.

### *7.2.4 Alternative 4: Tar Saturated Soil Excavation/Treatment Zone*

Alternative 4 will include the excavation of all DNAPL tar saturated soils and the possible installation of an engineered treatment barrier/zone to address any persistent residual impacted groundwater. Specifically, the following actions will be taken for each site area:

In the Upland Area, this alternative will include the excavation of all DNAPL tar saturated soils including any structures that may remain in place with off-site thermal treatment of soils. These excavations will extend to the horizontal limits of tar saturation at the fine-grained unit and below ranging from approximately 40 feet bgs on the western boundary and approximately 70 feet bgs along the eastern boundary. If excavation depths of 40 to 70 feet can be achieved in the Upland Area, this alternative will remove approximately 9,000 cubic yards of soil and approximately 45 percent of the total contaminant mass at the site. However, site access constraints and construction safety setback requirements will make it very unlikely that all material could be removed. Excavated areas will be backfilled to existing grades with clean soil materials imported from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use.

In the Lowland Area, this alternative will include the excavation of DNAPL tar saturated soils including any structures that may remain in place with off-site thermal treatment of soils. These excavations will extend to the horizontal limits of tar saturation at the fine-grained unit and below ranging from approximately 12 to 13 feet bgs along New York Avenue. The excavations in the Lowland Area will remove approximately 1,400 cubic yards of soil and approximately 41 percent of the total contaminant mass at the site. Excavated areas will be backfilled to existing grades with clean soil materials imported from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use.

On the Office Building Property, this alternative will include excavation of the tar-saturated material in the parking area to a depth of approximately 12 feet bgs. Excavations in this area will remove approximately 1,000 cubic yards of soil and less than 1 percent of the total contaminant mass at the site. Soils will be transported to an off-site thermal treatment facility and the excavation will be backfilled to existing grade with clean imported backfill from a NYSDOT approved burrow source. Confirmation samples will be collected from the borrow source prior to use. Existing asphalt surface and sub grade will be restored to pre-excavation conditions.

Site-wide actions will include the installation of passive DNAPL recovery wells, where feasible, to recover DNAPL and further reduce the mass of contaminants in the subsurface. Site-wide groundwater monitoring will continue to assess potential effects from MGP-related contaminants remaining in the subsurface. If post excavation groundwater monitoring results depict a persistent flux to groundwater from the remaining source material that could not be removed due to construction constraints, a treatment zone will be installed. Target depths for groundwater treatment under this alternative will be determined based on the results of post excavation groundwater monitoring. A long-term monitoring, operation, and maintenance plan for treatment system will be instituted. Finally, institutional controls will be implemented to prevent use of groundwater in the area impacted by MGP-related contaminants and to manage future subsurface disturbance and resultant potential exposures.

With respect to the guidance, the alternative is described as follows.

- ***Size and Configuration.*** Figure 7-4 illustrates the conceptual plans of this alternative. Excavation of the source material will occur over approximately 10,100 square feet of the site.

- ***Time for remediation.*** The estimated time to complete all construction-related remediation activities is 1.3 years. Maintenance and monitoring of the treatment system (if necessary) and maintenance of the institutional controls will continue indefinitely.

- ***Spatial Requirements.*** The alternative will require substantial room for equipment and material storage, access, logistics, and operation. The site can accommodate these needs, but careful staging and sequencing of the work will be required.

  Ongoing access to properties in the Downgradient Area will be required to monitor progress of remediation.

  It will be necessary to control traffic to accommodate construction equipment along New York Avenue during phases of the project when excavations occur adjacent to the street.

  Access to adjacent properties will be required during phases of excavation activities adjacent to or on those properties (i.e., Post Office Property, Office Building Property). Access agreements will be required between the owners of these parcels and KeySpan.

  Further, when excavations or installation of the treatment barrier/zone occur adjacent to New York Avenue, it will likely be necessary to control traffic to accommodate construction equipment and control access to the areas adjacent to the remediation.

- ***Options for Disposal.*** Options for disposal of residual materials are readily available; however, the large volume of material to be treated may require shipment of soil over long distances, as closer facilities may not have the capacity to process all the soil in a reasonable amount of time. Dewatering operations will have similar logistical issues with regard to treatment and discharge of a large volume of effluent, and disposal of spent treatment media.

- ***Permit Requirements.*** Substantive technical permit requirements will be associated with establishing allowable flow rates and discharge limits for the temporary dewatering system. Dewatering will need to be sustained around the clock for the period of time that excavations are occurring in the saturated zone of the Lowland Area. Local permits will be required for road closures for implementing remedial activities. Any permits determined necessary after further development of this alternative will be addressed under the voluntary consent order process, and all necessary details will be provided in the remedial work plan.

- ***Limitations.*** Further analysis of earth support requirements may identify technical or cost barriers to feasibility. These may include difficulty excavating to 50+ feet bgs in the Upland Area with the steep slope and limited access to this area for construction equipment.

- ***Ecological Impacts.*** This alternative is not anticipated to have any significant beneficial or adverse impacts on fish and wildlife resources.

### *7.2.5 Alternative 5: Institutional Controls/Groundwater Monitoring*

Alternative 5 will include the implementation of institutional controls to manage future subsurface disturbance and resultant potential exposures to MGP-related contaminants. A long-term monitoring plan for groundwater will be instituted to monitor groundwater quality and to ensure that impacted groundwater from the site does not migrate into Huntington Harbor.

Under this alternative, there will not be any direct reduction of the total mass of source material through excavation or containment. Passive DNAPL recovery to reduce the mass of contaminants in the subsurface will be implemented where feasible.

To date, there have not been any identified MGP-related impacts in groundwater migrating to Huntington Harbor. The dissolved phase flux of source material to the Downgradient Area will be monitored to ensure that the no migration of MGP-related impacts in groundwater reach Huntington Harbor.

With respect to the guidance, the alternative is described as follows:

- ***Size and Configuration.*** There will be no disturbance to the site for this alternative.

- ***Time for Remediation.*** Maintenance of the institutional controls and groundwater monitoring will continue indefinitely.

- ***Spatial Requirements.*** The alternative will require minimal room for equipment and material storage, access, logistics, and operations for the long-term groundwater monitoring program. The site can accommodate easily these needs.

- ***Options for Disposal.*** Options for disposal of residual materials are readily available.

- ***Permit Requirements.*** There are no known permits required for this alternative. However, any permits determined necessary after further development of this alternative will be addressed under the voluntary consent order process, and all necessary details will be provided in the remedial work plan.

- ***Limitations.*** The effectiveness this remedy will be based on the ability to implement and enforce the appropriate institutional controls to prevent exposure to the impacted materials on the site.

- ***Ecological Impacts.*** This alternative is not anticipated to have any significant beneficial or adverse impacts on fish and wildlife resources.

## 7.3 Evaluation Criteria

TAGM # 4030 Section 5.1.1 requires a detailed analysis of remedial alternatives against seven criteria and specifies specific factors to consider for each criterion. The seven criteria, also described in the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, are:

### *7.3.1 Overall Protection of Public Health and the Environment*

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

### *7.3.2 Compliance with Standards, Criteria, and Guidance*

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

### *7.3.3 Long-term Effectiveness and Permanence*

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

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

### 7.3.4 Reduction of Toxicity, Mobility, or Volume with Treatment

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

### 7.3.5 Short-term Effectiveness

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

### 7.3.6 Implementability

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

### 7.3.7 Cost

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

## 7.4 Evaluation of Alternatives

### 7.4.1 Alternative 1: Containment and Cap

- ***Overall Protection of Public Health and the Environment.*** The alternative eliminates or effectively controls the potential exposure to contaminants in surface pathways by containing and preventing exposure to source material, and establishing institutional controls to manage future potential exposures.

  The alternative achieves each RAO as described below:

  - *Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.* Containment of the impacted material in the vadose zone of the Upland Area will reduce rainwater infiltration in this area and the resultant flux of contaminants to groundwater. Impacted material in the Lowland Area will remain as a source of contaminants to groundwater. However, affected groundwater at the site is not currently used for water supply and institutional controls will prevent its use in the future.

- *Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.* Under current site conditions, the concentrations of potentially MGP-related contaminants are low to non-detect along the bulkhead. The flux of contaminants into the Downgradient Area will be reduced by the containing the Upland contaminant source areas.

- *Remove, to the extent practicable, the source of groundwater contamination.* This alternative will not remove any contaminant mass; however, it will contain a significant mass of contaminants.

- *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Exposures to soil are prevented by capping shallow soils and establishing institutional controls to prevent disturbance to the surface caps/visual excavation barriers and exposures to contaminants remaining in deeper soils.

- *Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.* Significant source areas in the Upland Area will be contained reducing the migration of contaminants into groundwater. Some degree of downgradient migration will remain.

- *Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.* The surface cap will reduce the flux of contaminants in the vadose zone to structures on the site.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By containing the deep source material, and eliminating or controlling the exposure pathways, the alternative complies with the site-specific SCGs as described in Section 4.1.

- ***Long-Term Effectiveness and Permanence.*** The magnitude of the remaining risks is moderate. Maintenance of a cap/excavation barrier is straightforward and readily achievable. Long-term performance of the containment cell could be questionable and should not be considered a permanent solution, given the persistence of the contaminants of concern in the subsurface. The RAOs can continue to be met in the future by maintaining the cap, control system, and institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** The containment cell will reduce mobility, but will not reduce volume or toxicity. NAPL recovery will reduce contaminant mass.

- ***Short-Term Effectiveness.*** The alternative will require construction activity and some potential short-term impacts are expected. These potential impacts can be managed through careful planning and controls, such as suppression of odors, perimeter air monitoring, and implementation of health and safety and community awareness plans.

- ***Implementability.*** The alternative is technically implementable. The general technologies are available commercially from multiple sources. However, site-specific conditions in the Upland Area may require specialized equipment and may substantially affect the ability to implement the remedy.

- ***Cost.*** The estimated cost is $3.2 million and is summarized in Table 7-2 and Table A-1.

### *7.4.2 Alternative 2: Deep Source Area Excavation*

- ***Overall Protection of Public Health and the Environment.*** The alternative eliminates or effectively controls the potential exposure pathways by removing source material where feasible and establishing institutional controls to manage future potential exposures.

  The alternative achieves each RAO as described below:

  - *Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.* Affected groundwater at the site is not currently used for water supply and institutional controls will prevent its use in the future.

  - *Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.* The flux of contaminants into the Downgradient Area will be reduced to the extent practicable by the removing contaminant source areas in the Upland and Lowland Areas.

  - *Remove, to the extent practicable, the source of groundwater contamination.* Significant source areas will be removed, reducing the flux of contaminants into groundwater.

- *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Exposures to soil are prevented by removing shallow soils and establishing institutional controls to prevent exposures to contaminants remaining in deeper soils.

- *Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.* Significant source areas will be removed reducing the mass of contaminants driving potential DNAPL lateral migration. DNAPL recovery will remove additional mass of DNAPL and further reduce potential migration.

- *Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.* Removal of shallow soils in DNAPL source areas will reduce the mass of contaminants in the vadose zone.

▪ ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By removing the source material where feasible and eliminating or controlling the exposure pathways, the alternative complies with the site-specific SCGs as described in Section 4.1.

▪ ***Long-Term Effectiveness and Permanence.*** The magnitude of the remaining risks is minimal given the removal of source material, the depths at which contamination remains, and the institutional controls preventing future exposures. The proposed institutional controls are readily implementable and reliable. The RAOs can continue to be met in the future by maintaining the institutional controls.

▪ ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** Off-site thermal desorption of the excavated materials will reduce toxicity, mobility, and volume significantly. NAPL recovery, and to some extent dewatering, will also reduce contaminant mass.

▪ ***Short-Term Effectiveness.*** The alternative will require intensive construction activity and some potential short- to medium-term impacts are expected. These potential impacts can be managed through careful planning and controls, such as suppression of odors, perimeter air monitoring, and implementation of health and safety and community awareness plans.

▪ ***Implementability.*** The alternative is technically implementable. The technologies are available commercially from multiple sources. However, site-specific conditions in the Upland Area may require specialized equipment and may substantially affect the ability to implement the remedy.

- ***Cost.*** The estimated cost is $5.0 million and is summarized in Table 7-2 and Table A-2.

### 7.4.3 Alternative 3: Shallow Source Area Excavation/Engineering Controls/ Treatment Zone

- ***Overall Protection of Public Health and the Environment.*** The alternative eliminates or effectively controls the potential exposure pathways by removing source material where feasible, treating residual groundwater contamination, and establishing institutional controls to manage future potential exposures.

  The alternative achieves each RAO as described below:

  - *Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.* Affected groundwater at the site is not currently used for water supply and institutional controls will prevent its use in the future. Groundwater treatment will further reduce the concentration of contaminants in groundwater.

  - *Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.* The flux of contaminants into the Downgradient Area will be reduced by removing the contaminant source areas. Installation of a groundwater treatment barrier/zone will further reduce the flux to the Downgradient Area and Huntington Harbor.

  - *Remove, to the extent practicable, the source of groundwater contamination.* Significant source areas will be removed, reducing the migration of contaminants into groundwater. In addition, installation of a surface cap in the Upland Area will reduce rainwater infiltration and the resultant flux of contaminants to groundwater.

  - *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Exposures to soil are prevented by removing shallow soils and establishing institutional controls to prevent exposures to contaminants remaining in deeper soils.

  - *Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.* Significant source areas will be removed reducing the mass of contaminants driving potential DNAPL lateral migration.

  - *Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.* Removal of shallow soils in DNAPL source areas will reduce the mass of contaminants in the vadose zone. In addition, groundwater treatment and passive NAPL recovery will further reduce the mass of contaminants and the potential for soil vapor resulting from site contamination.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By removing the source material where feasible, and eliminating or controlling the exposure pathways, the alternative complies with the site-specific SCGs as described in Section 4.1.

- ***Long-Term Effectiveness and Permanence.*** The magnitude of the remaining risks is minimal given the removal of source material, the depths at which contamination remains, and the engineering and institutional controls preventing future exposures. The proposed institutional controls are readily implementable and reliable. The RAOs can continue to be met in the future by maintaining the institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** Off-site thermal desorption of the excavated materials will reduce toxicity, mobility, and volume significantly. Treatment barrier/zone will reduce the toxicity of the groundwater leaving the site. NAPL recovery, and to some extent dewatering, will also reduce contaminant mass.

- ***Short-Term Effectiveness.*** The alternative will require intensive construction activity and some potential short- to medium-term impacts are expected. These potential impacts can be managed through careful planning and controls, such as suppression of odors, perimeter air monitoring, and implementation of health and safety and community awareness plans.

- ***Implementability.*** The alternative is technically implementable. Multiple treatment technologies are available commercially from multiple sources. However, access constraints to the Downgradient Area may restrict the ability to install a treatment system. In addition, a pilot study will be required to determine the effectiveness of the selected treatment technology prior to full installation.

  Site-specific conditions in the Upland Area may require specialized construction equipment and may substantially affect the ability to implement the remedy.

- ***Cost.*** The estimated cost is $4.5 million and is summarized in Table 7-2 and Table A-3.

### 7.4.4 Alternative 4: Tar Saturated Soil Excavation/Treatment Zone

- ***Overall Protection of Public Health and the Environment.*** The alternative eliminates or effectively controls the potential exposure pathways by removing source material where feasible, treating residual groundwater contamination, and establishing institutional controls to manage future potential exposures.

  The alternative achieves each RAO as described below:

  - *Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.* Affected groundwater at the site is not currently used for water supply and institutional controls will prevent its use in the future.

  - *Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.* The flux of contaminants into the Downgradient Area will be reduced by removing the contaminant source areas. Installation of a groundwater treatment barrier/zone will further reduce the flux to the Downgradient Area and Huntington Harbor.

  - *Remove, to the extent practicable, the source of groundwater contamination.* Significant source areas will be removed, reducing the migration of contaminants into groundwater.

  - *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Exposures to soil are prevented by removing shallow soils and establishing institutional controls to prevent exposures to contaminants remaining in deeper soils.

  - *Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.* Significant source areas will be removed reducing the mass of contaminants driving potential DNAPL lateral migration.

  - *Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.* Removal of shallow and deeper soils in DNAPL source areas will reduce the mass of contaminants in the vadose zone. In addition, passive NAPL recovery and, if necessary, groundwater treatment will further reduce the mass of contaminants and the potential for soil vapor resulting from site contamination.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By removing the source material where feasible and eliminating or controlling the exposure pathways, the alternative complies with the site-specific SCGs as described in Section 4.1.

- ***Long-Term Effectiveness and Permanence.*** The magnitude of the remaining risks is minimal given the removal of source material, the depths at which contamination remains, and the institutional controls preventing future exposures. The proposed institutional controls are readily implementable and reliable. The RAOs can continue to be met in the future by maintaining the institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** Off-site thermal desorption of the excavated materials will reduce toxicity, mobility, and volume significantly. Treatment barrier/zone will reduce the toxicity of the groundwater leaving the site. NAPL recovery, and to some extent dewatering, will also reduce contaminant mass.

- ***Short-Term Effectiveness.*** The alternative will require intensive construction activity and some potential medium- to long-term impacts are expected. These potential impacts can be managed through careful planning and controls, such as suppression of odors, perimeter air monitoring, and implementation of health and safety and community awareness plans.

- ***Implementability.*** The alternative is technically implementable. The technologies are available commercially from multiple sources. However, site-specific conditions in the Upland Area may require specialized equipment and may substantially affect the ability to implement the remedy.

  Multiple treatment technologies are available commercially from multiple sources. However, access constraints to the Downgradient Area may restrict the ability to install a treatment system. In addition, a pilot study will be required to determine the effectiveness of the selected treatment technology prior to full installation.

- ***Cost.*** The estimated cost is $11.3 million and is summarized in Table 7-2 and Table A-4.

### 7.4.5 Alternative 5: Institutional Controls/Groundwater Monitoring

- ***Overall Protection of Public Health and the Environment.*** The alternative effectively controls the potential exposure pathways by establishing institutional controls such as deed restrictions to manage future potential exposures. The site is currently owned by LIPA, and it is anticipated that a portion of the site will continue to be used indefinitely as a substation, and the remainder of the site is not suitable for development.

The alternative achieves each RAO as described below:

- *Prevent, to the extent practicable, contact with or ingestion of contaminated groundwater associated with the site.* Affected groundwater at the site is not currently used for water supply and institutional controls will prevent its use in the future.

- *Prevent, to the extent practicable, the migration of contaminated groundwater into Huntington Harbor.* Under current site conditions, the concentrations of potentially MGP-related contaminants are low to non-detect along the bulkhead.

- *Remove, to the extent practicable, the source of groundwater contamination.* This alternative will not remove any contaminant mass.

- *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Exposures to soil are prevented by establishing institutional controls to prevent exposures to contaminants in soil.

- *Prevent, to the extent practicable, the migration of DNAPL tar beyond the boundaries of the site.* Passive DNAPL tar recovery will reduce the mass of DNAPL tar driving potential DNAPL lateral migration. Some degree of downgradient migration will remain.

- *Prevent, to the extent practicable, inhalation of contaminants volatilizing from soil or groundwater into closed structures.* Institutional/engineering controls, such as deed restrictions, will be implemented to prevent exposure to and/or reduce the potential for contaminants in soil vapor at the site.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By eliminating or controlling the exposure pathways, the alternative complies with the site-specific SCGs as described in Section 4.1.

- ***Long-Term Effectiveness and Permanence.*** The magnitude of the remaining risks is medium given the implementation of engineering and institutional controls preventing future exposures. The proposed institutional controls are readily implementable and reliable. The RAOs can continue to be met in the future by maintaining the institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** NAPL recovery will reduce contaminant mass.

- ***Short-Term Effectiveness.*** The alternative will not require intrusive activities at the site. The effectiveness of the remedy will be a direct reflection of the ability to implement and manage the institutional controls designed to protect human health and the environment.

- ***Implementability.*** The alternative is technically implementable. However, access constraints to the Downgradient Area and the Office Building Property may restrict the ability to effectively manage the institutional controls.

- ***Cost.*** The estimated cost is $1.3 million and is summarized in Table 7-2 and Table A-5.

## 7.5 Comparison of Alternatives

Table 7-2 summarizes estimated remedial costs for the alternatives. Table 7-3 presents a comparative matrix of the alternatives with the evaluation criteria. A qualitative scoring system has been used to give a general sense of how the alternatives differ in meeting each of the criteria. This scoring system is somewhat subjective, but can provide some insights into the relative strengths and limitations of the alternatives. Each of the alternatives satisfies the criteria to some degree. The primary differences are found in reduction of toxicity, mobility, and volume; implementability; and cost. Considering all of the criteria and the strong probability that the site will continue in its current uses, Alternative 3 was selected as the remedy for the site. Alternative 3 achieves all RAOs, provides better reduction in toxicity and mobility of site contaminants than the other alternatives, and offers a reasonably comparable removal of contaminated materials to the other alternatives that include removal as an element. Alternative 3 is at least as implementable as the other alternatives and is the most cost effective.

# 8. Recommended Remedy

Alternative 3 is the proposed remedy. As described in Section 7.4.3, the RAOs are achieved through a combination of excavation, groundwater treatment, containment, NAPL recovery, and institutional controls. Source removal and destruction will dramatically reduce the ongoing contribution source materials to groundwater quality. With the mass flux from the Upland and Lowland Areas reduced to a fraction of its current state, residual groundwater impacts can be addressed through treatment.

The selected alternative will include the following:

- Excavating shallow/unsaturated soils in the two DNAPL tar source areas in the Upland Area and excavating shallow soils below the water table in two DNAPL source Areas in the Lowland Area including any structures that may remain in place with off-site thermal treatment of soils. Excavations will extend to the horizontal limits of shallow tar saturation in the Upland Area (Tar Deposit Area #5 excavate to ~22 feet bgs, Tar Deposit Area #3 excavate to ~13 feet bgs) and the Lowland Area (Southwest Corner excavate to ~12 feet bgs and Northwest Corner excavate to ~13 feet bgs).

- Constructing an engineered cap in the unsaturated zone across the two DNAPL tar source areas in the Upland Area.

- Constructing a treatment system along the Eastern and the Western property boundaries of the Lowland Area.

- Implementing a CAMP during remedial activities.

- Development and Implementation of a Site Management Plan (SMP). The SMP would identify the institutional controls and engineering controls (IC/ECs) required for the remedy and details their implementation.

    - An IC/EC plan would be developed to establish the controls and procedures for future actions on the site to include:

        - A soil management plan to manage remaining contaminated soils that may be excavated from the site during future activities, including procedures for soil characterization, handling, health and safety of workers and the community, and disturbance of the engineered cap in the Upland Area, as well as, disposal/reuse in accordance with applicable NYSDEC regulations and procedures.

- Criteria to evaluate the potential for vapor intrusion for any future buildings developed on the site, including mitigation of any impacts identified.

- Institutional controls to maintain use restrictions regarding site development or groundwater use identified in the environmental easement.

- Requirements for the property owner to provide an IC/EC certification, as required by regulations, on a periodic basis.

- A monitoring plan to monitor the continued effectiveness of the groundwater treatment systems, the engineered cap in the Upland Area, and passive NAPL recovery wells, as well as groundwater monitoring for MGP-related contaminants in the Downgradient area and on the office building property south of the site.

- An operation and maintenance plan to provide the detailed procedures necessary to operate and maintain the remedy, including passive NAPL recovery where feasible, maintenance of the engineered cap in the Upland Area, and groundwater treatment system. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

Excavation of the areas described above removes approximately 43 percent of the contaminant mass. This mass reduction reduces the potential for future exposure to site-related contaminants in soil and groundwater. The flux of contaminants into groundwater is reduced by removal and destruction of source material. The treatment barrier/zone and NAPL recovery mitigate the potential migration of residual contamination from the site. These measures drastically reduce the contribution of contaminants to the Downgradient Area.

Deeper excavations in the Upland and Lowland Areas as proposed in Alternatives 2 and 4 are not practicable approaches to a remedy at this site. Neither alternative will return the site to pre-release conditions; therefore, each is compared to the recommended alternative based on the expected mass removal. Alternatives 2 and 4 will remove an additional 3 to 7 percent of the contaminant mass at the site, respectively. The additional removal is then evaluated against the additional cost and time required to complete the remedy. This minimal additional removal would carry additional costs of $0.5 million to $6.5 million and require an additional 1 to 11 months to complete. In addition to the practical concerns, the recommended alternative will eliminate exposure pathways to site contaminants as effectively as Alternatives 2 and 4. The additional removal will not create a condition that is substantially more protective of human health and the environment.

The alternative will allow and support a variety of future site uses. Institutional controls will be required to prevent and control potential exposure to remaining contaminants. These controls are straightforward and readily implementable and will reliably prevent exposures. Future disturbance of remaining zones of contamination will be infrequent. Groundwater at the site is not currently used for water supply, and preventing new wells from being installed will ensure that none will be in the future. Future routine excavation activity can be controlled through prescribed methods and protocols for managing work, groundwater, and soils.

The remedy will be effective over the long term, provided a reasonable and responsible degree of long-term operation and maintenance of the treatment system occurs. With proper maintenance of institutional controls, the remedy will support a variety of potential future land uses, including residential use.

Many issues and details related to the implementation of the remedy will be resolved in the upcoming design phase. Significant design and engineering is required prior to implementing the remedy, including selection of a final location and alignment of the treatment barrier/zone, and pilot-scale testing of the treatment barrier/zone technology to minimize disturbance to the LIPA substation.

Pilot-scale testing is currently being conducted at a similar KeySpan site, and the results of that testing will be used to develop the pilot test for this site. Results of these studies will be used to determine the type of treatment (ozone injection, oxygen injection, etc.) to be used and optimal dosing rates, locations, and methods. The design will also include methods for determining efficiency of treatment during implementation.

The design process will also identify and resolve issues related to excavation and containment, and the project’s impact on the local community during implementation, such as dust and odor control, temporary utility relocation, street/lane closures, and truck traffic. Property access and occupancy issues must also be resolved during the design phase.

## Selected Remedial Alternative Contingency

A small area of tar-saturated soil was discovered on an adjoining property, which contains an office building and associated parking areas. The adjoining property is referred to as the "office building property", and is located in the lowland area immediately to the south of the former MGP site.

Five borings were installed on the office building property. Only one of the five borings showed visible tar contamination. Three borings revealed lower-level impacts (MGP tar odors). In general, contamination levels decrease to the south and west. The contamination levels noted in the office building property are not severe, contamination does not appear to be widely distributed, and it is not believed to be a continuous source of groundwater impacts.

The current property owner has expressed reservations about the possible short-term and long-term impacts of excavation to the building structure and has suggested the voluntary imposition of an environmental easement to control exposure to MGP contaminants instead. The remedy for the office building property has been structured as a contingency, depending on the results of further soil vapor sampling and an analysis of potential impacts to indoor air quality inside the office building.

At the present time, it is not possible to rule out the possibility that contaminated soil vapors may infiltrate the office building via the building elevator, which rests directly on the ground surface.

The recommended remedy may exclude active remediation of the office building property parking lot under the following conditions:

- There is clear evidence that contamination under the parking lot is not affecting indoor air in the office building. To gather this evidence, subsurface soil gas samples will be collected around the perimeter of the office building elevator shaft. In addition, air samples will be collected inside the shaft. It is noted that the office building sits above ground on pile columns, with the ground floor being used for parking spaces.

- Implementation of an Environmental Easement on the office building property that would preclude all further active remediation efforts associated with the former MGP, and would:

    - Restrict the use of the building to current office space uses or other non-residential uses compliant with zoning codes and preclude any digging into disturbance of the office building property parking lot without consent of the NYSDEC.

- Restrict the use of groundwater at the property.

- Require the management of the site in accordance with the provisions of the site management plan, to be approved for the site by the Department.

- Require the property owner to complete and submit to the NYSDEC a periodic certification.

# References

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# Tables

**Table 6-1**
**Summary of Remedial Technology Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Response Action | Technology | Effectiveness | Implementability | Cost | Status for Alternative Development |
|---|---|---|---|---|---|
| Excavation | Excavation above and in fine-grained unit only | Effective in elimination of exposure pathway via direct contact and providing long-term protection of human health. Involves excavation in the Lowland area of the site, as well as in the Upland area. Residual contaminants may pose future threat to construction workers depending on site usage. Combined with institutional controls or cap to prevent groundwater contact, RAOs can be met. | Technology proven and readily implemented. Large scale removal necessary and will require dust, emissions and odor controls. | Medium relative to other removal options. | Retained for alternative development. |
| | Deep Excavation below Tar Deposit Areas | Effective in elimination of exposure pathway and providing long-term protection of human health. Involves removal to a depth of about 60 feet in areas of source material below the former tar deposit areas. While impacts have been identified as deep as 85 feet, impacts to groundwater drop off significantly past 60 bgs. RAOs can be met with natural attenuation monitoring for residual groundwater contamination and institutional controls to restrict groundwater use in the immediate area. | Technology proven and readily implemented. Very large scale removal necessary and will require dust, emissions and odor controls. Hydraulic control of tidally influenced aquifer with possible upward (discharging) vertical gradient will require large scale dewatering operation. | High relative to other removal options. | Retained for alternative development. |
| Ex-Situ Treatment | Off-site Low Temperature Thermal Desorption | Effective form of treatment of soils with low to high concentrations of organic contamination. Technology has been used at similar sites effectively. | Technology proven, but lack of locally permitted facility may make transportation of soils for treatment an issue. | Medium compared to other ex situ treatment technologies. | Retained for alternative development. |
| | On-site Low Temperature Thermal Desorption | Effective form of treatment of soils with low to high concentrations of organic contamination. Technology has been used at similar sites effectively. | Due to proximity of local population and available space at site, permitting of temporary facility would be difficult. | Medium to High compared to other ex situ technologies. | Not Retained. |
| | Slurry Phase Bioreactors | Technology in developmental stage for MGP waste streams. High concentrations of contaminants and breakdown of five ring benzene compounds will reduce effectiveness. Effectiveness should be field tested before implementation. | Technology not proven. Bioreactor can be constructed on-site. | Costs may be high compared to other ex situ technologies. | Not Retained. |

**Table 6-1**
**Summary of Remedial Technology Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Response Action | Technology | Effectiveness | Implementability | Cost | Status for Alternative Development |
|---|---|---|---|---|---|
| In Situ Treatment | Dynamic Underground Stripping | Effective on small areas. Injecting steam in the subsurface will have a small radius of influence due to tidal fluctuations and high hydraulic conductivity. | Readily implemented. | Capital costs may be medium. Operation and maintenance costs may be high when compared to other in situ technologies. | Not Retained. |
| | Surfactant/ Co-solvent flushing | Effective in enhancing DNAPL solubility and mobility. Is not effective in soils with low permeability. When combined with other recovery technologies may achieve RAOs. Tidal action and discharging aquifer conditions will make delivery, contact and recovery difficult. | Technology proven in controlled settings. Tidal action will be difficult to control the process. | High capital costs when compared to other alternatives. | Not Retained. |
| | Chemical Oxidation | Effective in destroying source material and meeting the RAOs at similar sites. High contaminant concentrations will increase soil-oxidant demand. Tidal influences will make delivery and contact with target source material difficult. | Technology proven. High contaminant concentrations will increase soil-oxidant demand and increase cost per pound of COC destroyed effectiveness. | High capital and operating costs compared to other alternatives. | Not Retained. |
| | Six Phase Heating | Effective in shallow depths (less than 40 feet) and low volumes. Technology is not proven below the water table. | Technology proven but the high water table in the site area will make it difficult to implement. | High compared to other alternatives. | Not Retained. |
| Engineering Control | Engineered cap/cover system | Effective at controlling the pathways for future worker and trespasser exposure. Will need to be flexible to include redevelopment plans for the site. | Technology proven and readily implemented. | Medium compared to other technologies. | Retained for alternative development. |
| | Engineered Treatment Barrier/Zone | Effective at meeting RAO for preventing migration and terminating exposure. | Technology proven, however, utility corridor adjacent to site could be an issue. | Medium capital cost, and long-term maintenance cost relative to other technologies. | Retained for alternative development. |

**Table 6-1**
**Summary of Remedial Technology Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Response Action | Technology | Effectiveness | Implementability | Cost | Status for Alternative Development |
|---|---|---|---|---|---|
| Containment | DNAPL tar Recovery | Effective at capturing subsurface fluids. May capture more water than DNAPL tar. Tidal influence and flow direction changes may reduce effectiveness. | Technology proven and readily implemented. Will require extensive on-site treatment for high volumes of fluids anticipated. | Low installation costs, but higher operation and maintenance costs relative to other technologies. | Retained for alternative development. |
| | Hydraulic Control | Effective in maintaining hydraulic gradient into the contained area. Tidal effects at the site may require complex modeling and pumping arrangements. | Technology proven and readily implemented. | Medium capital cost, high long-term maintenance cost relative to other technologies. | Not Retained. |
| | Containment Barriers | Effective at meeting RAO for preventing migration and terminating exposure. Minimal disturbance of soils. Continuity and compatibility are concerns. | Technology proven and readily implemented. However tidal effects and hydraulic conductivity may pose a problem. | Medium relative to other containment technologies. | Retained for alternative development. |
| | In Situ Stabilization | Effective at meeting RAO for preventing migration and terminating exposure. However, large-scale construction may pose difficulties. | Technology proven but compatible site-specific materials may be needed. | High relative to other containment technologies. | Not Retained. |
| Institutional Controls | Access Controls, Deed Restrictions, Health & Safety Plans, Long-Term Monitoring, Notifications | Effective in preventing risks to future construction or utility workers. Not effective in limiting migration. | Readily implementable. | Low. Monitoring to be performed semi-annually. | Retained for alternative development. |

**Table 7-1**
**Remedial Action Alternatives - Initial Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Action Alternative | Ability to Achieve RAOs | Implementability | Short-Term Effectiveness | Long-Term Effectiveness | Retained for Detailed Analysis? |
|---|---|---|---|---|---|
| **Alternative 1: Containment and Engineered Cap:**<br><br>Upland: Containment cell with Surface Cap<br><br>Lowland: Visual Excavation Barrier<br><br>DNAPL Recovery where feasible | Achieves RAOs to some extent by eliminating exposure to source.<br><br>Minimizes GW contaminant flux from Upland Area to Lowland Area. | Executed with conventional sheet pile driving equipment in the Upland Area. May need to remove surface structures to accommodate sheet piles.<br><br>Requires installation of a Visual Excavation Barrier in the active LIPA Substation footprint.<br><br>Special containment wall material (Waterloo Barrier or similar) is necessary for long-term reliability. | Effective in eliminating migration of Impacts from the Upland Area.<br><br>Effective in eliminating significant exposure pathway.<br><br>Will not reduce all impacted soils to cleanup criteria.<br><br>Minor disruptions only to Active LIPA substation. | Will not reduce all impacted soils to cleanup criteria.<br><br>NAPL sources in Lowland Area will not be contained.<br><br>Long-term migration from Upland Area eliminated effectively with continued monitoring and controls. | Yes – Moderately effective if containment cell in the Upland Area and visual excavation barriers and deed restrictions in the Lowland Area eliminate exposure pathways to remaining impacted soils.<br><br>Requires long term NAPL recovery program.<br><br>Requires post closure long-term monitoring program to ensure effectiveness. |
| **Alternative 2: Deep Source Area Excavation:**<br><br>Upland: Excavate two cells to ~55 ft and ~50 ft<br><br>Lowland: Excavate two cells to ~12 ft and ~13 ft<br><br>DNAPL Recovery where feasible | Removes/treats majority of source of impacts<br><br>Achieves RAOs by eliminating exposure to source material. | Executed with conventional excavating equipment. Requires installation of excavation support for source area removals to ~70 ft Upland Area.<br><br>Requires construction of dewatering (Lowland Area) handling system. | Effective in removing source material and eliminating exposure pathways.<br><br>Will not reduce all impacted soils to cleanup criteria.<br><br>Minor disruptions only to Active LIPA substation. | Will not reduce all impacted soils to cleanup criteria.<br><br>NAPL sources below the substation footprint will not be removed.<br><br>Long-term migration from Upland Area eliminated effectively with continued monitoring and controls. | Yes - effectiveness on eliminating exposure pathways may be countered by lack of cost-effectiveness and technical limitations.<br><br>Requires long term NAPL recovery program.<br><br>Requires post closure long-term monitoring program to ensure effectiveness. |

**Table 7-1**
**Remedial Action Alternatives - Initial Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Action Alternative | Ability to Achieve RAOs | Implementability | Short-Term Effectiveness | Long-Term Effectiveness | Retained for Detailed Analysis? |
|---|---|---|---|---|---|
| **Alternative 3: Shallow Source Area Excavation/Engineering Controls/Treatment Zone:**<br><br>Upland: Excavate two cells to ~22 ft and ~13 ft with Cap/Visual Excavation Barrier<br><br>Lowland: Excavate two cells to ~12 ft and ~13 ft<br><br>Treatment Barrier/Zone<br><br>DNAPL Recovery where feasible | Removes/treats majority of source of impacts.<br><br>Achieves RAOs by eliminating exposure to source material.<br><br>Treatment Barrier Zone prevents migration in the saturated zones. | Executed with conventional excavating equipment.<br><br>Requires installation of excavation support for source area removals.<br><br>Requires construction of dewatering (Lowland Area) handling system. | Effective in removing majority of source material and eliminating exposure pathway.<br><br>Will not reduce all impacted soils to cleanup criteria.<br><br>Minor disruptions only to Active LIPA substation. | Effective in removing majority source material and eliminating exposure pathways.<br><br>NAPL sources below the substation footprint will not be removed.<br><br>Will not reduce all impacted soils to cleanup criteria. | Yes – Moderately Effective.<br><br>Removes majority of source material with targeted excavations.<br><br>Requires long term NAPL recovery program.<br><br>Requires post closure long-term monitoring program to ensure effectiveness. |

**Table 7-1**
**Remedial Action Alternatives - Initial Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Action Alternative | Ability to Achieve RAOs | Implementability | Short-Term Effectiveness | Long-Term Effectiveness | Retained for Detailed Analysis? |
|---|---|---|---|---|---|
| **Alternative 4: Tar Saturated Soil Excavation/Treatment Zone:**<br><br>Upland: Excavate tar saturated soils to fine grained unit ~40 ft to ~70 ft<br><br>Lowland: Excavate Excavate tar saturated soils to fine grained unit to ~12 ft to ~13 ft<br><br>Treatment Barrier/Zone if Groundwater impacts persistent | Achieves RAO by removing majority of source material and eliminating exposure to the remaining impacts. | May not be feasible due to technology limitations to excavate to 70 feet in Upland Area.<br><br>Will require construction of dewatering system for Lowland Area.<br><br>Site access constraints and construction safety setback requirements will make it very unlikely that all material could be removed in the Upland Area or the Lowland Area.<br><br>The large volume of material to be excavated and treated may require shipment of soil over long distances, as closer facilities may not have the capacity to process all the soil in a reasonable amount of time.<br><br>Would require removal/ relocation of the LIPA substation to complete excavation. | Effective in removing source material and eliminating exposure pathway.<br><br>Significant disruption to local community. | Effective in removing source material and eliminating exposure pathways. | Yes - effectiveness on eliminating exposure pathways may be countered by lack of cost-effectiveness and technical limitations.<br><br>Requires long term NAPL recovery program.<br><br>Requires post closure long-term monitoring program to ensure effectiveness. |

**Table 7-1**
**Remedial Action Alternatives - Initial Screening**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Action Alternative | Ability to Achieve RAOs | Implementability | Short-Term Effectiveness | Long-Term Effectiveness | Retained for Detailed Analysis? |
|---|---|---|---|---|---|
| **Institutional Controls/Groundwater Monitoring** | Achieves RAO by eliminating exposure. | Readily implementable. | Effective in removing eliminating exposure pathways. | Effective in removing eliminating exposure pathways. | Yes - Low to Moderately Effective<br><br>Requires long term management plan and appropriate measure to ensure institutional controls are adhered to.<br><br>Requires long-term groundwater monitoring program to ensure conditions remain constant. |

**Table 7-2**
**Estimated Remedial Component Costs**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Area | Remedial Action | Estimated Remedial Component Cost (millions of dollars) | | | | |
|---|---|---|---|---|---|---|
| | | Alternative 1: Containment and Cap | Alternative 2: Deep Source Area Excavation | Alternative 3: Shallow Source Area Excavation/ Engineering Controls/ Treatment Zone | Alternative 4: Tar Saturated Soil Excavation/ Treatment Zone | Alternative 5: Institutional Controls/ Groundwater Monitoring |
| Upland Area | Excavate, Treat & Dispose, Surface Cap | 0.66 | 1.3 | 0.40 | 5.0 | NA |
| Lowland Area | Excavate, Treat & Dispose, Surface Cap | 0.77 | 0.40 | 0.43 | 0.64 | NA |
| Office Building Area | Excavate, Treat & Dispose, and/or Surface Cap/Excavation Barrier | 0.09 | 0.37 | 0.36 | 0.37 | NA |
| Site Wide Costs | Groundwater Treatment Zone | NA[1] | NA | 0.10 | 0.10 | NA |
| | Design, Construction Management, and Mobilization | 0.70 | 1.0 | 0.81 | 1.5 | NA |
| | NAPL Recovery Well Install | 0.08 | 0.08 | 0.08 | 0.08 | NA |
| | Long-Term Monitoring/NAPL Recovery | 1.0 | 1.0 | 1.4 | 1.4 | 1.0 |
| | Contingency 25% | 0.64 | 1.0 | 0.89 | 2.3 | 0.2 |
| | **TOTALS** | **3.2** | **5.0** | **4.5** | **11.3** | **1.2** |

**Notes:**
1. NA - Not Applicable
Differences in the sum of the Remedial Area costs and the Total Costs are due to rounding.

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**Table 7-3**
**Remedial Action Alternatives – Comparative Analysis**
**Halesite Former MGP Site**
**Halesite, New York**

| | Sub-Criteria | Rating[1] Alt. 1: Containment and Cap | Criteria | Alt. 3: Shallow Source Area Excavation/ Engineering Controls/ Treatment Zone | Alt. 4: Tar Saturated Soil Excavation/ Treatment Zone | Alt 5: Institutional Controls/ Groundwater Monitoring | Comparison Statement |
|---|---|---|---|---|---|---|---|
| Overall Protection of Human Health and the Environment | | 4 | 2 | 3 | 1 | 5 | All of the alternatives with shallow source excavations and/or surface caps are protective of human health and the environment, but 1 and 2 involve larger excavations/containment areas providing potentially additional protection. |
| | **Score[2]** | **4** | **2** | **3** | **1** | **5** | |
| New York State or Site-Specific SCGs | Soil | 4 | 2 | 3 | 1 | 5 | Alternatives were ranked based on the volume of source material removed, treated, and/or contained. |
| | Groundwater | 4 | 3 | 2 | 1 | 5 | Alternatives were ranked based on whether they included NAPL recovery and quantity of source removal/ treatment/containment. Alt. 3 and 4 include groundwater treatment for residuals. |
| | **Score** | **4** | **2.5** | **2.5** | **1** | **5** | |
| Long-Term Effectiveness and Permanence | Permanence of Remedial Alternative | 4 | 3 | 2 | 1 | 5 | All of the alternatives are expected to be a permanent remedy for the Site; however the alternatives that include containment and/or groundwater treatment to address migration of remaining contaminants are considered more permanent remedies. |
| | Magnitude of Remaining Risk | 4 | 3 | 2 | 1 | 5 | Alternatives 4 and 2 pose the least risk that additional remediation work will be required in the future. |
| | Adequacy of Controls | 1 | 1 | 1 | 1 | 1 | All alternatives will provide equal controls. |
| | Reliability of Controls | 1 | 1 | 1 | 1 | 1 | All alternatives will provide equal controls. |
| | **Score** | **2.5** | **2** | **1.5** | **1** | **3** | |

**Table 7-3**
**Remedial Action Alternatives – Comparative Analysis**
**Halesite Former MGP Site**
**Halesite, New York**

| Criteria | Sub-Criteria | Rating[1] | | | | | Comparison Statement |
|---|---|---|---|---|---|---|---|
| | | Alt. 1: Containment and Cap | Alt. 2: Deep Source Area Excavation | Alt. 3: Shallow Source Area Excavation/ Engineering Controls/ Treatment Zone | Alt. 4: Tar Saturated Soil Excavation/ Treatment Zone | Alt 5: Institutional Controls/ Groundwater Monitoring | |
| Reduction of Toxicity, Mobility, and Volume | Amount of material destroyed or treated | 4 | 2 | 3 | 1 | 5 | Alternative 4 will remove/contain/treat the largest volume of material. |
| | Degree of Toxicity, Mobility, or Volume reduced | 4 | 3 | 2 | 1 | 5 | Alternative 4 reduces migration more than 2 or 3, and provides a greater reduction in mobility than 1 does in regards to toxicity and volume. |
| | Irreversibility | 1 | 1 | 1 | 1 | 1 | All alternatives are permanent. |
| | Residuals Remaining | 4 | 3 | 2 | 1 | 5 | Alternative 4 would remove the largest volume of impacted materials from the Site. |
| | **Score** | **3.25** | **2.25** | **2** | **1** | **4** | |
| Short-Term Impacts and Effectivene ss | Protection of Community during Remedial Action | 2 | 4 | 3 | 5 | 1 | Alternative 5 will not require any excavation or off-site transport of soil. All other alternatives require some degree of excavation and off-site transport of impacted soils that will potentially impact the community and will require the implementation of appropriate controls during construction (air monitoring, dust suppression, etc.) and times when portions of local roads will be closed. |
| | Environment al Impacts | 1 | 1 | 1 | 1 | 1 | There are no foreseeable adverse environmental impacts for any alternative. |
| | Time Required to Meet Remedial Objectives | 2 | 4 | 3 | 5 | 1 | Alternative 5 will not require construction activities. Alternative 1 could be completed in 3 months, and all of the alternatives could be completed in 1.5 years or less. |
| | Protection of Workers | 2 | 4 | 3 | 5 | 1 | Alternative 5 will not require construction activities and Alternatives 2 and 4 is the only alternative that includes deeper excavation into the saturated zone. |
| | **Score** | **1.75** | **3.25** | **2.25** | **4** | **1** | |

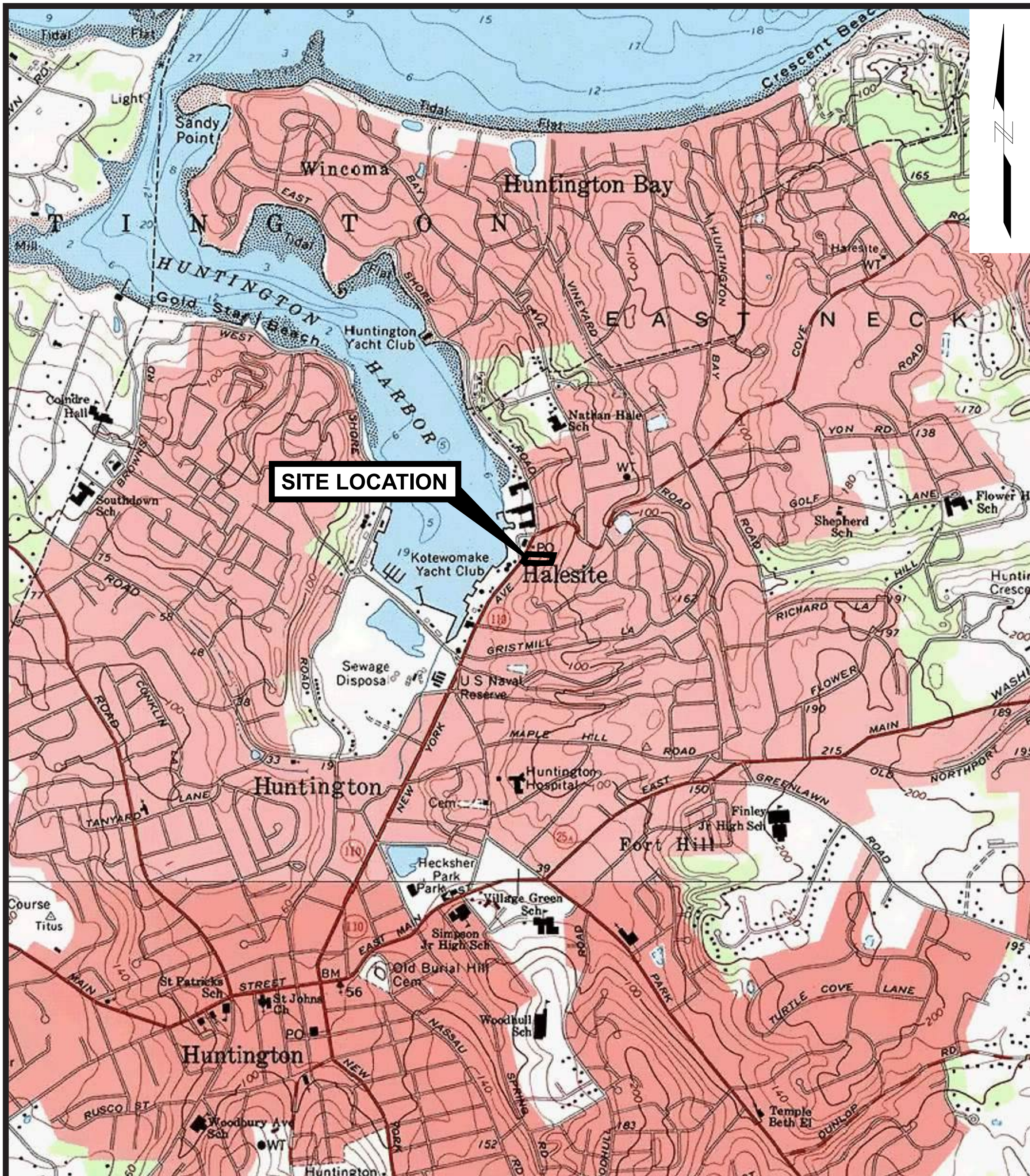
**Table 7-3**
**Remedial Action Alternatives – Comparative Analysis**
**Halesite Former MGP Site**
**Halesite, New York**

| Criteria | Sub-Criteria | Rating[1] | | | | | Comparison Statement |
|---|---|---|---|---|---|---|---|
| | | Alt. 1: Containment and Cap | Alt. 2: Deep Source Area Excavation | Alt. 3: Shallow Source Area Excavation/ Engineering Controls/ Treatment Zone | Alt. 4: Tar Saturated Soil Excavation/ Treatment Zone | Alt 5: Institutional Controls/ Groundwater Monitoring | |
| Implementability | Technical Feasibility | 4 | 3 | 2 | 5 | 1 | Alternative 5 will not require construction activities. Alternative 2 is the least construction intensive alternative with the highest technical feasibility. |
| | Administrative Feasibility | 2 | 4 | 3 | 5 | 1 | Alternative 5 will not require construction activities. |
| | Availability of Services | 3 | 4 | 2 | 5 | 1 | The majority of site work will be completed with conventional construction equipment, those alternatives requiring the use of specialized equipment for work at depth may have slightly less available. |
| | **Score** | **3** | **3.67** | **2.33** | **5** | **1** | |
| Cost | Capital Costs | 2 | 4 | 3 | 5 | 1 | Capital costs for construction dewatering and treatment of impacted soils drive the costs of the remedies. Those alternatives with larger excavation volumes, disposal volumes, and/or dewatering costs have increased associated capital costs. |
| | O&M costs | 1 | 1 | 2 | 2 | 1 | All alternatives will require similar post remedy monitoring programs. Alternatives that include groundwater treatment will require additional monitoring. |
| | **Score** | **1.5** | **2.5** | **2.5** | **3.5** | **1** | |
| **Total Score** | | **20** | **18.17** | **16.08** | **16.5** | **20** | |

**Note:**

1. Sub-criteria score are based on a qualitative forced ranking scale. The alternative with the best rating receives a score of 1, the 2nd best – a score of 2, and so on. If alternatives are equal in rating, ties are included (i.e., if Alternative 1 is the best, it receives a score of 1, but if Alternatives 3 and 4 are the next equal in scale, then they both will receive a score of 2, the next rated Alternative will receive a 4 since it is the fourth rated Alternative). The tie scoring system is used to prevent the last place rated alternative from receiving a score of 2, if all of the other alternatives are justifiably scored with the highest rating.
2. Sub-criteria scores for each major criteria are summed, and then divided by the number of sub-criteria so that the main criteria receive the same overall weighting, regardless of the number of sub-criteria.

# Figures




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

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SCALE, FEET

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|---|---|---|
| HALESITE FORMER MGP SITE<br>HALESITE, NEW YORK | GEI Consultants | SITE LOCATION MAP |
| KEYSPAN CORPORATION | PROJECT 982482-18-2801 | March 2006 Figure 1-1 |

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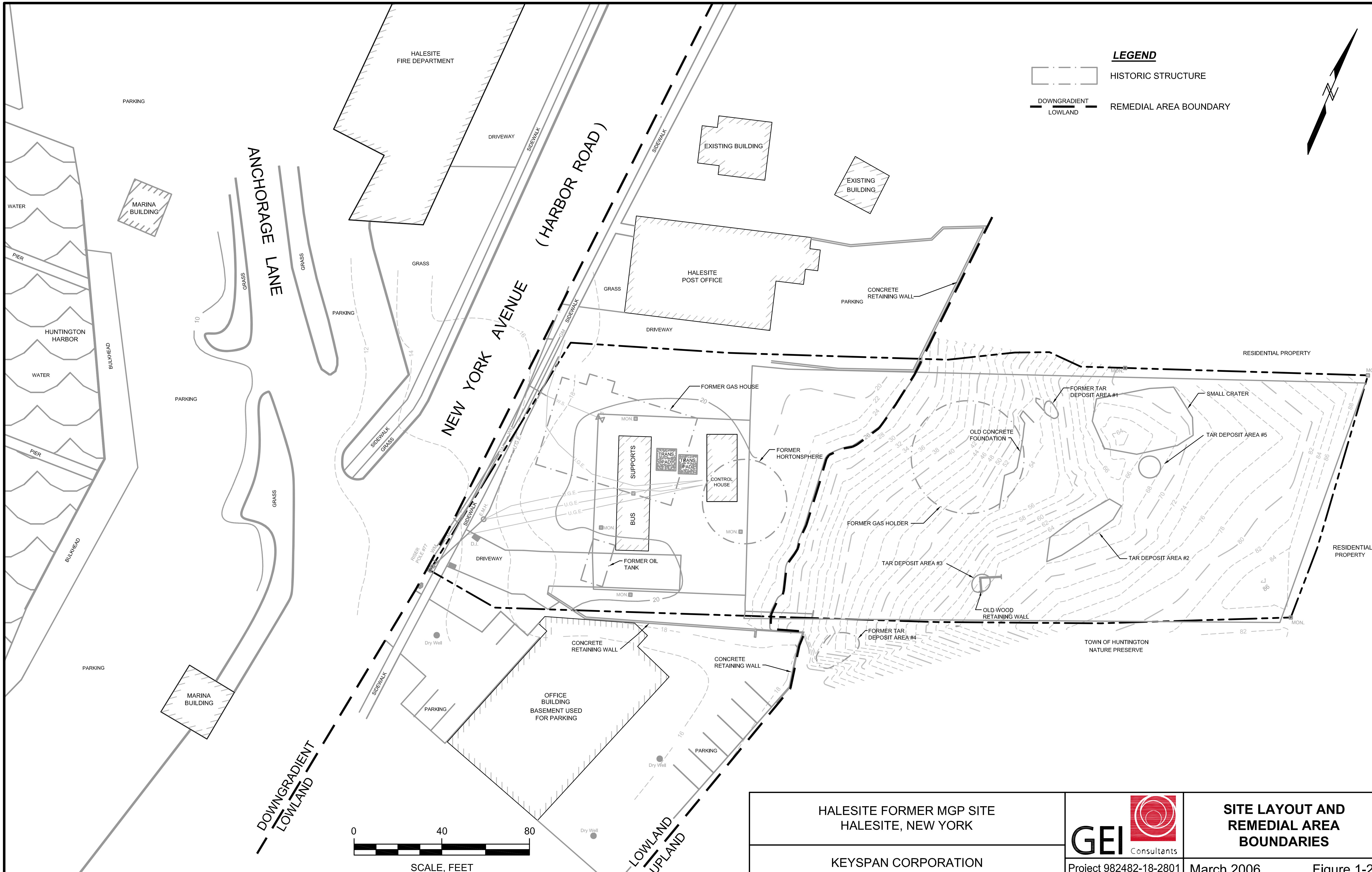



HALESITE FORMER MGP SITE
HALESITE, NEW YORK

KEYSPAN CORPORATION

GEI Consultants

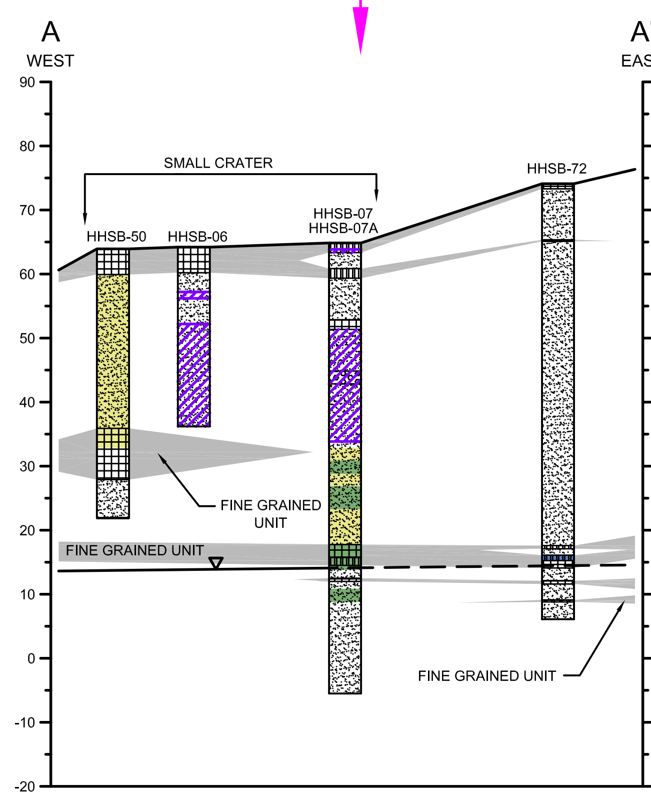
Project 982482-18-2801

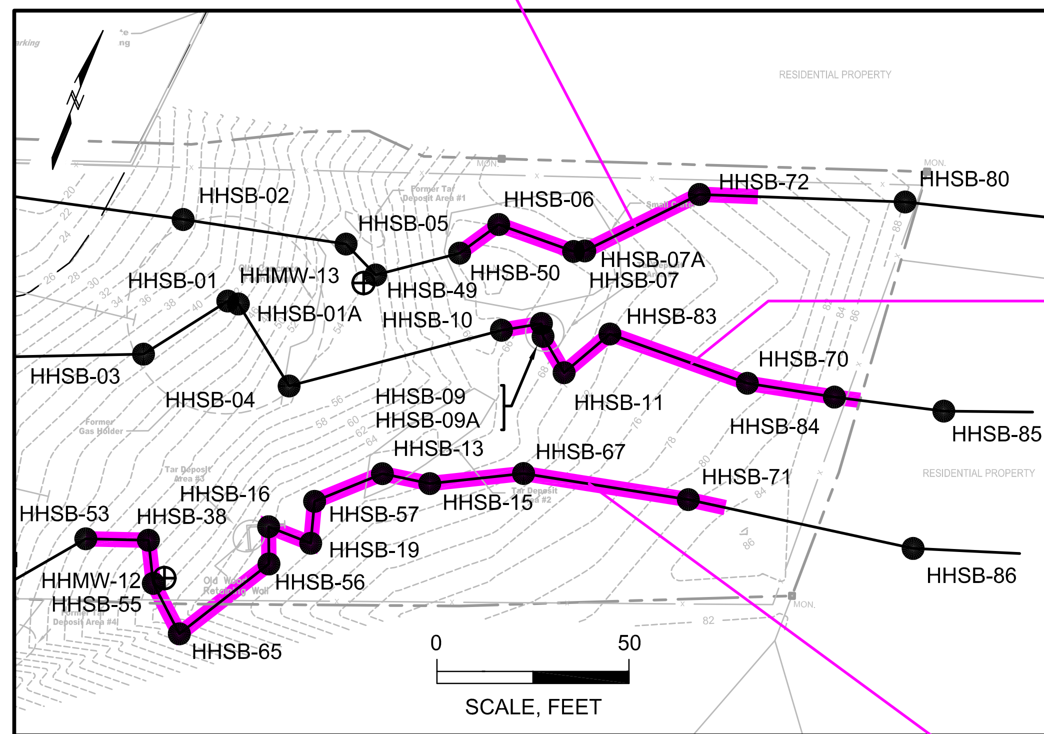
**SITE LAYOUT AND REMEDIAL AREA BOUNDARIES**

March 2006

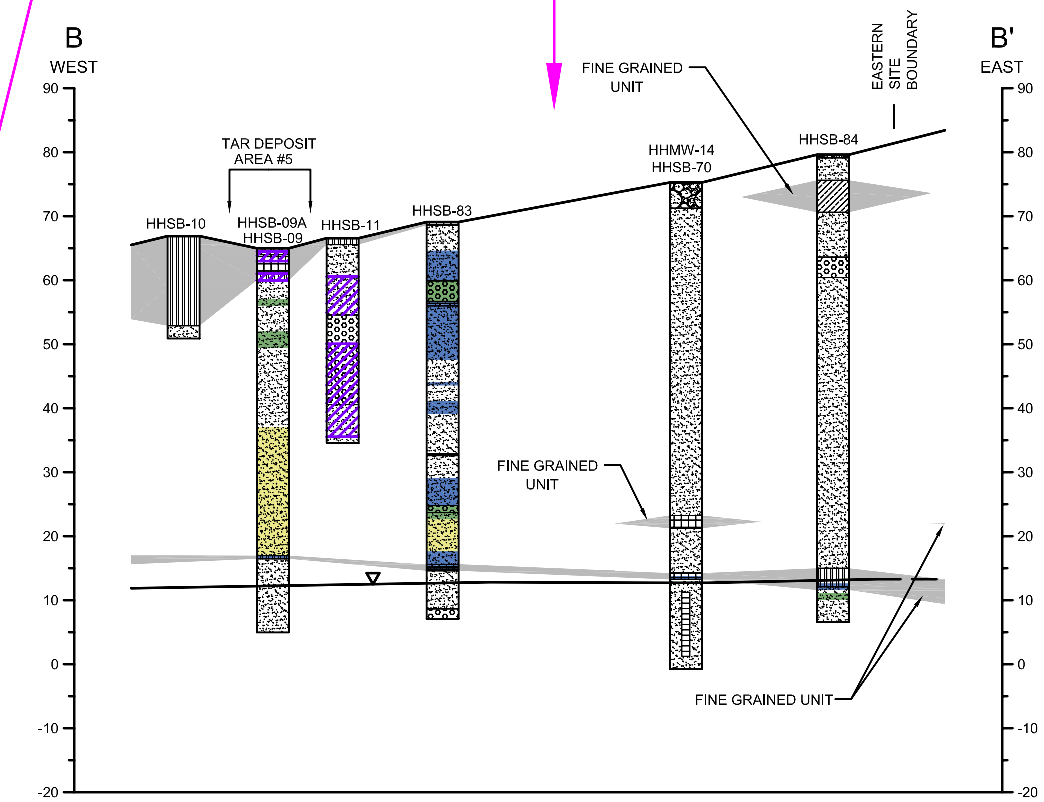
Figure 1-2

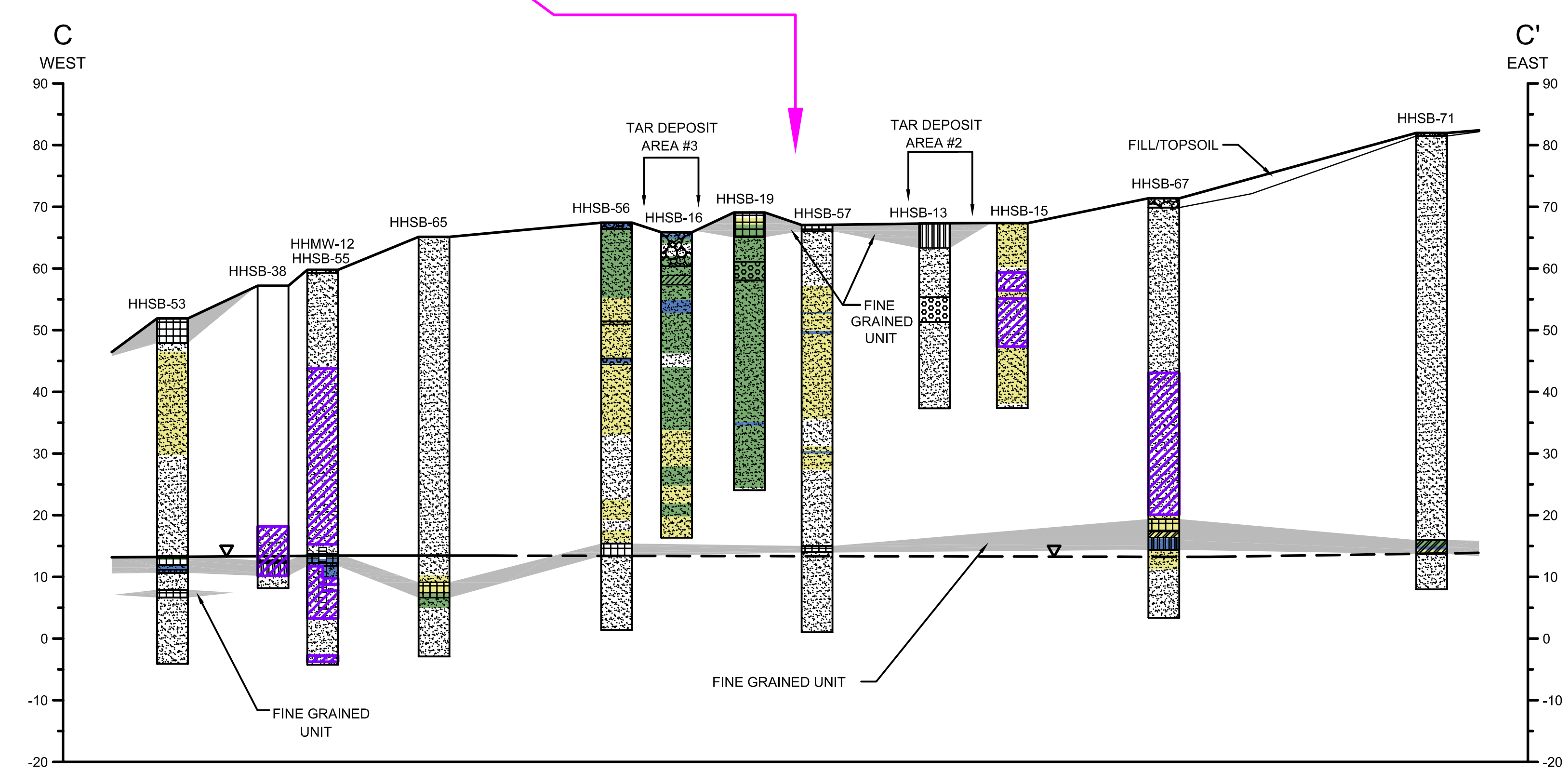
KEYSPAN\HALESITE\RAP\HALESITE-SITE LAYOUT.dwg




## UPLAND CROSS SECTION LOCATION MAP




## LEGEND

**GEOLOGICAL CLASSIFICATIONS**

- TOPSOIL AND/OR FILL
- FINE, MEDIUM TO COARSE SANDS TO FINE, MEDIUM TO COARSE SANDS WITH GRAVEL
- GRAVEL, GRAVEL WITH SAND, GRAVELY SANDS
- SILTY SANDS TO SILT WITH SAND
- SILTS TO CLAY RICH SILTS
- CLAYS WITH SANDS
- CLAYS
- PEAT

**PHYSICAL DESCRIPTIONS**

- TAR/NAPHTHA ODORS
- TAR STAINING, BLEBS, GLOBS, LENSES GRAIN-COATING, SHEENS
- TAR SATURATED
- PETROLEUM-LIKE STAINING, SHEENS AND ODORS
- WELL SCREEN INTERVAL
- APPROXIMATE ELEVATION OF WATER TABLE GIVEN IN FEET ABOVE MEAN SEA LEVEL, DASHED WHERE INFERRED
- GROUND SURFACE

***SOURCES:***

*GEOLOGIC CROSS SECTIONS A-A', B-B'* FINAL REMEDIAL INVESTIGATION, HALESITE FORMER MGP SITE, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CT, HORIZONTAL SCALE: 1"=20'; VERTICAL SCALE: 1"=20', DATE: APRIL 2004.

*GEOLOGIC CROSS SECTIONS A-A', B-B'* FINAL REMEDIAL INVESTIGATION, HALESITE FORMER MGP SITE, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CT, HORIZONTAL SCALE: 1"=20'; VERTICAL SCALE: 1"=20', DATE: APRIL 2004.

30 / 0 VERTICAL SCALE, FEET

0 / 30 HORIZONTAL SCALE, FEET

HALESITE FORMER MGP SITE
HALESITE, NEW YORK

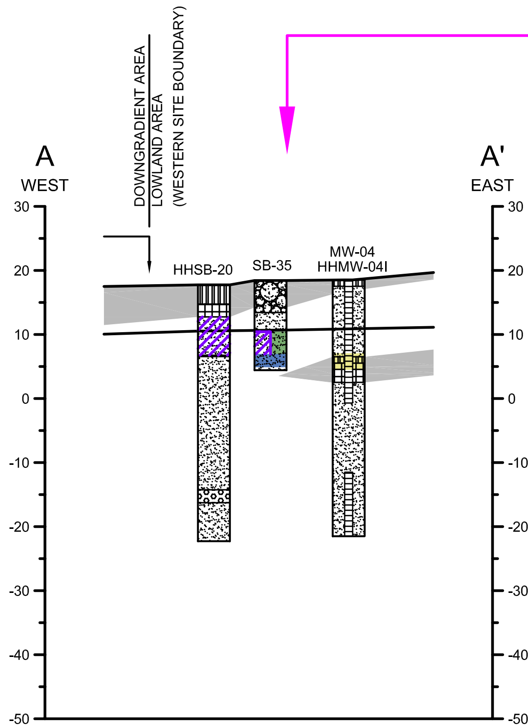
KEYSPAN CORPORATION

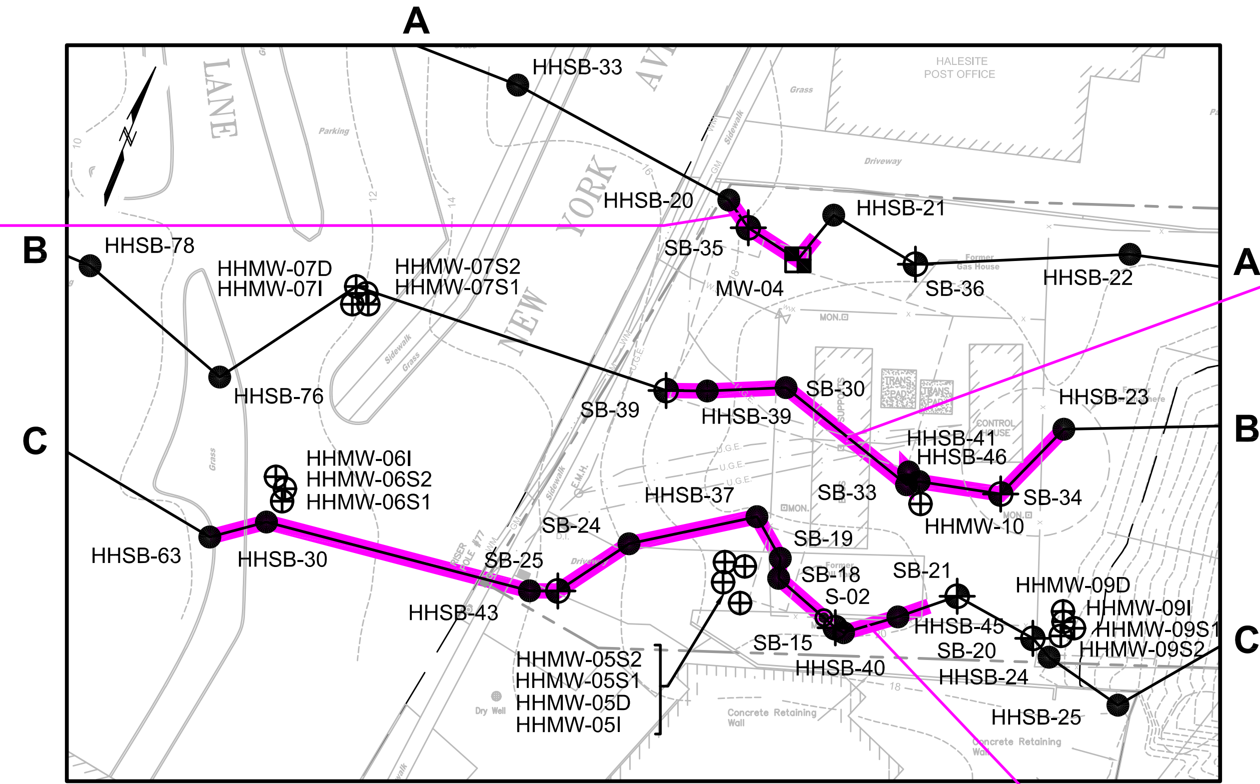
GEI Consultants

**UPLAND AREAS REMEDIAL INVESTIGATION CROSS SECTION EXERPTS**

Project 982482-18-2801 | March 2006 | Figure 3-1

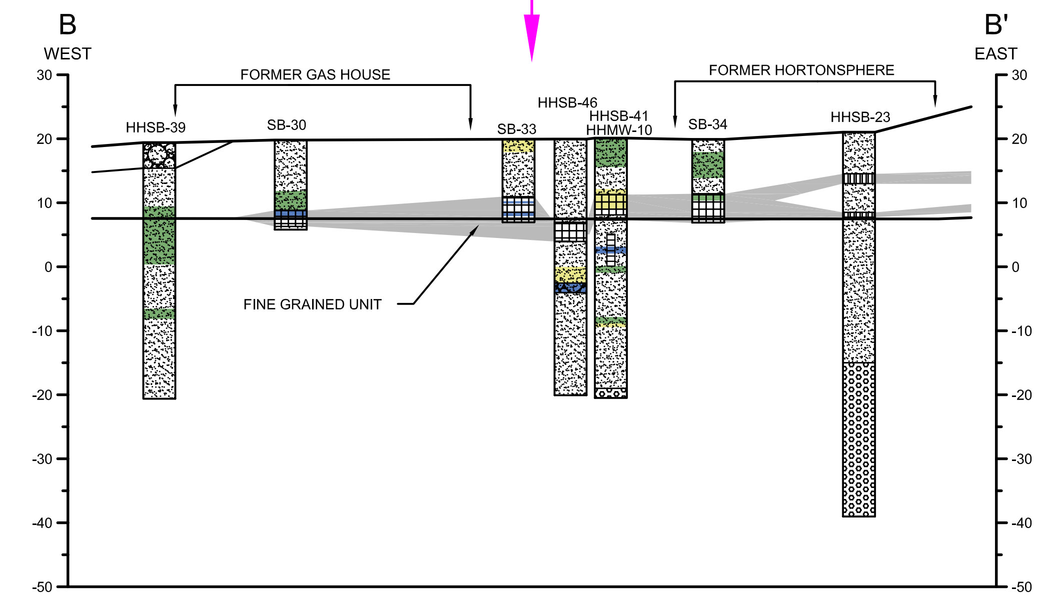
KEYSPAN\HALESITE\RAP\HALESITE-CROSS SECTIONS.dwg




## LOWLAND CROSS SECTION LOCATION MAP

0 50
SCALE, FEET



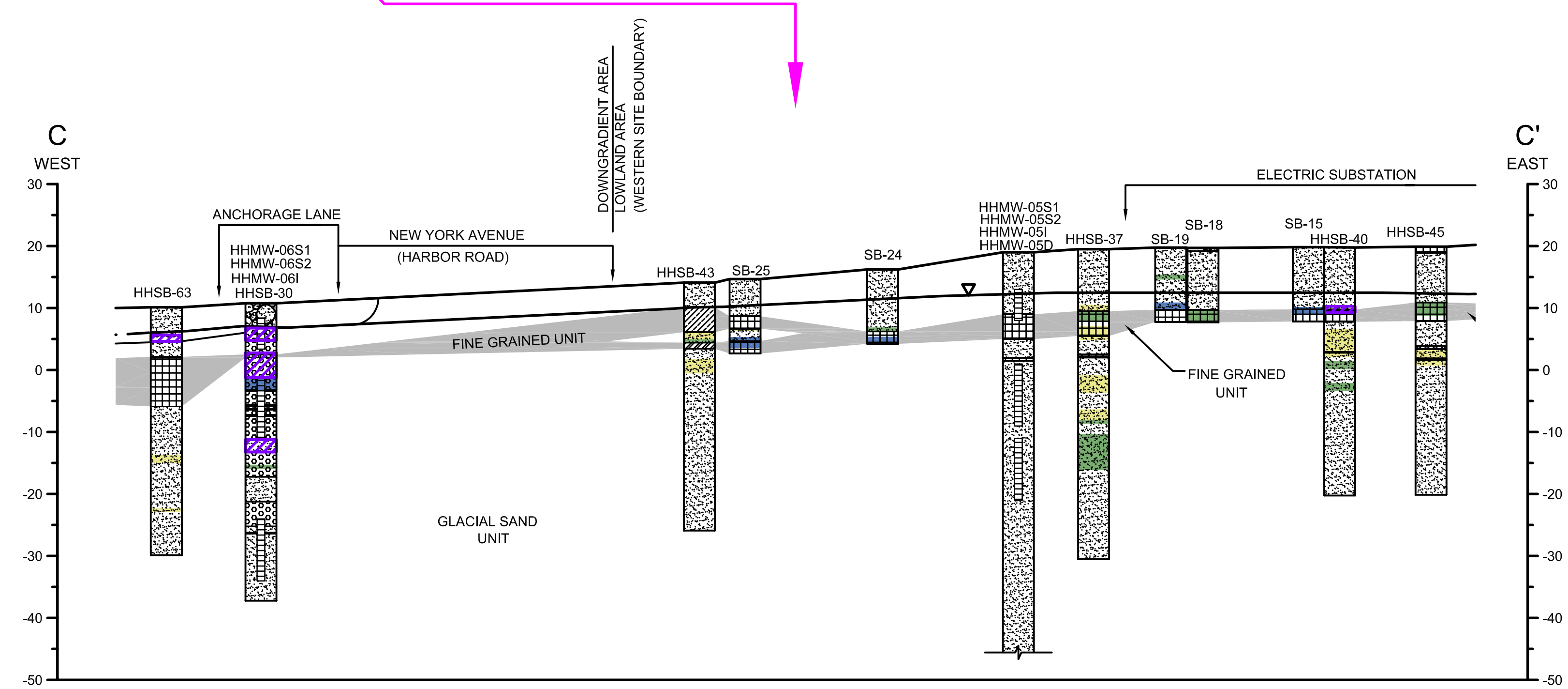

## LEGEND

**GEOLOGICAL CLASSIFICATIONS**

- TOPSOIL AND/OR FILL
- FINE, MEDIUM TO COARSE SANDS TO FINE, MEDIUM TO COARSE SANDS WITH GRAVEL
- GRAVEL, GRAVEL WITH SAND, GRAVELY SANDS
- SILTY SANDS TO SILT WITH SAND
- SILTS TO CLAY RICH SILTS
- CLAYS WITH SANDS
- CLAYS
- PEAT

**PHYSICAL DESCRIPTIONS**

- TAR/NAPHTHA ODORS
- TAR STAINING, BLEBS, GLOBS, LENSES GRAIN-COATING, SHEENS
- TAR SATURATED
- PETROLEUM-LIKE STAINING, SHEENS AND ODORS
- WELL SCREEN INTERVAL
- APPROXIMATE ELEVATION OF WATER TABLE GIVEN IN FEET ABOVE MEAN SEA LEVEL, DASHED WHERE INFERRED
- GROUND SURFACE




***SOURCES:***

*GEOLOGIC CROSS SECTIONS A-A', B-B'* FINAL REMEDIAL INVESTIGATION, HALESITE FORMER MGP SITE, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CT, HORIZONTAL SCALE: 1"=20'; VERTICAL SCALE: 1"=20', DATE: APRIL 2004.

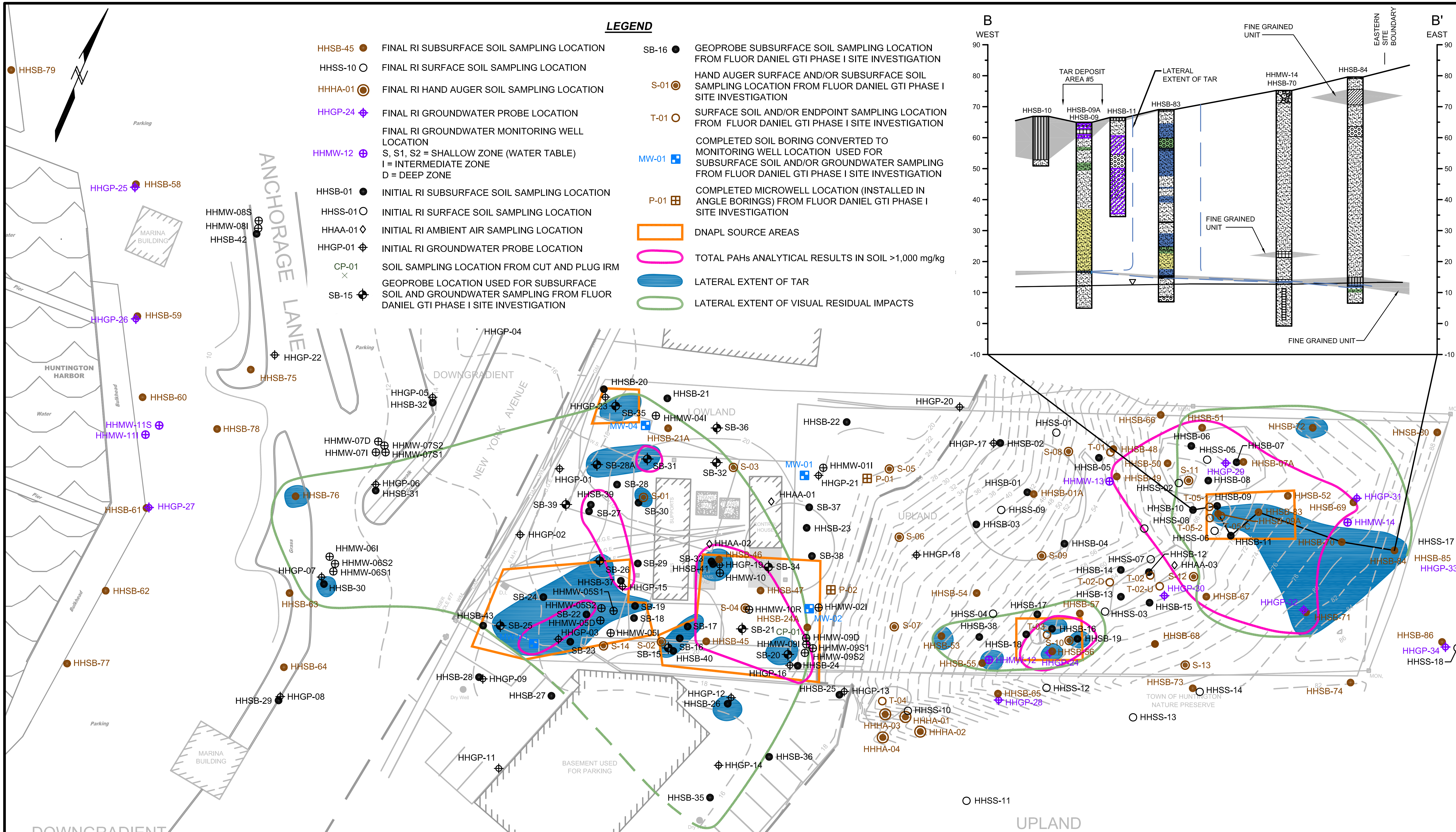
*GEOLOGIC CROSS SECTIONS A-A', B-B'* FINAL REMEDIAL INVESTIGATION, HALESITE FORMER MGP SITE, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CT, HORIZONTAL SCALE: 1"=20'; VERTICAL SCALE: 1"=20', DATE: APRIL 2004.

30
0
VERTICAL SCALE, FEET

0 30
HORIZONTAL SCALE, FEET

| | | |
|---|---|---|
| HALESITE FORMER MGP SITE<br>HALESITE, NEW YORK | GEI Consultants | LOWLAND AREAS REMEDIAL INVESTIGATION CROSS SECTION EXERPTS |
| KEYSPAN CORPORATION | Project 982482-18-2801 | March 2006 Figure 3-2 |

KEYSPAN\HALESITE\RAP\HALESITE-CROSS SECTIONS.dwg




HALESITE FORMER MGP SITE
HALESITE, NEW YORK

KEYSPAN CORPORATION

GEI Consultants

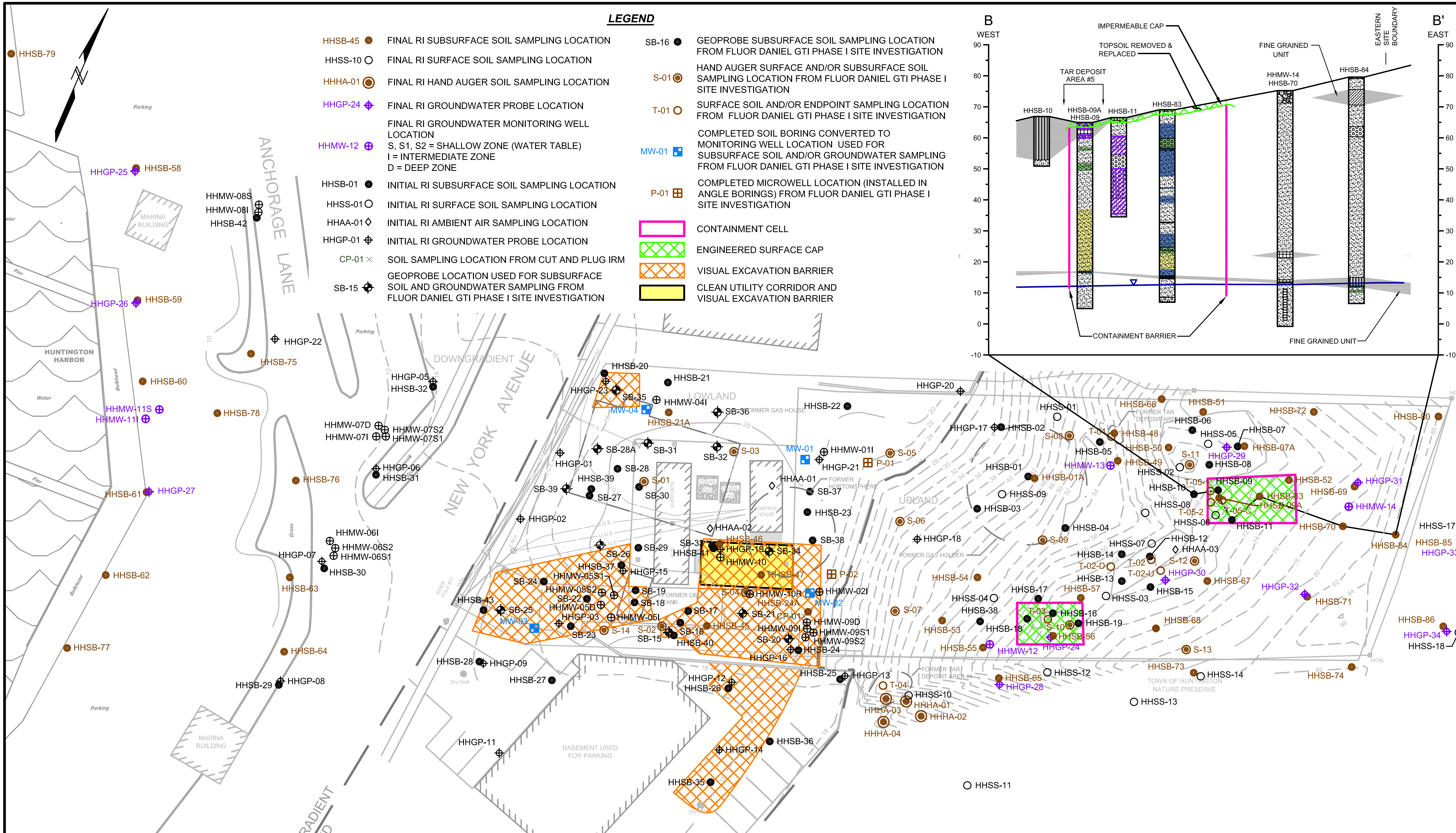
Project 982482-18-2801

**CONCEPTUAL MODEL**

March 2006

Figure 3-3

KEYSPAN\HALESITE\RAP\HALESITE-CONCEPTUAL.dwg




HALESITE FORMER MGP SITE
HALESITE, NEW YORK

KEYSPAN CORPORATION

GEI Consultants

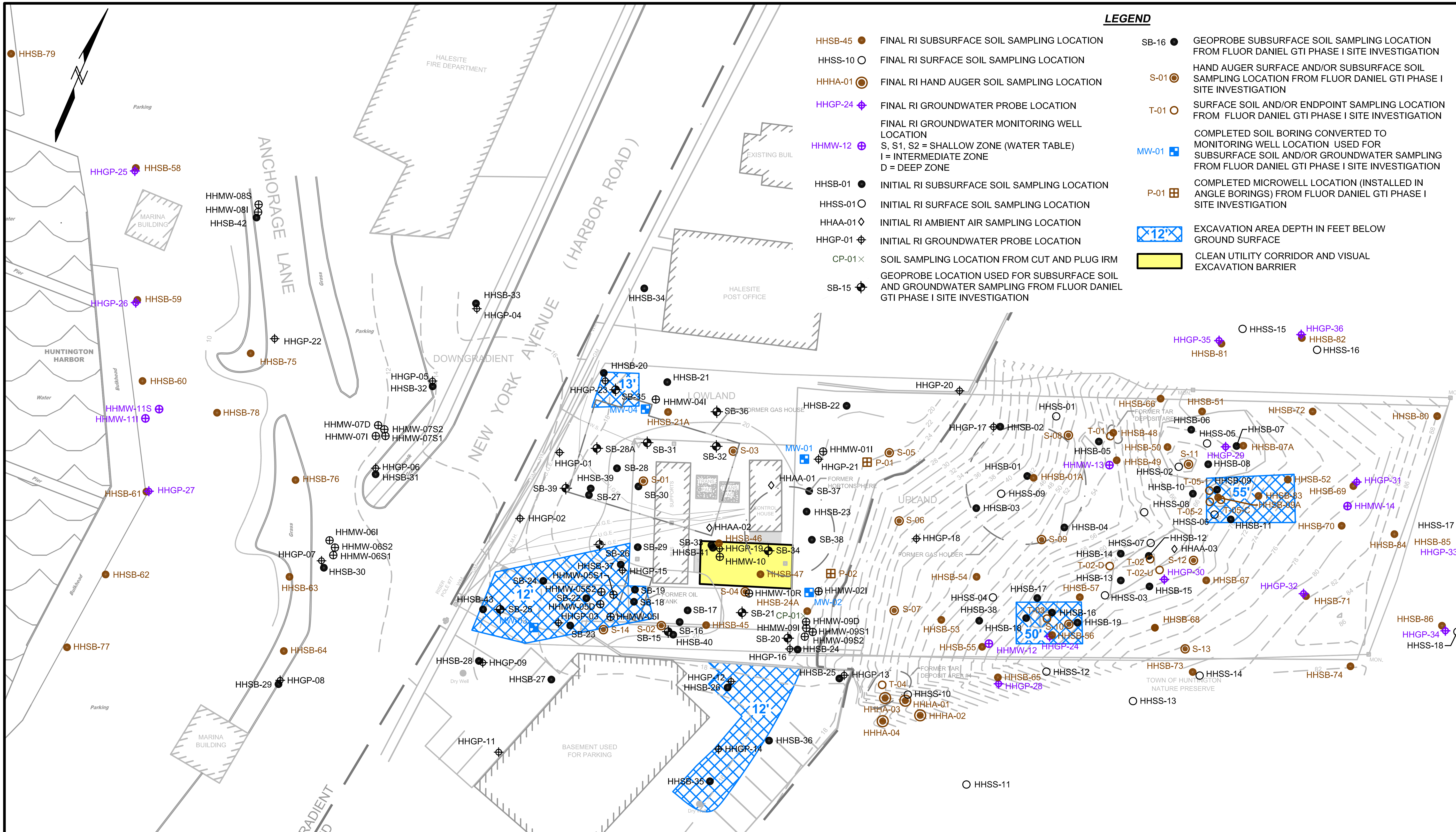
Project 982482-18-2801

**ALTERNATIVE 1**

March 2006

Figure 7-1

KEYSPAN\HALESITE\RAP\HALESITE-REMEDIAL ALTERNATIVES 1&3.dwg




HALESITE FORMER MGP SITE
HALESITE, NEW YORK

KEYSPAN CORPORATION

GEI Consultants

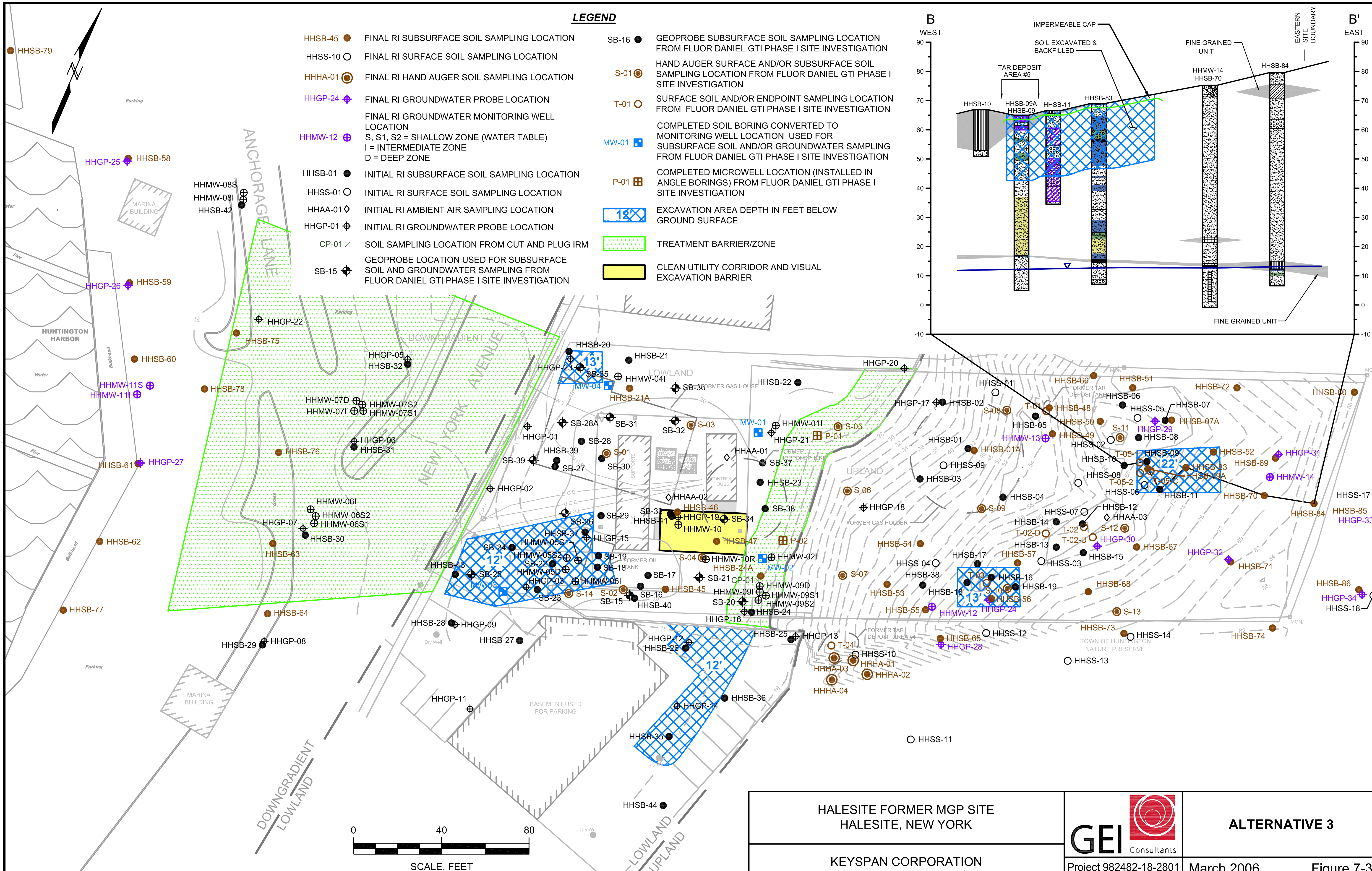
Project 982482-18-2801

**ALTERNATIVE 2**

March 2006

Figure 7-2

KEYSPAN\HALESITE\RAP\HALESITE-REMEDIAL ALTERNATIVES 2&4.dwg




HALESITE FORMER MGP SITE
HALESITE, NEW YORK

KEYSPAN CORPORATION

GEI Consultants

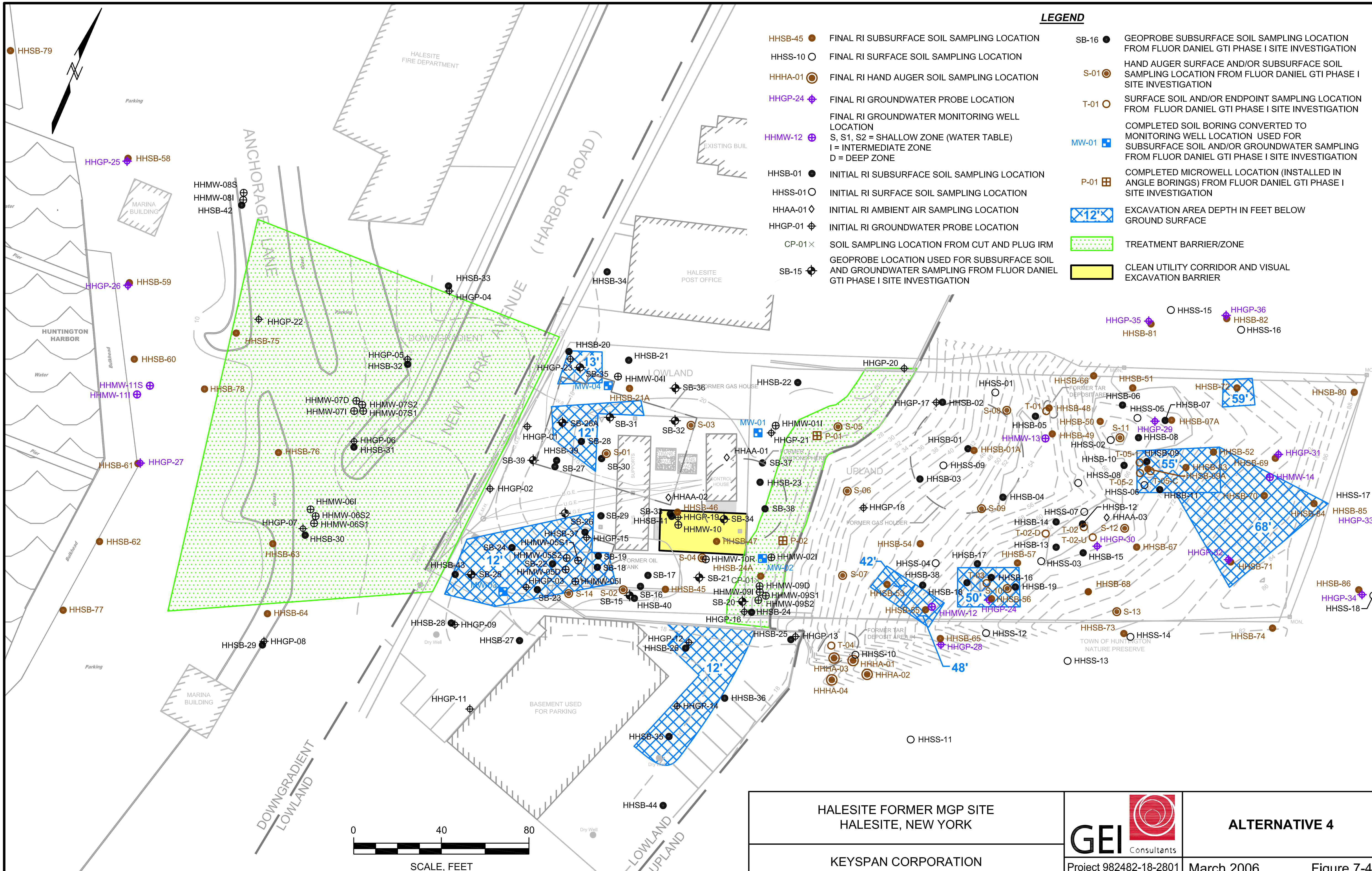
Project 982482-18-2801

ALTERNATIVE 3

March 2006

Figure 7-3

KEYSPAN\HALESITE\RAP\HALESITE-REMEDIAL ALTERNATIVES 1&3.dwg



KEYSPAN\HALESITE\RAP\HALESITE-REMEDIAL ALTERNATIVES 2&4.dwg

# Appendix A

## Remedial Alternative Cost Estimates

**Table A-1**
**Detailed Cost Estimate for Remedial Alternative 1**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Component | Unit | Unit Price | Remedial Alternative 1 Containment and Cap Quantity | Total Cost |
|---|---|---|---|---|
| **COMMON COST COMPONENTS** | | | | |
| ***Preconstruction*** | | | | |
| 1 Engineering Design, Plans, Specs, Bid | Lump Sum | $ 200,000 | 1 | $ 200,000 |
| 2 Permitting and Regulatory submittals | Lump Sum | $ 61,000 | 1 | $ 61,000 |
| 3 Pre Construction Analytical Sampling | Lump Sum | $ 65,000 | 1 | $ 65,000 |
| | | | **Subtotal** | $ 326,000 |
| | | | **% Total Costs** | 10% |
| ***Construction Management*** | | | | |
| 1 Construction Oversight | Day | $ 1,044 | 60 | $ 62,640 |
| 2 Air Monitoring during construction | Day | $ 780 | 60 | $ 46,800 |
| 3 Air Monitoring System | Month | $ 30,000 | 2 | $ 60,000 |
| 4 Site Survey (Preconstruction and Post-Remediation) | Acre | $ 5,000 | 1 | $ 5,000 |
| | | | **Subtotal** | $ 174,440 |
| | | | **% Total Costs** | 5% |
| ***General Conditions*** | | | | |
| 1 Mobilization/Demobilization | Lump Sum | $ 150,000 | 1 | $ 150,000 |
| 2 Site Preparation (fence and shrub removal) | Lump Sum | $ 25,000 | 1 | $ 25,000 |
| 3 Temporary Offices for construction period +3 months | Month | $ 3,000 | 5 | $ 15,000 |
| 4 Temporary Utilities | Lump Sum | $ 15,000 | 1 | $ 15,000 |
| | | | **Subtotal** | $ 205,000 |
| | | | **% Total Costs** | 6% |
| **REMEDIAL COMPONENTS** | | | | |
| ***Upland Area:*** | | | | |
| 1 Spot Excavations to remove surface/shallow obstructions | Cubic Yard | $ 37 | 93 | $ 3,441 |
| 2 Water Tight Sheeting (60 foot depth) | Square Feet | $ 50 | 12,080 | $ 604,000 |
| 3 Engineered Surface Cap | Square Feet | $ 34 | 1,262 | $ 43,337 |
| 4 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 35,000 | 1 | $ 35,000 |
| 5 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 6 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 140 | $ 11,200 |
| ***Lowland Area:*** | | | | |
| 1 Spot Excavations to remove surface/shallow obstructions | Cubic Yard | $ 37 | 397 | $ 14,689 |
| 2 Visual Excavation Barrier | 400 SQ FT | $ 40 | 11 | $ 454 |
| 3 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 4 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 5 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 595 | $ 47,600 |
| 6 Backfill all excavations | Cubic Yard | $ 30 | 397 | $ 11,910 |
| ***Office Building Area:*** | | | | |
| 1 Spot Excavations to remove surface/shallow obstructions | Cubic Yard | $ 37 | 163 | $ 6,031 |
| 2 Visual Excavation Barrier | 400 SQ FT | $ 40 | 5 | $ 220 |
| 3 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 4 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 5 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 244 | $ 19,520 |
| 6 Backfill all excavations | Cubic Yard | $ 30 | 93 | $ 2,790 |
| 7 Replace Paving | Square Feet | $ 30 | 2,199 | $ 65,970 |
| | | | **Subtotal** | $ 849,131 |
| | | | **% Total Costs** | 27% |
| ***Long term monitoring and maintenance*** | | | | |
| 1 Periodic Monitoring, Reporting, Disposal and Maintenance | Year | $ 65,000 | 30 | $ 999,209 |
| assume I=5% | | | **Subtotal** | $999,209 |
| | | | **% Total Costs** | 31% |
| | | | | |
| **REMEDIAL COST SUMMARY** | | | | |
| Total Capital costs without contingency | | | | $ 1,554,571 |
| Total O & M costs | | | | $ 999,209 |
| Total Capital and O&M costs without contingency | | | | $ 2,553,781 |
| Contingency (25%) | | | 25% | $ 638,445 |
| | | | **% TOTAL COSTS** | 20% |
| | | | **TOTAL COST** | **$ 3,192,226** |

**Table A-2**
**Detailed Cost Estimate for Remedial Alternative 2**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Component | Unit | Unit Price | Remedial Alternative 2 Deep Source Area Excavations Quantity | Total Cost |
|---|---|---|---|---|
| **COMMON COST COMPONENTS** | | | | |
| ***Preconstruction*** | | | | |
| 1 Engineering Design, Plans, Specs, Bid | Lump Sum | $ 200,000 | 1 | $ 200,000 |
| 2 Permitting and Regulatory submittals | Lump Sum | $ 110,000 | 1 | $ 110,000 |
| 3 Pre Construction Analytical Sampling | Lump Sum | $ 65,000 | 1 | $ 65,000 |
| | | | **Subtotal** | $ 375,000 |
| | | | **% Total Costs** | 7% |
| ***Construction Management*** | | | | |
| 1 Construction Oversight | Day | $ 1,044 | 95 | $ 99,180 |
| 2 Air Monitoring during construction | Day | $ 780 | 95 | $ 74,100 |
| 3 Air Monitoring System | Month | $ 30,000 | 5 | $ 144,000 |
| 4 Site Survey (Preconstruction and Post-Remediation) | Acre | $ 5,000 | 1 | $ 5,000 |
| | | | **Subtotal** | $ 322,280 |
| | | | **% Total Costs** | 6% |
| ***General Conditions*** | | | | |
| 1 Mobilization/Demobilization | Lump Sum | $ 150,000 | 1 | $ 150,000 |
| 2 Site Preparation (fence and shrub removal) | Lump Sum | $ 25,000 | 1 | $ 25,000 |
| 3 Temporary Offices for construction period +3 months | Month | $ 3,000 | 8 | $ 23,400 |
| 4 Temporary Utilities | Lump Sum | $ 15,000 | 1 | $ 15,000 |
| | | | **Subtotal** | $ 213,400 |
| | | | **% Total Costs** | 4% |
| **REMEDIAL COMPONENTS** | | | | |
| ***Upland Area:*** | | | | |
| 1 Excavations to remove impacted materials (55-50 foot depth) | Cubic Yard | $ 25 | 2,476 | $ 61,900 |
| 2 Standard Sheeting with Tiebacks | Square Feet | $ 60 | 14,170 | $ 850,200 |
| 3 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 35,000 | 1 | $ 35,000 |
| 4 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 5 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 3,714 | $ 297,120 |
| 6 Backfill all excavations | Cubic Yard | $ 30 | 2,476 | $ 74,280 |
| ***Lowland Area:*** | | | | |
| 1 Unsaturated Excavations to remove impacted materials | Cubic Yard | $ 25 | 521 | $ 13,025 |
| 2 Saturated Excavations to remove impacted materials | Cubic Yard | $ 30 | 569 | $ 17,070 |
| 3 Dewatering and Treatment | Day | $ 4,500 | 10 | $ 45,000 |
| 4 Standard Sheeting & Underpinning | Square Feet | $ 50 | 1,650 | $ 82,500 |
| 5 Standard Sheeting | Square Feet | $ 35 | 1,650 | $ 57,750 |
| 6 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 7 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 8 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 1,806 | $ 144,456 |
| 9 Backfill all excavations | Cubic Yard | $ 30 | 1,090 | $ 32,700 |
| ***Office Building Area:*** | | | | |
| 1 Unsaturated Excavations to remove impacted materials | Cubic Yard | $ 25 | 489 | $ 12,225 |
| 2 Saturated Excavations to remove impacted materials | Cubic Yard | $ 30 | 489 | $ 14,670 |
| 3 Dewatering and Treatment | Day | $ 3,500 | 17 | $ 60,034 |
| 4 Sheeting & Underpinning | Square Feet | $ 50 | 1,650 | $ 82,500 |
| 5 Office Building Column Support | Linear Feet | $ 100 | 360 | $ 36,000 |
| 6 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 7 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 8 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 1,613 | $ 129,040 |
| 9 Backfill all excavations | Cubic Yard | $ 30 | 978 | $ 29,340 |
| | | | **Subtotal** | $ 2,123,750 |
| | | | **% Total Costs** | 42% |
| ***Long term monitoring and maintenance*** | | | | |
| 1 Periodic Monitoring, Reporting, Disposal and Maintenance | Year | $ 65,000 | 30 | $ 999,209 |
| assume I=5% | | | **Subtotal** | $999,209 |
| | | | **% Total Costs** | 20% |
| | | | | |
| **REMEDIAL COST SUMMARY** | | | | |
| Total Capital costs without contingency | | | | $ 3,034,430 |
| Total O & M costs | | | | $ 999,209 |
| Total Capital and O&M costs without contingency | | | | $ 4,033,639 |
| Contingency (25%) | | | 25% | $ 1,008,410 |
| | | | **% TOTAL COSTS** | 20% |
| | | | **TOTAL COST** | **$ 5,042,049** |

**Table A-3**
**Detailed Cost Estimate for Remedial Alternative 3**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Component | Unit | Unit Price | Remedial Alternative 3 Shallow Source Excavation and Treatment Zone Quantity | Total Cost |
|---|---|---|---|---|
| **COMMON COST COMPONENTS** | | | | |
| ***Preconstruction*** | | | | |
| 1 Engineering Design, Plans, Specs, Bid | Lump Sum | $ 200,000 | 1 | $ 200,000 |
| 2 Permitting and Regulatory submittals | Lump Sum | $ 61,000 | 1 | $ 61,000 |
| 3 Pre Construction Analytical Sampling | Lump Sum | $ 65,000 | 1 | $ 65,000 |
| | | | **Subtotal** | $ 326,000 |
| | | | **% Total Costs** | 7% |
| ***Construction Management*** | | | | |
| 1 Construction Oversight | Day | $ 1,044 | 80 | $ 83,520 |
| 2 Air Monitoring during construction | Day | $ 780 | 80 | $ 62,400 |
| 3 Air Monitoring System | Month | $ 30,000 | 4 | $ 120,000 |
| 4 Site Survey (Preconstruction and Post-Remediation) | Acre | $ 5,000 | 1 | $ 5,000 |
| | | | **Subtotal** | $ 270,920 |
| | | | **% Total Costs** | 6% |
| ***General Conditions*** | | | | |
| 1 Mobilization/Demobilization | Lump Sum | $ 150,000 | 1 | $ 150,000 |
| 2 Site Preparation (fence and shrub removal) | Lump Sum | $ 25,000 | 1 | $ 25,000 |
| 3 Temporary Offices for construction period +3 months | Month | $ 3,000 | 7 | $ 21,000 |
| 4 Temporary Utilities | Lump Sum | $ 15,000 | 1 | $ 15,000 |
| | | | **Subtotal** | $ 211,000 |
| | | | **% Total Costs** | 5% |
| **REMEDIAL COMPONENTS** | | | | |
| ***Upland Area:*** | | | | |
| 1 Excavations to remove impacted materials (22-13 foot depth) | Cubic Yard | $ 25 | 859 | $ 21,475 |
| 4 Standard Sheeting | Square Feet | $ 35 | 5,860 | $ 205,100 |
| 3 Engineered Surface Cap | Square Feet | $ 34 | 1,262 | $ 43,337 |
| 4 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 35,000 | 1 | $ 35,000 |
| 5 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 6 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 1,289 | $ 103,120 |
| 7 Backfill all excavations | Cubic Yard | $ 30 | 859 | $ 25,770 |
| ***Lowland Area:*** | | | | |
| 1 Unsaturated Excavations to remove impacted materials | Cubic Yard | $ 25 | 521 | $ 13,025 |
| 2 Saturated Excavations to remove impacted materials | Cubic Yard | $ 30 | 569 | $ 17,070 |
| 3 Dewatering and Treatment | Day | $ 3,500 | 24 | $ 82,979 |
| 4 Standard Sheeting & Underpinning | Square Feet | $ 50 | 1,650 | $ 82,500 |
| 5 Standard Sheeting | Square Feet | $ 35 | 1,650 | $ 57,750 |
| 6 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 7 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 8 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 1,806 | $ 144,456 |
| 9 Backfill all excavations | Cubic Yard | $ 30 | 1,090 | $ 32,700 |
| ***Office Building Area:*** | | | | |
| 1 Unsaturated Excavations to remove impacted materials | Cubic Yard | $ 25 | 489 | $ 12,225 |
| 2 Saturated Excavations to remove impacted materials | Cubic Yard | $ 30 | 489 | $ 14,670 |
| 3 Dewatering and Treatment | Day | $ 3,500 | 17 | $ 60,034 |
| 4 Standard Sheeting & Underpinning | Square Feet | $ 50 | 1,650 | $ 82,500 |
| 5 Office Building Column Support | Linear Feet | $ 100 | 360 | $ 36,000 |
| 6 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 7 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 8 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 1,613 | $ 129,040 |
| 9 Backfill all excavations | Cubic Yard | $ 30 | 978 | $ 29,340 |
| ***Treatment System*** | | | | |
| 1 Treatment System Pilot Test, Install | Lump Sum | $ 100,000 | 1 | $ 100,000 |
| | | | **Subtotal** | $ 1,377,031 |
| | | | **% Total Costs** | 31% |
| ***Long term monitoring and maintenance*** | | | | |
| 1 Periodic Monitoring, Reporting, System O&M, Disposal and Maintenance | Year | $ 90,000 | 30 | $ 1,383,521 |
| assume I=5% | | | **Subtotal** | $1,383,521 |
| | | | **% Total Costs** | 31% |
| | | | | |
| **REMEDIAL COST SUMMARY** | | | | |
| Total Capital costs without contingency | | | | $ 2,184,951 |
| Total O & M costs | | | | $ 1,383,521 |
| Total Capital and O&M costs without contingency | | | | $ 3,568,472 |
| Contingency (25%) | | | 25% | $ 892,118 |
| | | | **% TOTAL COSTS** | 20% |
| | | | **TOTAL COST** | **$ 4,460,589** |

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J:\WPROC\Project\KEYSPAN\Halesite\Remedial Action Plan\
Halesite Table A-1 to A-5 122805.xls

**Table A-4**
**Detailed Cost Estimate for Remedial Alternative 4**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Component | Unit | Unit Price | Remedial Alternative 4 Tar Saturated Soil Excavation/Treatment Zone Quantity | Total Cost |
|---|---|---|---|---|
| **COMMON COST COMPONENTS** | | | | |
| ***Preconstruction*** | | | | |
| 1 Engineering Design, Plans, Specs, Bid | Lump Sum | $ 200,000 | 1 | $ 200,000 |
| 2 Permitting and Regulatory submittals | Lump Sum | $ 110,000 | 1 | $ 110,000 |
| 3 Pre Construction Analytical Sampling | Lump Sum | $ 65,000 | 1 | $ 65,000 |
| | | | **Subtotal** | $ 375,000 |
| | | | **% Total Costs** | 3% |
| ***Construction Management*** | | | | |
| 1 Construction Oversight | Day | $ 1,044 | 260 | $ 271,440 |
| 2 Air Monitoring during construction | Day | $ 780 | 260 | $ 202,800 |
| 3 Air Monitoring System | Month | $ 30,000 | 13 | $ 390,000 |
| 4 Site Survey (Preconstruction and Post-Remediation) | Acre | $ 5,000 | 1 | $ 5,000 |
| | | | **Subtotal** | $ 869,240 |
| | | | **% Total Costs** | 8% |
| ***General Conditions*** | | | | |
| 1 Mobilization/Demobilization | Lump Sum | $ 150,000 | 1 | $ 150,000 |
| 2 Site Preparation (fence and shrub removal) | Lump Sum | $ 25,000 | 1 | $ 25,000 |
| 3 Temporary Offices for construction period +3 months | Month | $ 3,000 | 16 | $ 48,000 |
| 4 Temporary Utilities | Lump Sum | $ 15,000 | 1 | $ 15,000 |
| | | | **Subtotal** | $ 238,000 |
| | | | **% Total Costs** | 2% |
| **REMEDIAL COMPONENTS** | | | | |
| ***Upland Area:*** | | | | |
| 2 Excavations to remove impacted materials | Cubic Yard | $ 30 | 8,576 | $ 257,280 |
| 3 Standard Sheeting Material Costs | Square Feet | $ 85 | 40,665 | $ 3,456,525 |
| 4 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 35,000 | 1 | $ 35,000 |
| 5 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 6 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 12,864 | $ 1,029,120 |
| 7 Backfill all excavations | Cubic Yard | $ 30 | 8,576 | $ 257,280 |
| ***Lowland Area:*** | | | | |
| 1 Unsaturated Excavations to remove impacted materials | Cubic Yard | $ 25 | 607 | $ 15,175 |
| 2 Saturated Excavations to remove impacted materials | Cubic Yard | $ 30 | 741 | $ 22,230 |
| 3 Dewatering and Treatment | Day | $ 3,500 | 25 | $ 87,364 |
| 4 Standard Sheeting | Square Feet | $ 35 | 1,650 | $ 57,750 |
| 5 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 6 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 7 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 5,223 | $ 417,840 |
| 8 Backfill all excavations | Cubic Yard | $ 30 | 1,348 | $ 40,440 |
| ***Office Building Area:*** | | | | |
| 1 Unsaturated Excavations to remove impacted materials | Cubic Yard | $ 25 | 489 | $ 12,225 |
| 2 Saturated Excavations to remove impacted materials | Cubic Yard | $ 30 | 489 | $ 14,670 |
| 3 Dewatering and Treatment | Day | $ 3,500 | 17 | $ 60,034 |
| 4 Standard Sheeting & Underpinning | Square Feet | $ 50 | 1,650 | $ 82,500 |
| 5 Office Building Column Support | Linear Feet | $ 100 | 360 | $ 36,000 |
| 6 NAPL recovery system - 3 wells, storage, handling system and disposal | Lump Sum | $ 20,000 | 1 | $ 20,000 |
| 7 Disposal Costs and Hauling of Bulky Waste | Ton | $ 149 | 20 | $ 2,980 |
| 8 Disposal Costs Hauling and Thermal Treatment | Ton | $ 80 | 1,613 | $ 129,040 |
| 9 Backfill all excavations | Cubic Yard | $ 30 | 978 | $ 29,340 |
| ***Treatment System*** | | | | |
| 1 Treatment System Pilot Test, Install | Lump Sum | $ 100,000 | 1 | $ 100,000 |
| | | | **Subtotal** | $ 6,188,753 |
| | | | **% Total Costs** | 55% |
| ***Long term monitoring and maintenance*** | | | | |
| 1 Periodic Monitoring, Reporting, System O&M, Disposal and Maintenance | Year | $ 90,000 | 30 | $ 1,383,521 |
| assume I=5% | | | **Subtotal** | $1,383,521 |
| | | | **% Total Costs** | 12% |
| | | | | |
| **REMEDIAL COST SUMMARY** | | | | |
| Total Capital costs without contingency | | | | $ 7,670,993 |
| Total O & M costs | | | | $ 1,383,521 |
| Total Capital and O&M costs without contingency | | | | $ 9,054,513 |
| Contingency (25%) | | | 25% | $ 2,263,628 |
| | | | **% TOTAL COSTS** | 20% |
| | | | **TOTAL COST** | **$ 11,318,141** |

**Table A-5**
**Detailed Cost Estimate for Remedial Alternative 5**
**Halesite Former MGP Site**
**Halesite, New York**

| Remedial Component | Unit | Unit Price | Remedial Alternative 5 Institutional Controls Quantity | Total Cost |
|---|---|---|---|---|
| ***Long term monitoring and maintenance*** | | | | |
| 1 Periodic Monitoring, Reporting, Disposal and Maintenance | Year | $ 65,000 | 30 | $ 999,209 |
| assume I=5% | | | **Subtotal** | $999,209 |
| | | | **% Total Costs** | 80% |
| | | | | |
| **REMEDIAL COST SUMMARY** | | | | |
| Total Capital costs without contingency | | | | $ - |
| Total O & M costs | | | | $ 999,209 |
| Total Capital and O&M costs without contingency | | | | $ 999,209 |
| Contingency (25%) | | | 25% | $ 249,802 |
| | | | **% TOTAL COSTS** | 20% |
| | | | **TOTAL COST** | **$ 1,249,012** |