REVISED FINAL
FOCUSED FEASIBILITY STUDY REPORT
SARANAC LAKE GAS COMPANY
OPERABLE UNIT NO. 01
SITE # 516008

WORK ASSIGNMENT NO. D007619-23

Prepared for:

New York State Department of Environmental Conservation
Ray Brook, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC: 3612132271

JANUARY 2016

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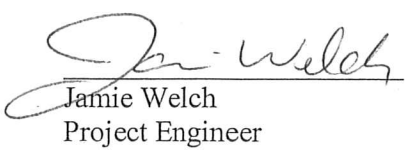

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	contaminants of concern
cy	cubic yard
DNAPL	dense non-aqueous phase liquid
EC	engineering control
FFS	Focused Feasibility Study
FS	Feasibility Study
GCL	geocomposite clay layer
GHG	greenhouse gas
IC	institutional control
ISS	In-Situ Solidification
MACTEC	MACTEC Engineering and Consulting, P.C.
MGP	manufactured gas plant
NAPL	non-aqueous phase liquid
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
O&M	operation and maintenance
OMB	Office of Management and Budget
ORC	oxygen-release compound

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

OU	operable unit
PAHs	polycyclic aromatic hydrocarbons
PID	photoionization detector
PW	present worth
RAO	Remedial Action Objective
RI	Remedial Investigation
SB	soil bentonite
SCGs	standards, criteria, and guidance values
SCOs	Soil Cleanup Objectives
SF	square feet
Site	Saranac Lake Gas Company site
SMP	Site Management Plan
SVOC	semivolatile organic compound
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WA	work assignment

1.0 INTRODUCTION

This Focused Feasibility Study (FS [FFS]) Report has been prepared by MACTEC Engineering and Consulting, P.C. (MACTEC), in response to Work Assignment (WA) No. D007619-23 from the New York State (NYS) Department of Environmental Conservation (NYSDEC) for Operable Unit (OU) 01 (site Property) of the former Saranac Lake Gas Company site (Site) in the Village of Saranac Lake of North Elba, Essex County, New York (Figure 1.1).

The FFS has been conducted in accordance with the WA, as well as with applicable portions of the following documents:

- NYSDEC DER-10 "Technical Guidance for Site Investigation and Remediation" (NYSDEC, 2010)
- 6 New York Codes, Rules, and Regulations Part 375 "Environmental Remediation Programs"
- United States Environmental Protection Agency (USEPA) "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (USEPA, 1988)

The site is a Class 2 site. The remedial investigation (RI) completed by MACTEC in 2015 (MACTEC, 2015) concluded that manufactured gas plant (MGP)-related contamination was detected in soil and groundwater at OU01 and remedial action is necessary for unrestricted use. OU01 consists of the former MGP-related structures and Site property (see Figure 1.2).

1.1 PURPOSE

The purpose of this FFS Report is to develop and evaluate remedial action alternatives for MGP-related contaminants detected in soil and groundwater at OU01. Remedial action alternatives for impacted sediments at Brandy Brook and Lake Flower have been evaluated under separate FS reports for OU02 and OU03 respectively.

The approach to the FFS involves integration of data and conclusions presented in the RI Report (MACTEC, 2015), with development, screening, and evaluation of proposed remedial alternatives

from engineering, environmental, public health, and economic perspectives. This FFS Report is organized into the following sections.

- Section 1.0 – Introduction
- Section 2.0 – Summary and Conclusions of OU01 Remedial Investigation
- Section 3.0 – Development of Remedial Action Goals and Objectives
- Section 4.0 – Identification of General Response Actions and Extent of Contamination Requiring Remedial Action
- Section 5.0 – Identification and Screening of Technologies
- Section 6.0 – Development and Screening of Alternatives
- Section 7.0 – Detailed Analysis of Alternatives
- Section 8.0 – Comparative Analysis
- Section 9.0 – References

2.0 SUMMARY AND CONCLUSIONS OF THE REMEDIAL INVESTIGATION

The RI Report (MACTEC, 2015) documents the investigation activities completed from August 2013 through October 2014 at the Site for all OUs (as shown in Figure 1.1):

- OU01 – Site property (the former MGP property);
- OU02 – Brandy Brook (the section of brook from OU01 to Pontiac Bay in Lake Flower); and
- OU03 – Pontiac Bay of Lake Flower.

The former Saranac Lake Gas Company manufactured lighting gas through the coal gasification process for the Village of Saranac Lake. According to Sanborn insurance maps and photos obtained from the town library, the MGP likely operated until the 1930s or 1940s and included two above ground gas holders, a building housing the purifier and retort (heating) operations, as well as additional areas for coal storage and offices.

Based on the operational age of this MGP site, the most likely method of gas manufacturing was via the Carbureted Water Gas process. In general, this method involved:

- Coal heated in closed retorts in which the coal was prevented from combusting by limiting the oxygen.
- During the heating process steam was injected into the retort and a chemical reaction occurred that produced a flammable gas mixture.
- Liquid petroleum hydrocarbons were sprayed into the hot gas mixture creating additional methane.
- The gas was collected, cooled, and purified before being used.
- Condensed tar (coal-tar) was produced as a by-product.

OU01 is approximately 4.5 acres in size and is located east of, and adjacent to the Adirondack Scenic Railroad. Residential properties border OU01 to the north, east, and part of the west side and North Country Community College soccer fields and facilities border OU01 to the south. An access road extends from Payville Road west to the former gas plant setting. The Site and surrounding area is serviced by public water; therefore, groundwater is not believed to be used as a source of drinking water. Currently, OU01 is a vacant lot with an open, unoccupied one story brick

building. A figure showing existing and historical MGP-related features within OU01 is provided as Figure 1.2.

Investigations conducted between 2007 and 2014 revealed the presence of MGP-related contamination within OU01 soil and groundwater; OU02 sediment in Brandy Brook between the OU01 property and Pontiac Bay; and OU03 sediment within Pontiac Bay and extending further into Lake Flower. MGP-related contamination in sediment was not observed upgradient of OU01.

Contaminants of Concern: The by-products resulting from manufacturing of coal gas contain a number of different chemical constituents that are a cause for concern when left untreated in the environment. The following contaminants of concern (COCs) are a result of the coal tar producing MGP process:

- Coal-tar includes two predominant contaminant classifications, volatile organic compounds (VOCs) and semi-VOCs (SVOCs).
    - MGP-related VOCs are specifically characterized by four compounds; benzene, toluene, ethylbenzene and xylene (BTEX) compounds. BTEX compounds often represent a small percentage of the mass of MGP-related waste, but are the most soluble and therefore are the most likely to migrate in groundwater. BTEX are also the most volatile and are thus the most likely to migrate through subsurface soils as vapors or soil gas.
    - SVOCs found in coal-tar are known as polycyclic aromatic hydrocarbons (PAHs). Naphthalene, a PAH, is present in coal-tar in relatively high concentrations and was used as an indicator compound for detecting MGP-related waste in media.

OU01 Soil Results: Section 4.1 of the RI Report (MACTEC, 2015) presents the findings of the OU01 RI. Soils throughout OU01 show evidence of impact from MGP-related contamination. Soil contamination was evaluated primarily based on field observations, (visual, olfactory and photoionization detector (PID) readings). Select boring logs from the RI are presented in Appendix A and include: two boring logs indicative of purifier box waste impacts; two boring logs indicative of MGP-impacted soil; and two boring logs with no observable MGP impacts. A subset of the samples collected for screening (both with and without observed impacts) were submitted for laboratory analysis for confirmation. MGP-impacted soil and contaminant concentrations throughout OU01 exceed the Residential, Commercial and Industrial Soil Cleanup Objectives (SCOs) for BTEX and PAH compounds. Dense non-aqueous phase liquid (DNAPL) or product was present in 27 of the 54 borings advanced during the RI.

The interpreted extent of visually impacted soils (i.e., source area) is presented three-dimensionally in Figures 2.1A and 2.1B, and two-dimensionally in Figure 2.2. Figure 2.2 shows the lateral extent of MGP-impacted soil (red and yellow dashed line), the area where purifier box waste (typically wood chips and/or cyanide staining [blue dashed line]) were observed, and also includes the estimated extent of soil with any visual/olfactory evidence of MGP impacts (gray dashed line). In this case, visual/olfactory evidence of MGP impacts were used to estimate the extent of soil with detectable PAH concentrations. The representations of visually impacted soils are complemented by Figure 2.3, which presents the extent of PAHs detected in select soil samples compared to the SCOs Criteria from Subpart 375-6.8(b).

This interpretation of the extent of visual MGP-impacted soil in OU01 is estimated to be approximately 38,500 cubic yards (cy). This volume is based on variable soil thicknesses throughout the impacted area as shown on the three-dimensional figures (Figures 2.1A and 2.1B). The majority of the source area is located within the fenced perimeter of the Site, with a portion extending beyond the fence to the north and south. Field screening indicated the greatest extent of MGP-impact was generally present between eight feet and 20 feet below ground surface (bgs), but varies throughout the impacted area.

In addition to BTEX and PAH compounds, soil concentrations of cyanide, arsenic, and lead also exceeded SCOs, but to a much lesser extent (refer to RI Report, Appendix F).

OU01 Groundwater Results: Depth to groundwater at OU01 ranges from five to ten feet bgs. Sixteen groundwater samples were collected from monitoring wells within OU01 as part of the RI. Naphthalene was detected at concentrations exceeding the standards, criteria, and guidance value (SCG) in seven of the 16 monitoring wells and one or more of the BTEX compounds were detected at concentrations exceeding the SCG in nine of the 16 monitoring wells. The extent of groundwater contamination using benzene and naphthalene as indicator compounds suggest that MGP-related contamination is migrating southward from the OU01 source area. The main component of groundwater flow from the Site appears to be migrating towards wetlands located to the south of OU01. Groundwater contamination to the south of the Site is observed at depth (15 to 25 feet bgs). Naphthalene was detected at a concentration greater than ten percent of its solubility approximately 300 feet south of the Site at a depth of approximately 25 feet bgs (2,200 milligrams

per liter at MW-205D). Naphthalene was also detected below the SCG from shallow groundwater (approximately 15 feet bgs) at the same location (MW-205S).

Cyanide was the only Site-related inorganic COC, detected at a concentration in groundwater exceeding its SCG within the interpreted OU01 source area and show limited migration with concentrations decreasing with distance from the source area. Iron and manganese were also detected in groundwater at concentrations exceeding their SCGs; however, iron and manganese are naturally occurring in the environment, are not contaminants associated with MGP process and were not detected in OU01 soil above the SCOs; therefore these metals are not considered COCs for this site. Additional details and figures related to groundwater contamination are provided in the RI report.

3.0 DEVELOPMENT OF REMEDIAL ACTION GOALS AND OBJECTIVES

The RI concluded that under current and projected future use scenarios, complete exposure pathways for soil include:

1. Current potential of direct exposure with VOC and PAH impacted surface soils (within one foot of the ground surface). The site is surrounded by a fence which would limit this exposure to trespassers;
2. Future potential of direct exposure with VOC and PAH impacted surface and subsurface soils in the event that the property is sold and/or redeveloped; and
3. Future potential of indoor air intrusion in the event that a building is placed over the VOC and PAH impacted surface soil.

Therefore, the Remedial Action Objectives (RAOs) for soil at OU01 are:

- Restore site soils to pre-disposal/pre-release conditions, to the extent practicable. If restoration to pre-release conditions is impractical then the following:
    - Prevent or eliminate direct exposure to MGP waste and contaminated soil by current and future human receptors;
    - Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil; and
    - Prevent migration of contaminants that would result in groundwater contamination.

Groundwater at and in the vicinity of the Site is contaminated above NYS drinking water standards. However, the area is serviced by public water and therefore, groundwater is not believed to be used as a source of drinking water. Therefore, the groundwater pathway as a drinking water source is not a complete exposure pathway of concern under the existing land uses. Direct contact with contaminated groundwater is possible if subsurface construction is conducted within the area of the overburden groundwater plume (depth to groundwater at the Site ranges from five to ten feet bgs) and if impacted groundwater is discharging to the wetlands south of the site.

The RAOs for groundwater are:

- Prevent the ingestion of groundwater with contaminant levels exceeding the drinking water standards
- Prevent contact with or inhalation of volatiles from contaminated groundwater
- Remove or control the source of groundwater contamination

Further, the remediation goals for OU01 include attaining to the extent practicable the following chemical-specific SCGs:

- Commercial SCOs for soil (NYS, 2006)
- Residential SCOs for soil in the top foot bgs (NYS, 2006), or throughout to the extent feasible (NYS, 2006)
- GA Groundwater Quality Standards (NYS, 1999)

4.0 IDENTIFICATION OF GENERAL RESPONSE ACTIONS AND EXTENT OF CONTAMINATION REQUIRING REMEDIAL ACTION

Site-specific RAOs, presented in Section 3, were developed to address the contamination requiring remedial action for OU01 soil and groundwater. General response actions describe those actions that will satisfy the RAOs (USEPA, 1988). General response actions may include treatment, containment, excavation, disposal, institutional actions, or a combination of these. Like RAOs, general response actions are medium-specific. The general response actions presented in the following subsections have been developed to address soil and groundwater contamination at OU01.

4.1 GENERAL RESPONSE ACTIONS

The following general response actions would address the RAOs identified for OU01 soil and groundwater:

- Access Restrictions
- Continued Site Monitoring
- In-Situ Treatment
- Containment / Stabilization
- Removal

These general response actions are appropriate for soil contamination requiring remediation. No Action will also be evaluated for the use of comparing baseline conditions to general response actions and remedial alternatives.

4.2 CONTAMINATION REQUIRING REMEDIAL ACTION

This subsection identifies the distribution of contaminated media to which the RAOs and general response actions will apply. Figures 2.1 A and B presents three dimensional distributions of visually impacted MGP-related soil contamination within OU01. As discussed in the RI Report, soil contamination was evaluated primarily based on field observations (visual, olfactory and PID readings) and a subset of the samples were submitted for laboratory analysis. Based on this data an

estimated 38,500 cy of in-place soil requires remediation to meet Residential SCOs (Figures 2.1A and 2.1B), and the greatest extent of MGP-impact was generally present between eight and 20 feet bgs.

5.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section presents the identification and screening of potential remedial technologies. Technologies are identified for the purpose of attaining the RAOs established in Section 3.

Following identification, candidate technologies are screened based on their applicability to site- and contaminant-limiting characteristics, to produce an inventory of suitable technologies that can be assembled into remedial alternatives capable of mitigating actual or potential risks at the Site. Potential technologies representing a range of general response actions are considered. The result of technology screening is a list of potential remedial technologies that may be developed into candidate remedial alternatives.

5.1 TECHNOLOGY IDENTIFICATION

Table 5.1 lists remedial technologies and associated process options identified for screening. These technologies were identified based on USEPA's guidance for Conducting RI/FS (USEPA, 1988) and on experience preparing FS documents and performing site remediation.

5.2 TECHNOLOGY SCREENING

The technology screening process reduces the number of potentially applicable technologies and process options by evaluating factors that may influence process-option effectiveness and implementability. This overall screening is consistent with guidance for conducting an FS under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA, 1988). Effectiveness and implementability are incorporated into two screening criteria: waste- and site-limiting characteristics. Waste-limiting characteristics consider the suitability of a technology based on contaminant types, individual compound properties (e.g., volatility, solubility, specific gravity, adsorption potential, and biodegradability), and interactions that may occur between mixtures of compounds. Site-limiting characteristics consider the effect of site-specific physical features on the implementability of a technology, such as site topography and geology, the location of buildings and underground utilities, available space, and proximity to sensitive operations. Technology screening serves a two-fold purpose of screening out technologies whose applicability

is limited by site-specific waste or site considerations, while retaining as many potentially applicable technologies as possible.

Table 5.1 presents the technology-screening process. Technologies and process options judged ineffective or prohibitively difficult to implement were eliminated from further consideration. The technologies retained following screening represent an inventory of technologies considered most suitable for remediation of soil and groundwater at the Site and may be used alone or integrated with other technologies to develop remedial alternatives. Pilot-scale treatability studies may be required prior to final technology selection to confirm the effectiveness of a given technology.

The technologies that have been retained for further evaluation for the remediation of soil through the technology-screening process are:

- No Action – Required as a baseline condition to compare to other technologies
- Impermeable Cap– Retained for further evaluation.
- In-Situ Solidification (ISS) – Retained for further evaluation as a stand-alone remedy or in combination with other technologies.
- Excavation – Retained as a stand-alone remedy or in combination with other technologies.

The technologies that have been retained for further evaluation for the remediation of groundwater through the technology-screening process are:

- No Action – Required as a baseline condition to compare to other technologies
- Institutional Controls (ICs) – Viable in conjunction with other remedial technologies.
- Continued Site Monitoring – Viable in conjunction with other remedial technologies.
- Vertical Barrier – Retained for further evaluation.
- Non-aqueous phase liquid (NAPL) Collection System – Viable in conjunction with other remedial technologies.
- Biological Treatment - Viable in conjunction with other remedial technologies.
- Dual Phase Extraction with On-Site Treatment – Viable in conjunction with other remedial technologies.

6.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

The retained technologies are considered technically feasible and applicable to the waste types and physical conditions at OU01. These technologies were assembled into potential Site-specific remedial alternatives capable of achieving the RAOs for the contaminated media requiring remediation.

6.1 DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES FOR THE SITE

Table 6.1 presents a screening of the retained technologies to identify remedial alternatives applicable for the site. Consistent with DER-10, the developed medium-specific remedial alternatives were screened on the basis of whether they are technically implementable for OU01 (Implementability) and whether they have the ability to meet the RAOs (Effectiveness). Additionally, based upon available information, the relative cost of each remedial alternative is also evaluated. Those remedial alternatives which are not technically implementable, would not achieve RAOs for the Site, or would incur costs significantly higher than other remedial alternatives without providing greater effectiveness or implementability, will not be evaluated further. The following subsections provide a brief description of the remedial alternatives retained for detailed evaluation.

6.1.1 No Action

This alternative will be used as a baseline for comparison to other remedial alternatives. No action would be taken to address contaminated soil and groundwater at the Site. No Action has been retained as Alternative 1.

6.1.2 Capping & Vertical Barrier

This alternative will include the installation of a low-permeability vertical barrier wall and low-permeability surface cap over the soil with visual MGP impacts. This alternative will result in eliminating the potential for direct exposure to impacted soil and reduce mobility of contamination

by controlling the source of groundwater contamination. Continued site monitoring or continued site monitoring with biological enhancement will be used to address downgradient groundwater. This alternative has been retained as:

- Alternative 2 – Impermeable Cap and Vertical Barrier with Downgradient Continued Site Monitoring (and Potential Downgradient Biological Enhancement)

6.1.3 In-Situ Solidification

In-Situ Solidification will involve mixing the impacted soil with solidifying or binding agents (such as Portland cement) using an excavator or augers. The soil and binding agents produce a solidified mass resulting in a low permeability solid matrix that reduces or eliminates mobility of contamination by controlling the source of groundwater contamination. The following two solidification alternatives have been retained for detailed analysis:

- Alternative 3A – ISS within Visually Impacted Areas with Continued Site Monitoring Downgradient (and Potential Downgradient Biological Enhancement).
- Alternative 3B – Partial ISS with NAPL collection and Continued Site Monitoring Downgradient (and Potential Downgradient Biological Enhancement).

6.1.4 Excavation

Excavation of impacted soil will involve excavation support, dewatering, excavation, transportation and disposal of soil, backfilling and site restoration, which will result in removal of contaminant mass. The following three excavation alternatives have been retained for detailed analysis:

- Alternative 4A – Excavation within Visually Impacted Areas with Continued Site Monitoring Downgradient (and Potential Downgradient Biological Enhancement).
- Alternative 4B – Partial Excavation with NAPL collection and Continued Site Monitoring Downgradient (and Potential Downgradient Biological Enhancement).
- Alternative 4C – Excavation to Meet Pre-Disposal Conditions with Continued Site Monitoring Downgradient (and Potential Downgradient Biological Enhancement).

6.1.5 Combined Excavation and In-situ Solidification

Combined excavation and solidification will include partial source area excavation, with solidification of the remaining visually impacted areas. This alternative has been retained as:

- Alternative 5 – Combined Excavation and Solidification with Continued Site Monitoring Downgradient (and Potential Downgradient Biological Enhancement).)

7.0 DETAILED ANALYSIS OF ALTERNATIVES

The detailed analysis of each remedial action alternative for OU01 was performed using the evaluation criteria identified in DER-10 (NYSDEC, 2010) and Subpart 375-1.8(f) (NYS, 2006). The evaluation includes, where appropriate, a discussion of limitations, assumptions, and uncertainties for each evaluation criteria and provides a conceptual design of each alternative to support an alternatives-comparison and cost-estimation. Evaluation criteria include:

- Compliance with SCGs
- Overall Protection of Public Health and the Environment
- Short-term Impacts and Effectiveness
- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume with Treatment
- Implementability
- Land Use
- Cost-Effectiveness
- Sustainability / Green Remediation (DER-31)

Compliance with Standards, Criteria, and Guidance. Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance. 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, there will be a discussion and evaluation of the impacts of each, and whether waivers are necessary. Chemical-Specific SCGs were identified in Section 3. Table 7.1 summarizes the list of applicable SCGs used in the evaluation of alternatives. Location- and Action-Specific SCGs will be identified for each alternative in this Section.

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 (ECs) or ICs. The remedy's ability to achieve each of the RAOs will be evaluated.

Short-term Impacts and 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, will be presented, along with a discussion of ECs that will be used to mitigate short term impacts (e.g., contaminant migration/odor control measures). The length of time needed to achieve the remedial objectives will be estimated.

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

1. magnitude of remaining risks
2. adequacy of the ECs/ICs intended to limit the risk
3. reliability of these controls
4. ability of the remedy to continue to meet RAOs in the future

Effectiveness of alternatives in protecting human health and the environment after RAOs are met will be evaluated. This will include an evaluation of the permanence of the alternative, the magnitude of residual risk, and the adequacy and reliability of controls required to manage wastes or residuals remaining at the Site.

Reduction of Toxicity, Mobility, or Volume with Treatment. The remedy's ability to reduce the toxicity, mobility or volume of site contamination will be evaluated. Preference will be given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.

Implementability. The technical and administrative feasibility of implementing the remedy will be 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 will be evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, or other issues.

Land Use. The current, intended, and reasonably anticipated future land uses of the Site and its surroundings will be considered in the evaluation of remedial alternatives.

Cost-Effectiveness. Capital and Site Management costs, including Operation, Maintenance and Monitoring costs, will be estimated for the remedy and presented on a present worth (PW) basis.

Sustainability / Green Remediation (DER-31). DER-31 (NYSDEC, 2011) includes applying green remediation concepts, such as minimizing energy consumption, reducing greenhouse gas (GHG) emissions, maximizing the reuse of land and the recycling of materials, and conserving natural resources such as soil, water and habitat to the extent possible while still implementing remedies that are protective of public health and the environment.

7.1 COST ANALYSIS PROCEDURES

Estimated costs presented in this Report are intended to be within the target accuracy range of minus 30 to plus 50 percent of actual cost (USEPA, 1988). Costs are presented as a PW and as a total cost for up to a 30-year period.

A summary of the costs for each alternative identifying capital and PW costs are included in each alternative's cost description. Each cost estimate includes a PW analysis to evaluate expenditures that occur over different time periods. The analysis discounts future costs to a PW and allows the cost of remedial alternatives to be compared on an equal basis. PW represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover costs associated with the remedial action over its planned life. A discount rate of 3.4 percent, as published by the Office of Management and Budget (OMB), was used to prepare the cost estimates (OMB, 2014).

Consistent with USEPA FS cost estimating guidance (USEPA, 2000), the remedial alternative cost estimates include costs for project management, remedial design, construction management, technical support, and scope contingency.

Project management includes planning and reporting, community relations support during construction or Operation and Maintenance (O&M), bid or contract administration, permitting (not already provided by the construction or O&M contractor), and legal services outside of ICs. Project management cost are generally between 5 and 10 percent of total direct costs.

Remedial design cost includes cost for pre-design collection and analysis of field data, engineering survey for design, treatability study/pilot-scale testing, and the various design components such as design analysis, plans, specifications, cost estimate, and schedule. Remedial design cost is generally between 6 and 20 percent of total direct costs.

Construction management cost includes costs associated with services to manage construction or installation of the remedial action, except similar services provided as part of regular construction activities. Activities include review of submittals, design modifications, construction observation or oversight, engineering survey for construction, preparation of O&M manual, documentation of quality control/quality assurance, and record drawings. Construction management cost is generally between 6 and 15 percent of total direct costs.

Technical support during O&M includes services to monitor, evaluate, and report progress of remedial action. This includes oversight of O&M activities, update of O&M manual, and progress reporting and is generally between 10 percent and 20 percent of total annual O&M costs depending on complexity of the remedial action (USEPA, 2000).

Scope contingency represents project risks associated with the feasibility-level of design presented in this Report. This type of contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial design proceeds. Scope contingency ranges from 10 to 25 percent, with higher values appropriate for alternatives with greater levels of cost growth potential (USEPA, 2000). A contingency of 20% was added to each of the alternatives described herein.

Project management, remedial design, and construction management costs, related to implementation of the chosen remedial alternative, presented in this Report are based upon the following matrix presented in the USEPA FS cost estimating guidance (USEPA, 2000).

Professional and Technical Costs as Percentage of Direct Costs					
Indirect Cost	< $100K (%)	$100K-$500K (%)	$500K-$2M (%)	$2M-$10M (%)	>$10M (%)
Project Management	10	8	6	5	5
Remedial Design	20	15	12	8	6
Construction Management	15	10	8	6	6

7.2 GENERAL ASSUMPTIONS

Alternative-specific details and assumptions pertaining to the cost estimates are included in each alternative's cost description. In addition to the alternative-specific assumptions, the following is a list of assumptions that are carried through from the screening of technologies phase to the comparison of remedial alternatives:

- Remedial actions for OU02 and OU03 will take place prior to OU01 and will make use of the OU01 property for work layout. For remedies that require dewatering for excavation purposes, the water will be treated prior to discharge. If discharging treated water to Brandy Brook, water will be discharged in a manner that will minimize erosion.
- Regardless of the chosen remedy, the top foot of soil will meet Residential SCOs to minimize the potential of direct contact with impacted soil. This will include the removal of an existing building and several concrete slabs.
- A contingency of 20 percent has been added to the total quantity of visually-impacted soil identified in the RI investigation to account for potential data gaps and potential over-treatment required for constructability.
- The lateral and vertical extent of soil with any detectable PAH concentrations is based on the extent of soil borings that had visual/olfactory evidence of MGP impacts, a pre-design investigation will be needed if the chosen alternative is one that will remediate the site to pre-disposal conditions.
- Waste characterization sampling will be conducted at a rate of one sample per 1,000 cy, or more frequently if required by the disposal facility.
- Confirmation bottom samples for excavation scenarios will be collected in accordance with DER-10.

- Air monitoring and odor control will be conducted as part of the chosen remedial alternative, which will be described in detail in a Community Air Monitoring Program.
- The department will coordinate with the public and adjacent landowners to provide access to areas outside of the property boundary as needed for pre-design investigation and remediation.
- Following implementation of a chosen alternative, site monitoring of downgradient groundwater with dissolved PAHs will continue. Following a five year review, it has been assumed that enhancements will be used to accelerate the biodegradation process.

The following subsections present a conceptual design and cost estimate for each of the remedial alternatives and a discussion of each alternative relative to the evaluation criteria as set forth in DER-10 (NYSDEC, 2010).

7.3 ALTERNATIVE 1: NO ACTION

This alternative will not include any actions to address soil or groundwater contamination at the Site.

Compliance with Standards, Criteria, and Guidance. This alternative will not meet Chemical-specific SCGs because it will not address soil or groundwater contamination in excess of the NYSDEC SCOs for soil or the GA Groundwater Quality Standards. This alternative will not trigger any Location- or Action-specific SCGs.

Overall Protection of Public Health and the Environment. This remedial alternative will not protect public health and the environment through eliminating, reducing, or controlling existing or potential exposure pathways through removal, treatment, ECs, or ICs. This remedial alternative will not achieve the RAOs for soil or groundwater.

Short-term Effectiveness. Because no actions will be taken, this alternative will not result in short-term adverse impacts and risks to the community, site workers, and the environment, but will also not provide any shot-term effectiveness.

Long-term Effectiveness and Permanence. This alternative will not include actions to address contaminated soil or groundwater at and in the vicinity of the Site. This remedy does not currently meet RAOs for soil or groundwater and, due to the properties of the Site-specific COCs (e.g., longevity of NAPL), will not be expected to meet RAOs in the future.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative will not result in the reduction of toxicity, mobility, or volume of soil or groundwater contamination through treatment.

Implementability. No actions will be conducted, therefore there are no technical difficulties associated with this alternative.

Land Use. The current and reasonably anticipated future land use of OU01 is for continued commercial use. Because no actions will be taken as part of this alternative, restrictions will not be placed on the property for future use, therefore, this alternative will not be protective of anticipated future land use (or compatible with land use scenarios should the Site be redeveloped for residential use).

Sustainability / Green Remediation (DER-31). This alternative will not result in energy consumption, generate GHG emission or use natural resources, however it will not be protective of public health and the environment since no action will be taken.

Cost. There are no costs associated with this alternative.

7.4 ALTERNATIVE 2: CAPPING & VERTICAL BARRIER

Alternative 2 consists of the following components, which are subsequently described in detail:

- pre-design investigation
- pre-remediation pumping/reduction of DNAPL
- mobilization of temporary facilities and controls
- clearing and grubbing, rough grading on Site and removal of large building remnants to establish an even surface for applying the soil cap and vertical barrier
- installation of the vertical barrier wall

- placement of an impermeable soil cap
- continued site monitoring with potential biological enhancement
- ICs
- long-term monitoring and reporting

7.4.1 Detailed Description of Alternative 2

Pre-Design Investigations and Studies. Pre-design investigations and/or studies will be conducted to support the remedial design, and will include a data gap analysis designed to delineate offsite groundwater contamination south of OU01, and to verify the horizontal and vertical boundaries of visually impacted soil to the southwest of the Site. Borings will be advanced within the area of impacted soil and along the perimeter of the impacted area to confirm the depth of soil contamination and the lateral extents. Soil samples from these locations will be submitted for laboratory analysis of VOCs, SVOCs and PAHs. Soil samples from the proposed vertical barrier perimeter will also be tested for geotechnical parameters such as sieve size analysis, and bench scale testing will be performed for the slurry mix design.

Up to seven monitoring wells will be installed outside the area of visually impacted soil, focusing on areas to the south. Soil and groundwater samples from these wells will be collected and submitted for laboratory analysis of VOCs, SVOCs and PAHs. Slug testing will be conducted to evaluate the groundwater velocity in the area and pore water samples will be collected at the wetlands located south of the Site to evaluate the potential groundwater migration pathway. Additionally, pre-design investigations, studies and modeling of storm water drainage pathways will be conducted and incorporated into the cap design to minimize storm water impacts to the adjacent residential and commercial properties.

Pre-Remediation Pumping/Reduction of NAPL. Prior to mobilization for full scale remediation, a NAPL pumping system will be installed. This system will minimize the mobility of NAPL outside of the visually impacted areas during remedial design of OU01, and be installed when remedial activities are taking place at OU02 and OU03. For costing purposes, it is assumed that two 4-inch diameter extraction wells will be installed along with NAPL pumps, solar powered control panels and an enclosed NAPL collection tank. Extracted NAPL will be transported off-site

for disposal. Monitoring data collected from the extraction system will be used as needed for full scale design if the chosen remedial alternative includes a permanent NAPL collection system.

Mobilization and Temporary Facilities and Controls. Site preparation, mobilization, temporary facilities and controls will include activities required to prepare the Site for construction, including, but not limited to:

- delivery and setup of site trailers
- delivery of heavy equipment
- installation of temporary utilities
- installation of a decontamination pad
- implementation of erosion control measures
- installation and of construction entrances and stockpile areas
- placement of temporary fencing around work areas
- demolition of 1-story wood frame building and existing concrete slabs

Placement of Vertical Barrier Wall. The vertical barrier will be designed and constructed along the perimeter of the visually impacted soil (Figure 7.1). The perimeter of the vertical barrier will be approximately 1,300 linear feet. The barrier will consist of a either a sheet-pile wall or low permeability soil bentonite (SB) or cement bentonite slurry. A low permeability SB slurry wall has been used for costing purposes. The depth of the slurry wall will extend from near ground surface to approximately 40 feet below grade, which is about twice as deep as the average depth of observed MGP impacts. However, if a low permeability layer is identified during the pre-design investigations, the depth may extend to key into this layer, this will be determined during the design phase of the project. It has been assumed for costing purposes that the slurry wall will be installed by DeWind One Pass Trenching and will be 27 inches wide and will result in a wall with a maximum permeability of 10^{-7} centimeters/second. DeWind One Pass Trenching uses an in-situ mixing technology that homogenizes the soils with bentonite from top to bottom in a continuous linear wall. This process is fast compared to traditional slurry wall installations.

Placement of Cap. The existing 1-story building and concrete pads will be demolished and transported off-site for disposal or re-use. Existing soils and spoils from the vertical wall

installation will be graded to provide a smooth area for the surface cap and so that storm water drains freely off of the cap.

The impermeable cap for Alternative 2 will be composed of a 24-inch low-permeability layer which will promote surface runoff, thereby limiting infiltration that could impact groundwater quality. The cap will consist of a geocomposite clay layer (GCL) followed by a clean clay/silt layer compacted to a permeability of approximately 10^{-5} centimeters/second overlain by at least six inches of topsoil. Placement of the cap will cover an approximate 100,500 square-foot (sf) area, which will extend approximately 5 feet beyond the vertical barrier. The capped area will be seeded and erosion control blankets will be installed on sloped areas as needed. The proposed overall extent of the cap and vertical barrier wall at the Site is shown on Figure 7.1.

Continued Site Monitoring with Biological Enhancement. Following implementation of this remedy, site monitoring will continue. Up to five additional groundwater monitoring wells will be installed upon completion of the remedy, downgradient of the visually impacted area. Monitoring will include periodic sampling of these and other site groundwater wells, an assumed 15 wells in total. Additionally, it has been assumed that biological enhancements will potentially be used to increase aerobic biodegradation of contamination outside of the treated area. For costing purposes, it is assumed that site monitoring will include groundwater sampling semi-annually for the first two years after remedy implementation, and annually for years 3, 4 and 5. A 5-year performance review will then be conducted to evaluate performance of the remedy and to assess the use of enhancements to accelerate the biodegradation process of dissolved PAHs in groundwater. It has been assumed that during year six five of the 2-inch wells installed south of the treated area will each be equipped with a controlled-release oxygen technology (costing assumes five Regenesis' oxygen-release compound (ORC) Advanced Filter Socks® per well). When combined with continued site monitoring for areas of groundwater impacts emanating from OU01, bio-enhancement will reduce PAH mass within groundwater and accelerate the restoration of the aquifer downgradient from the Site. ORC Advanced Filter Socks® generally release oxygen for up to one year, however for costing purposes it has been assumed that the ORC Filter Socks will be replaced once, approximately 6 months after installation. The second set of ORC Filter Socks will be removed after another six months. Site monitoring will occur approximately 3 months after the installation of each set of ORC Filter Socks and will continue on an annual basis after the ORC Filter Socks are removed. Actual locations and quantities of adding ORC Filter Socks, and

duration between replacing the ORC Filter Socks will depend upon ground water flow velocity, and dissolved PAH concentration and distribution within the groundwater based on results of monitoring.

Institutional Controls. ICs will likely include implementation of land-use restrictions to control subsurface activity in order to maintain the soil cap, prohibit changes in zoning of the Site, and prohibit extraction of groundwater for drinking purposes. Land-use restrictions will be implemented through legal instruments such as an Environmental Easement. A Site Management Plan (SMP) will also be required.

Long Term Maintenance Monitoring and Reporting. It is assumed that after the placement of the cap and vertical barrier technology, site monitoring will be carried out for a total of up to 30 years. Semi-annual monitoring will include a visual inspection of the capped area, and groundwater samples will be collected to evaluate potential ongoing impacts to groundwater from the surface soils. It has been assumed that sampling frequency will be reduced to annually after the first two years. Monitoring results will be presented in an annual report. In addition to monitoring, the capped area will need to be mowed semiannually to prevent woody vegetation from growing and impacting the cap.

7.4.2 Detailed Evaluation of Alternative 2 (Capping & Vertical Barrier)

Compliance with Standards, Criteria, and Guidance. Alternative 2 will meet Chemical-specific SCGs by capping soil contamination in excess of the Residential SCOs for total PAHs in the top two feet of soil at OU01, and minimize contaminant migration by installation of an impermeable barrier. Alternative 2 will trigger Location-Specific SCGs associated with construction in proximity to wetlands. Action-Specific SCGs for Alternative 2 will be associated with dust and odor control, erosion and sedimentation control, transportation and disposal of remediation wastes.

Overall Protection of Public Health and the Environment. This alternative will protect public health and the environment through eliminating, reducing, and controlling existing or potential exposure pathways through capping and a vertical barrier wall. This remedial alternative will achieve some of the RAOs for soil at OU01 by preventing direct contact and minimizing contaminant migration. Given that MGP contaminants will remain in place beneath the cap, land

use restrictions and an SMP including an IC/EC plan will be required, and future development will need to consider impacts to the cap system.

Short-term Effectiveness and Impacts. Alternative 2 will result in short-term adverse impacts and risks to the community, site workers, and the environment as a result of implementation. Implementation of this alternative will include preparation of and adherence to a construction work plan and health and safety plan. Odor control may be required for this alternative, however odors are likely to be minimal compared to other alternatives given that the barrier wall will be installed outside of the visually impacted area. Construction of this alternative will be relatively quick and will be effective at minimizing exposure and migration immediately upon completion of construction. Downgradient groundwater impacts are not likely to be effected in the short term.

Long-term Effectiveness and Permanence. This alternative, although protective of human health and the environment, will leave impacted soil in place below the cap. The cap will require mowing and inspections to ensure that it remains effective and may require maintenance in the future to maintain long-term effectiveness and permanence. Although the NAPL left in place is not likely to be mobile, it could possibly continue to impact groundwater below the depth of the barrier wall. Downgradient groundwater will be monitored to evaluate the long-term effectiveness of the remedy.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative will result in the reduction of mobility of groundwater contamination off site through pre-construction NAPL collection, on-site capping, and a vertical barrier wall. The volume of contaminants will be decreased through pre-construction NAPL collection, however, the majority of the contaminants will remain in place beneath the cap and within the limits of the barrier wall. Although the NAPL left in place is not likely to be mobile, it could possibly continue to impact groundwater below the depth of the barrier wall.

Implementability. There will be limited technical issues with implementing Alternative 2, associated primarily with the size of the equipment required to install the barrier wall. Implementability of this alternative will be contingent upon cooperation of the community and land owners surrounding OU01 as portions of the barrier wall and monitoring wells will likely require installation on adjacent property owner parcels.

Land Use. The current and reasonably anticipated future land use of OU01 is for continued commercial use. Alternative 2 will be compatible with current land use and reasonably anticipated future land use. Should the Site be redeveloped for residential use, this alternative would not be compatible with future land use, as source area soils will remain in place underneath the soil cap.

Sustainability / Green Remediation (DER-31). This alternative will result in energy consumption and GHG emissions during the construction phase, however the use of natural resources including water and soil will be minimal since the soil will remain in place and will not require dewatering. GHG will also be minimized since soil will not need to be transported off-site for disposal.

Cost. The capital cost estimate and present worth of Alternative 2 are:

	Capital Cost	**Present Worth**
Alternative 2 (Capping & Vertical Barrier)	$ 2469,000	$ 3,266,000

A summary of the costs associated with this alternative is presented in Table 7.2. Detailed cost analysis backup is provided in Appendix B. Subcontractor provided cost estimates for the trenching installation of a soil bentonite wall, ORC Advanced Filter Socks, and Free Product Recovery Equipment are included in Appendix C.

7.5 ALTERNATIVE 3: IN-SITU SOLIDIFICATION (ISS)

The ISS remedial alternative could potentially be conducted in two scenarios that will result in variability in costs as well as overall effectiveness.

- Alternative 3A –ISS with Downgradient Continued Site Monitoring (and potential Biological Enhancement).)
- Alternative 3B – Partial ISS with NAPL Collection and Downgradient Continued Site Monitoring (and potential Biological Enhancement).)

The primary components of each ISS scenario in Alternative 3 include:

- pre-design investigation and studies
- mobilization and temporary facilities and controls

- set-up of staging areas
- performance of in-situ stabilization within designated OU01 areas
- continued site monitoring with potential biological enhancement
- restoration
- long-term monitoring

7.5.1 Detailed Description of Alternatives 3A and 3B (In-Situ Solidification)

Pre-Design Investigation and Studies. Contaminant delineation studies of impacted soil and downgradient groundwater investigations will be the same as in Alternative 2. Similarly to Alternative 2, a pre-remediation NAPL extraction system will be installed and operated during remedial design of OU01, and when remedial activities are taking place at OU02 and OU03.

Additionally, studies to support suitable mix designs to solidify the soil will be conducted. These investigations will include testing existing impacted soil for unconfined compressive strength, permeability and the ability for contaminants to leach from the soil matrix. Bench tests will be conducted to evaluated proper mix designs to increase compressive strength, decrease permeability and minimize leachability of the contaminants. Following bench testing a pilot test would be conducted to evaluate the mix design's ability to solidify the soil. Adjustments to the mix design will be made as necessary prior to full scale implementation.

Mobilization and Temporary Facilities and Controls. Site preparation, mobilization, and temporary facilities and controls will include activities required to prepare the Site for construction, including, but not limited to:

- delivery and setup of site trailers
- delivery of heavy equipment
- installation of temporary utilities
- installation of a decontamination pad
- implementation of erosion control measures
- installation and of construction entrances and stockpile areas
- placement of temporary fencing around work areas

- demolition of 1-story wood frame building and existing concrete slabs
- set up staging area for solidification materials
- set up odor control and monitoring equipment

In-situ Stabilization. Prior to conducting ISS, the existing surface cover materials (remaining concrete slabs) and upper several feet of non-MGP impacted soil to the top of the groundwater table (five to ten feet depending on location) will be removed, segregated based on visual observations of MGP impacts and stockpiled. Samples will be collected from the stockpiled material to evaluate if the soil can be reused onsite and to evaluate disposal options. For costing purposes, it has been assumed that approximately 40% of the excavated soil will be reused as backfill after solidification is complete, and the remaining excavated soil will be transported off-site for disposal in accordance with the NYSDEC DER-4, Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants (NYSDEC, 2002).

In both Alternatives 3A and 3B, ISS will be performed by mixing a fluid cement/grout into a column of soil without excavating or removing the soil. The design mix of the cement/grout will be based on results of the pilot test. ISS will likely use a large crane or excavator-mounted auger to mix the soil while cement-bentonite grout is pumped through the auger and mixed into the soil. The resulting material is generally a homogeneous mixture of soil and grout that hardens to become a weakly-cemented material. The mixing auger may be six to 12 feet in diameter and the columns of mixed soil and cement will be overlapped to provide continuity. The result will be a significant reduction in leaching and mobility of the contaminants in the soil by reducing the free liquids and hydraulic conductivity of the soil. It is anticipated that the stabilization of the soil will increase the overall volume of the treated area by approximately 15-20%.

Alternative 3A: For this alternative, ISS will be applied to the estimated extent of visual MGP-impacted soils as shown on Figure 7.2. ISS will be performed on average from 8 to 20 feet bgs, depending on location, within an approximately 94,000 SF area.

Alternative 3B: In Alternative 3B, ISS will be applied to most concentrated area of MGP-impacted soil, which is also located in the vicinity of the estimated extent of purifier box waste material as shown on Figure 7.2. ISS in this area will be performed on average from 5 to 20 feet bgs over an

approximate 34,500 SF area. This alternative will also include the installation of a NAPL collection system at the southern portion of OU01, consisting of a stone-filled trench holding three extraction wells with NAPL pumps, solar powered control panels and an enclosed NAPL tank (Figure 7.2). Extracted NAPL will be transported off-site for disposal.

Additionally, for both Alternative 3A and 3B, as previously described, a soil cover consisting of approximately three feet of re-usable soil from the ISS excavation, overlain by one foot of clean, imported fill and topsoil will be installed for a total of four feet of clean fill over the stabilized soil. The soil cover will be higher than current grades due to the swelling of the soil during the stabilization process and will be graded as a gentle mound. Grass seed will be planted on the soil cover.

Continued Site Monitoring with Biological Enhancement. Alternatives 3A and 3B will also include site monitoring on a semi-annual basis for the first two years after remedy implementation, followed by annual monitoring for years 3, 4 and 5. Subsequently, a 5-year review will be conducted, and based on ISS performance, the application of biological enhancements will be assessed to increase aerobic biodegradation of contamination outside of the stabilized area. For costing purposes, it is assumed that the same system as described in Alternative 2 will be applied.

Institutional Controls. ICs, including land-use restrictions and an SMP will be similar to Alternative 2.

Long Term Maintenance, Monitoring and Reporting. It is assumed that after implementation of both ISS alternatives, monitoring will be carried out for a total of up to 30 years. Monitoring, including soil cover inspections and groundwater monitoring and reporting will be conducted similarly to Alternative 2. Additionally, for Alternative 3B, the NAPL collection system will need to be operated and maintained on a regular basis.

7.5.2 Detailed Evaluation of Alternatives 3A and 3B (In-Situ Solidification)

Compliance with Standards, Criteria, and Guidance.

Alternative 3A: Alternative 3A will meet Chemical-specific SCGs by solidifying soil with contaminants in excess of the Commercial SCOs and placing certified clean soil in the upper foot.

This alternative will also control the source of groundwater contamination originating at OU01. Alternative 3A will trigger Location-Specific SCGs associated with construction adjacent to residential and commercial properties and close to wetlands. Action-Specific SCGs for Alternative 3A will be associated with odor control, erosion control, transportation and disposal of remediation wastes, and Site restoration.

Alternative 3B: Alternative 3B will meet Chemical-specific SCGs by solidifying soil with contaminants in excess of the Commercial SCOs within the portion of the site with the highest MGP impacts which include purifier waste and placing certified clean soil in the upper foot of the entire MGP impact area. For the remainder to the MGP impacted area, the source of groundwater contamination would be controlled by the use of a NAPL collection trench. Alternative 3B will trigger Location-Specific SCGs associated with construction adjacent to residential and commercial properties and close to wetlands. Action-Specific SCGs for Alternative 3B will be associated with odor control, erosion control, transportation and disposal of remediation wastes, and Site restoration.

Overall Protection of Public Health and the Environment.

Alternative 3A: This remedial alternative will protect public health and the environment through eliminating, reducing, and controlling existing or potential exposure pathways through in-situ solidification of contaminated soils. This remedial alternative will achieve some of the RAOs for soil and groundwater at OU01. Given that soil contaminants will remain solidified in place, land use restrictions, an SMP including and IC/EC plan will be required, and future development will need to consider impacts to the ISS system.

Alternative 3B: This remedial alternative will also protect public health and the environment through eliminating, reducing, and controlling existing or potential exposure pathways through in-situ solidification within the portion of the site with the highest MGP impacts which include purifier wastes, and with NAPL extraction of remaining mobile contaminants. This remedial alternative will achieve some of the RAOs for soil and groundwater at OU01. Given that soil contaminants will remain solidified in place, remaining soils will be isolated beneath the cover, and a NAPL collection trench will be in operation; therefore, land use restrictions, an SMP including and IC/EC plan will be required, and future development will need to consider impacts to the ISS and collection systems.

Short-term Effectiveness and Impacts. Both alternatives will result in short-term adverse impacts and risks to the community, site workers, and the environment as a result of implementation. Implementation of this alternative will include preparation of and adherence to a construction work plan and health and safety plan. Both alternatives will be effective at reducing contaminant migration in the short-term immediately after implementation.

Long-term Effectiveness and Permanence.

Alternative 3A: This alternative, although protective of human health and the environment, will leave impacted soil solidified in place below the soil cover. The cover will require periodic inspections to ensure that it remains effective at minimizing direct contact and may require maintenance in the future to maintain long-term effectiveness and permanence. Downgradient groundwater contaminant concentrations are likely to reduce in the long-term.

Alternative 3B: This alternative, although protective of human health and the environment, will leave impacted soil solidified below the cover, as well as impacted soil that has not been solidified. The soil cover will require periodic inspections to ensure that it remains effective and the NAPL collection system will require operations and maintenance to maintain long-term effectiveness. Monitoring will also be required to ensure that the NAPL collection system is effective as minimizing downgradient migration. Downgradient groundwater contaminant concentrations are likely to reduce in the long-term.

Reduction of Toxicity, Mobility, or Volume with Treatment. Both alternatives will result in the reduction of mobility of groundwater contamination through on-site ISS. This alternative will also reduce the total volume of contamination through operation of a NAPL extraction system prior to construction, and ongoing NAPL extraction for Alternative 3B.

Implementability. There will be some technical issues with implementing Alternatives 3A and 3B, primarily due to the large equipment required for implementation in a relatively small footprint. Implementability of these alternatives will be contingent upon cooperation of the community and land owners surrounding the site for use of land for equipment, supplies, and access.

Land Use. The current and reasonably anticipated future land use of OU01 is for commercial use. Alternatives 3A and 3B will be compatible with current land use and reasonably anticipated future land use. Should the Site be redeveloped for residential use, Alternatives 3A and 3B will not be compatible as contaminated soils above Residential SCOs will remain in place and land use restrictions will be required.

Sustainability / Green Remediation (DER-31). The ISS alternatives will result in energy consumption and generation of GHG during construction. The amount of natural resources consumed by this alternative is low for this alternative considering that the majority of the impacted soil will remain onsite. Alternative 3A will rate higher for green remediation than Alternative 3B since 3B will require long-term operations of a NAPL extraction and disposal system.

Cost. The capital cost estimate and present worth of the Alternative 3 scenarios are as follows:

ISS Scenario	Capital Cost	Present Worth
Alternative 3A	$ 10,904,000	$ 11,701,000
Alternative 3B	$ 7,914,000	$ 10,760,000

A summary of the costs associated with these alternatives is presented in Table 7.3. Detailed cost analysis backup is provided in Appendix B.

7.6 ALTERNATIVE 4: EXCAVATION

The excavation remedial alternative could potentially be conducted in three scenarios that will result in variability in costs as well as overall effectiveness.

- Alternative 4A – Excavation with Downgradient Continued Site Monitoring (and potential Biological Enhancement).)
- Alternative 4B – Partial Excavation with NAPL collection and Downgradient Continued Site Monitoring (and potential Biological Enhancement).)
- Alternative 4C – Excavation to Meet Pre-Disposal Conditions with Continued Site Monitoring (and potential Biological Enhancement).

The primary components of each excavation scenario in Alternative 4 include:

- pre-design investigation and studies

- mobilization and temporary facilities and controls
- set-up of staging areas
- performance of excavation within designated OU01 areas
- continued site monitoring with biological enhancement
- restoration
- long-term monitoring

7.6.1 Detailed Description of Alternatives 4A, 4B and 4C (Excavation)

Pre-Design Investigation and Studies. Contaminant delineation studies of impacted soil and downgradient groundwater investigations will be the same as in Alternative 2. Additional soil borings will be required to delineate the extent of soils with no detectable PAH concentrations for Alternative 4C.

Similarly to the previously described Alternatives, a pre-construction NAPL removal system will be installed and operated to minimize the mobility of NAPL outside of the visually impacted areas during the time when remedial activities are taking place at OU02 and OU03 and during remedial design of OU01. Additionally geotechnical investigations of soil will be required for design of the excavation support system.

Mobilization and Temporary Facilities and Controls. Site preparation, mobilization, and temporary facilities and controls will include activities required to prepare the Site for construction, including, but not limited to:

- delivery and setup of site trailers
- delivery of heavy equipment
- installation of temporary utilities
- installation of a decontamination pad
- implementation of erosion control measures
- installation and of construction entrances and stockpile areas
- placement of temporary fencing around work areas
- demolition of 1-story wood frame building and existing concrete slabs

- set up odor control and monitoring equipment

Excavation. Prior to excavation of MGP impacted soil, the existing surface cover materials (remaining concrete slabs) and upper several feet of soil from the impacted area (5 feet is assumed for purposes of cost estimating) will be removed, characterized, and temporarily stockpiled for re-use as backfill in the excavation.

In Alternatives 4A, 4B and 4C a steel sheet pile wall will be advanced around the perimeter of the respective excavation area and will extend to a depth of approximately 50 feet, more than twice the average depth of the excavation. Dewatering will be required while excavating, and cross bracing of the excavation support will need to be constructed as the excavation gets deeper. Groundwater removed from the excavation will be treated through a temporary onsite treatment system and will be discharged to Brandy Brook after sampling. Confirmation samples will be collected from the bottom of the excavation after visually impacted soil has been removed. Excavation will extend deeper as required based on analytical results. Odor controls will be required during excavation, which may include phased excavation within a temporary tent-like structure. Excavated soil will be temporarily stockpiled, sampled and transported off-site for disposal in accordance with the NYSDEC DER-4, Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants (NYSDEC, 2002). The following describes the location and extent of the excavation areas for Alternative 4A, 4B and 4C:

Alternative 4A: For this alternative, the excavation will occur within the area of visual MGP-impacted soil in excess of the Commercial SCOs as shown on Figure 7.3. Soil will be excavated for off-site disposal on average from eight to 20 feet bgs within the approximate 94,000 SF area.

Alternative 4B: In Alternative 4B, excavation will remove soil from the most concentrated area of MGP-impacts, which is located in the vicinity of the estimated extent of purifier box waste material. The average thickness of the excavation in this area will be from five to 20 feet bgs over an approximate 34,500 SF area. Additionally, the top foot of soil outside of the excavation area, but within the MGP-impacted zone will also be removed and used as backfill within the excavation to allow placement of certified clean fill and topsoil in the upper foot. This alternative will also include the installation of a NAPL collection system at the southern border of OU01, consisting of a stone-filled trench holding three extraction wells with NAPL pumps, solar powered control

panels and an enclosed NAPL tank (Figure 7.3). Extracted NAPL will be transported off-site for disposal.

Alternative 4C: Alternative 4C will include excavation to meet pre-disposal conditions, and will remove soils within the OU01 Site boundary with detectable PAH concentrations. This extent of contamination has been estimated based on visual/olfactory evidence of MGP waste. The excavation is estimated to occur within a 224,000 SF area as shown on Figure 7.3. It is assumed that soil will be excavated for off-site disposal on average from 5 to 20 feet bgs within the 224,000 SF area. For costing purposes, it is assumed that this excavation will be conducted over a two-year period.

The excavations of Alternatives 4A, 4B and 4C will be backfilled with the reusable soil from the upper five feet, and with certified clean fill and topsoil. The final grade of the surface cover will promote surface runoff, thereby limiting infiltration that could impact groundwater quality in the impacted soils not excavated, specifically for Alternative 4B.

Continued Site Monitoring with Biological Enhancement. Alternatives 4A, 4B and 4C will also include site monitoring on a semi-annual basis for the first two years after remedy implementation, followed by annual monitoring for years 3, 4 and 5. Subsequently, a 5-year review will be conducted, and based on excavation performance, the application of biological enhancements will be assessed to increase aerobic biodegradation of contamination outside of the excavated area. For costing purposes, it is assumed that the same system as described in Alternative 2 will be applied. However, given the larger remedial footprint for Alternative 4C, fewer wells would likely be required.

Institutional Controls. ICs, including land-use restrictions and an SMP will be similar to Alternative 2.

Long Term Maintenance, Monitoring and Reporting. It is assumed that after implementation of both ISS alternatives, monitoring will be carried out for a total of up to 30 years. Monitoring, including soil cover inspections and groundwater monitoring and reporting will be conducted similarly to Alternative 2. Additionally, for Alternative 4B, the NAPL collection system will need to be operated and maintained on a regular basis.

7.6.2 Detailed Evaluation of Alternative 4 (Excavation)

Compliance with Standards, Criteria, and Guidance.

Alternative 4A: Alternative 4A will meet Chemical-specific SCGs by removing MGP-impacted soil in excess of the Commercial SCOs and is likely to meet Residential SCOs as well. This alternative will also remove the source of groundwater contamination originating at OU01. Alternative 4A will trigger Location-Specific SCGs associated with construction adjacent to residential and commercial properties and near wetlands. Action-Specific SCGs for Alternative 4A will be associated with odor control, erosion control, transportation and disposal of remediation wastes, and Site restoration.

Alternative 4B: Alternative 4B will meet Chemical-specific SCGs by removing impacted soil in excess of the Commercial SCOs within the portion of the site with the highest MGP impacts which include purifier waste and by placing a certified clean soil cover in the upper foot of the entire MGP-impacted area. For the soil covered portion of the MGP impacted area, the source of groundwater contamination would be controlled by the use of a NAPL collection trench. Alternative 4B will trigger Location-Specific SCGs associated with construction adjacent to residential and commercial properties and near wetlands. Action-Specific SCGs for Alternative 4B will be associated with odor control, erosion control, transportation and disposal of remediation wastes, and Site restoration.

Alternative 4C: Alternative 4C will meet Chemical-specific SCGs by removing MGP-impacted soil to meet pre-release conditions. This alternative will also remove the source of groundwater contamination originating at OU01. Alternative 4C will trigger Location-Specific SCGs associated with construction adjacent to residential and commercial properties and near wetlands. Action-Specific SCGs for Alternative 4C will be associated with odor control, erosion control, transportation and disposal of remediation wastes, and Site restoration.

Overall Protection of Public Health and the Environment.

Alternative 4A: This remedial alternative will protect public health and the environment through eliminating, reducing, and controlling existing or potential exposure pathways through excavation of contaminated soils. This remedial alternative is likely to achieve the majority of the RAOs for soil and groundwater at OU01.

Alternative 4B: This remedial alternative will protect public health and the environment through eliminating, reducing, and controlling existing or potential exposure pathways through excavation of contaminated soils within the portion of the site with the highest MGP impacts including purifier waste. This remedial alternative will achieve some of the RAOs for soil and groundwater at OU01. Given that some areas of soil contamination will remain in place, remaining soils will be isolated beneath a certified clean soil cover to minimize direct exposure, and a NAPL collection trench will be in operation to capture remaining mobile contaminants. Therefore, land use restrictions, an SMP including and IC/EC plan will be required, and future development will need to consider impacts to the soil cover and collection system.

Alternative 4C: This remedial alternative will protect public health and the environment through eliminating and controlling existing or potential exposure pathways through excavation of contaminated soils. This remedial alternative is likely to achieve the majority of the RAOs for soil and groundwater at OU01.

Short-term Effectiveness and Impacts. Alternative 4 options will result in short-term adverse impacts and risks to the community, site workers, and the environment as a result of implementation. Implementation of this alternative will include preparation of and adherence to a construction work plan and health and safety plan. Alternatives 4A, 4B and 4C will each require a significant amount of time to install steel sheeting for excavation support, this may cause a noise nuisance to the community and each of the alternatives are likely to result is significant odors that will need to be managed. Each of the three alternatives will be effective at removing contaminant mass in the short term, however Alternative 4C will remove the most contaminant mass in the short term, followed by 4A and finally B.

Long-term Effectiveness and Permanence.

Alternative 4A: This is a permanent alternative for soil that will be protective of human health and the environment in the long-term. Downgradient groundwater impacts are expected to reduce over time since the source of the groundwater contamination will be removed.

Alternative 4B: This alternative, although protective of human health and the environment, will leave some impacted soil in place below the soil cover. The soil cover and collection system will

require periodic inspections to ensure that they remain effective and may require maintenance in the future to maintain long-term effectiveness and permanence.

Alternative 4C: This is a permanent alternative for soil that will be protective of human health and the environment in the long-term. Downgradient groundwater impacts are expected to reduce over time since the source of the groundwater contamination will be removed.

Reduction of Toxicity, Mobility, or Volume with Treatment. The three alternatives will result in the reduction of toxicity, mobility and volume of contaminant mass through excavation with off-site disposal and through on-site collection of mobile NAPL. Alternative 4B however, will leave some impacted soil behind.

Implementability. There will be some technical issues with implementing Alternatives 4A, 4B and 4C specifically related to the size of the equipment required for implementation as well as difficulties associated with odor control. Implementability of these alternatives will be contingent upon cooperation of the community and land owners surrounding the site for use of land for equipment, supplies, and access.

Land Use. The current and reasonably anticipated future land use of OU01 is for commercial use. Alternatives 4A, 4B and 4C will be compatible with current land use and reasonably anticipated future land use. Should the Site be redeveloped for residential use, Alternative 4C will be compatible with future land use, as source area soils in this alternative will be removed and backfilled with certified clean soil. Alternative 4B will not be compatible with potential future residential land use as contaminated soils above the Residential SCOs will remain in place, and there will be an active DNAPL collection system.

Sustainability / Green Remediation (DER-31). These alternatives will result in significant energy consumption resulting in GHG emissions on-site during the construction phase, from trucks transporting the soil off-site, and potentially from the treatment of the soil depending on the chosen treatment/disposal options. These alternatives will also consume a significant amount of natural resource including both groundwater from excavation dewatering operations and from off-site disposal of soil. Therefore these alternatives are not considered to be sustainable or green remedial alternatives.

Cost. The capital cost estimate and present worth of the Alternative 4 scenarios are as follows:

Excavation Scenario	Capital Cost	Present Worth
Alternative 4A	$ 20,392,000	$ 21,189,000
Alternative 4B	$ 12,432,000	$ 15,278,000
Alternative 4C	$ 58,106,000	$ 58,903,000

A summary of the costs associated with these alternatives is presented in Table 7.4. Detailed cost analysis backup is provided in Appendix B.

7.7 ALTERNATIVE 5: EXCAVATION AND IN-SITU SOLIDIFICATION

The excavation and ISS remedial alternative consists of the following components:

- pre-design investigation and studies
- mobilization and temporary facilities and controls
- set-up of staging areas
- performance of excavation within designated OU01 areas
- performance of in-situ stabilization within designated OU01 areas
- continued site monitoring with potential biological enhancement
- restoration
- long-term monitoring

7.7.1 Detailed Description of Alternative 5

A description of Alternative 5 is presented below.

Pre-Design Investigation and Studies. Contaminant delineation investigations and downgradient groundwater investigations will be the same as described in previous alternatives. Geotechnical investigations will be required for the design of the excavation support system as described for Alternatives 4A and 4B. Bench testing and pilot testing will be required to evaluation the appropriate mix design for solidification. Similarly to the previously described Alternatives, a pre-construction NAPL removal system will be installed and operated to minimize the mobility of

NAPL outside of the visually impacted areas during the time when remedial activities are taking place at OU02 and OU03 and during remedial design of OU01.

Mobilization and Temporary Facilities and Controls. Site preparation, mobilization, and temporary facilities and controls will include activities required to prepare the Site for construction, including, but not limited to:

- delivery and setup of site trailers
- installation of temporary utilities
- installation of erosion and sediment control measures
- demolition of 1-story wood frame building
- installation decontamination pad
- installation stabilized construction entrance
- set up staging area for solidification materials
- set up odor control and monitoring equipment

Excavation and ISS. Site preparation for Alternative 5 will include an initial excavation of approximately the top five feet of soil and temporarily stockpiling the soil for reuse. The existing concrete slabs will be removed and disposed of off-site. A sheet pile wall will be installed around the area of excavation, which will be located within the most concentrated area of MGP-impacted soil, which is also associated with the vicinity of the purifier box waste material, an approximate 34,500 SF area. Excavation, temporary stockpiling of soil and off-site transportation of soil for disposal within the sheet pile area will take place first. The excavated area will be backfilled with previously excavated material deemed suitable for reuse and with a minimal of one foot of certified clean soil at the surface. The remainder of the visually impacted soil, over an approximate 59,500 SF area, will be stabilized in place using the techniques described in Alternatives 3A and 3B. After ISS is conducted, this area too will be backfilled will re-usable soil and with a minimal of one foot of certified clean soil at the surface. The approximate areas of excavation and solidification are shown on (Figure 7.4).

Continued Site Monitoring with Biological Enhancement. Alternative 5 will also include site monitoring and potential addition of biological enhancements to increase aerobic biodegradation of

contamination outside of the excavated and stabilized areas. For costing purposes, it is assumed that the same system as described in Alternative 2 will be applied.

Institutional Controls. ICs, including land-use restrictions and an SMP will be similar to Alternative 2.

Long Term Maintenance, Monitoring and Reporting. It is assumed that after implementation of both ISS alternatives, monitoring will be carried out for a total of up to 30 years. Monitoring, including soil cover inspections and groundwater monitoring and reporting will be conducted similarly to Alternative 2.

7.7.2 Detailed Evaluation of Alternative 5 (Excavation and In-Situ Solidification)

Compliance with Standards, Criteria, and Guidance. Alternative 5 will meet Chemical-specific SCGs by excavating impacted soil within the area of the estimated extent of purifier box waste material and solidifying the remaining visually impacted soil in place. This alternative will control the source of groundwater contamination originating at OU01. Alternative 5 will trigger Location-Specific SCGs associated with construction adjacent to residential and commercial properties and near wetlands. Action-Specific SCGs for Alternative 5 will be associated with odor control, erosion control, transportation and disposal of remediation wastes, and Site restoration.

Overall Protection of Public Health and the Environment. This remedial alternative will protect public health and the environment through eliminating, reducing, and controlling existing or potential exposure pathways through excavation and solidification of contaminated soils. This remedial alternative will achieve the majority of RAOs for soil and groundwater at OU01. Given that this alternative includes a soil cover, land use restrictions, an SMP including and IC/EC plan will be required, and future development will need to consider impacts to the soil cover.

Short-term Effectiveness and Impacts. This alternative will result in short-term adverse impacts and risks to the community, site workers, and the environment as a result of implementation. Implementation of this alternative will include preparation of and adherence to a construction work plan and health and safety plan. This alternative will require a significant amount of time to install steel sheeting for excavation support and to conduct the ISS. Both of which may cause a noise

nuisance to the community and result is significant odors that will need to be managed. This alternative will be effective at removing contaminant mass and reducing mobility in the short term.

Long-term Effectiveness and Permanence. This alternative, will be protective of human health and the environment. The soil cover will require periodic inspections to ensure that it remains effective and may require maintenance in the future to maintain long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative will result in the contaminant mass reduction and reduced contaminant mobility through on-site excavation and solidification.

Implementability. There will be some technical issues with implementing Alternative 5 specifically related to the size of equipment required for implementation and difficulties surrounding odor control. Implementability of these alternatives will be contingent upon cooperation of the community and land owners surrounding OU01 for use of land for equipment, supplies, and access.

Land Use. The current and reasonably anticipated future land use of OU01 is for commercial use. Alternative 5 will be compatible with current land use and reasonably anticipated future land use. Should the Site be redeveloped for residential use, Alternative 5 will not be compatible given that contaminated soils above the Residential SCOs will remain in place.

Sustainability / Green Remediation (DER-31). This alternative will result in significant energy consumption resulting in GHG emissions on-site during the construction phase, from trucks transporting the soil off-site, and potentially from the treatment of the soil depending on the chosen treatment/disposal options. This alternative will also consume a significant amount of natural resource including both groundwater from excavation dewater operations and from off-site disposal of soil. Therefore this alternative is not considered to be sustainable or green.

Cost. The capital cost estimate and present worth of the Alternative 4 scenarios are as follows:

Excavation & ISS Scenario	Capital Cost	Present Worth
Alternative 5	$ 13,851,000	$ 14,648,000

A summary of the costs associated with this alternative is presented in Table 7.5. Detailed cost analysis backup is provided in Appendix B.

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis evaluates the relative performance of each alternative using the same criteria by which the detailed analysis of each alternative was conducted. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another to aid in selecting an overall remedy for the Site.

The comparative analysis includes a narrative discussion of the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance, as applicable. The comparative analysis presented in this document uses a qualitative approach to comparison, with the exceptions of comparing alternative costs and the required time to implement each alternative.

A comparison of the capital and long-term costs associated with the remedial alternatives is presented in Table 8.1. Detailed cost analysis backup is provided in Appendix B.

Compliance with Standards, Criteria, and Guidance. Alternative 1 will not meet Chemical-specific SCGs because it will not address contamination at and in the vicinity of the Site which exceeds applicable SCG values.

Alternatives 2 through 5 will meet chemical-specific SCGs within the upper foot of soil and will control the source of contamination to reduce mobility.

Alternatives 4A and 4C rate highest for Compliance with SCGs because they will result in meeting chemical-specific SCGs for soil throughout the site upon completion of implementation.

Overall Protection of Public Health and the Environment. Alternative 1 will not protect public health and the environment through eliminating, reducing, or controlling existing or potential exposure pathways through removal, treatment, or ECs. This remedial alternative will not achieve the RAOs for OU01 soils.

Alternatives 2 through 5 will protect public health and the environment through eliminating, reducing, and/or controlling existing or potential exposure pathways through either excavation, solidification, containment or extraction. Alternatives 3B and 4B are likely the least reliable since there will be a significant amount of impacted soil that will continue to act as a source of ongoing groundwater contamination which will require capture by the NAPL extraction system. Dissolved phase impacts to groundwater are likely to continue under alternatives 3B and 4B.

Alternative 4A and 4C rate highest for Overall Protection of Public Health and the Environment, while Alternatives 2, 3A, and 5 rate second highest with equal overall protection.

Short-term Effectiveness & Impacts. Because no action will be taken, Alternative 1 will not result in short-term adverse impacts and risks to the community, site workers, and the environment, but will also not be effectiveness in the short term.

Alternatives 2 through 5 each have significant short-term impacts due to the large amount of construction equipment required, as well as the need for odor control measures. However, alternatives 2, 3A, 4A, 4C and 5 would be effective immediately after construction is complete.

Therefore, Alternative 2, having the overall shortest construction period, and least likely to contribute to significant odors rates highest for Short-term Effectiveness & Impacts, followed by Alternative 3A.

Long-term Effectiveness and Permanence. Alternative 1 will not include actions to address contaminated soils at and in the vicinity of the Site. This remedy does not currently meet RAOs for soil and will not be expected to meet RAOs in the future.

With the exception of Alternatives 4A and 4C, each of the alternatives will require periodic inspections and possibly maintenance for the soil or cap system and/or the NAPL extraction system. Alternative 3A also rate high with regard to long-term effectiveness and permanence. Therefore Alternative 4A and 4C rate highest for Long-term Effectiveness and Permanence followed by Alternative 3A and Alternative 5.

Reduction of Toxicity, Mobility, or Volume with Treatment. Alternative 1 will not result in the reduction of toxicity, mobility, or volume of soil contamination through treatment.

Alternatives 2, 3A and 3B will reduce the mobility of contamination through either containment or solidification, but will not reduce the volume of impacted soil.

Alternatives 4B and 5 will reduce the volume of impacted soil through excavation within a portion of the site. Alternative 4B will reduce mobility of NAPL through extraction while Alternative 5 will reduce mobility of remaining impacted soil through solidification.

Alternatives 4A and 4C rate highest for Reduction of Toxicity, Mobility, or Volume with treatment as it will involve excavation within the entire area of MGP impacted soil resulting in the highest reduction in contaminant volume and no control required to reduce mobility.

Implementability. Alternative 1 requires no action, therefore there are no technical difficulties associated with this alternative. However, obtaining regulatory approval of this alternative will be difficult.

Each of the Alternatives presented above will present some technical issues, primarily associated with cooperation of the community and land owners surrounding OU01 for potential access. Alternative 2 presents the fewest technical issues due to the shorter duration of construction, less space needed for equipment, supplies and stockpiles, and less risk of significant odors. Therefore Alternative 2 rates highest for implementability.

Land Use. The current and reasonably anticipated future land use of OU01 is for continued commercial use. Alternative 1 will not allow for safe future commercial use because no remedial actions will be taken. The remaining alternatives will be compatible with current use and reasonably anticipated future land use, however, with the exception of Alternatives 4A and 4C, they will require land use restriction and an SMP.

Sustainability / Green Remediation (DER-31). Alternative 1 does not require any resources to implement, however it is not protective of human health and the environment. Alternatives 4A, 4B, 4C and 5 are not considered sustainable or green because they require significant excavation

and off-site disposal resulting in both energy consumption and natural resource consumption. Alternatives 3A and 3B have significantly less soil transportation and disposal, however the alternatives will result in significant energy consumption during the construction phase. Alternatives 3B and 4B will also require long-term operations and maintenance which will require ongoing energy use and frequent travel to and from the site. Alternative 2 is likely to result in lower energy consumption than the other active remedies because it will not require transportation and disposal of soil and will require the fewest natural resources to complete the remedy while still being protection of human health and the environment. Therefore Alternative 2 rates highest for Sustainability/Green Remediation, followed by Alternative 3A.

Cost. A comparison of the capital and long-term costs associated with the remedial alternatives is presented in Table 8.1. Alternative 2 is the most cost effective alternative, while alternative 2C is the highest cost alternative.

9.0 REFERENCES

MACTEC Engineering and Consulting, P.C. (MACTEC), 2015. *Remedial Investigation Report – Saranac Lake Gas Company Site*. Prepared for New York State Department of Environmental Conservation, Albany, New York. January 30, 2015.

New York State (NYS), 2006. New York Codes, Rules, and Regulations, Title 6, Part 375-Inactive Hazardous Waste Disposal Sites Remedial Program. Amended 2006.

NYS, 1999. New York Codes, Rules, and Regulations, Title 6, Part 700-705 Water Quality Regulations Surface Water and Groundwater Classifications and Standards. Amended August 1999.

New York State Department of Environmental Conservation (NYSDEC), 2011. DER-31, Technical Guidance for Green Remediation. January 2011.

NYSDEC, 2010. DER-10, Technical Guidance for Site Investigation and Remediation. May 2010.

NYSDEC, 2002. DER-4, Management of Coal Tar Waste and Coal tar Contaminated Soils and Sediment from Former Manufactured Gas Plants ("MGP"s). January 2002.

Office of Management and Budget (OMB), 2014. Circular No. A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Appendix C: Discount Rates for Cost-Effectiveness, Lease-Purchase, and Related Analyses, Office of Management and Budget, The Executive Office of the President, January.

United States Environmental Protection Agency (USEPA), 2000. "A Guide for Developing and Documenting Cost Estimates During the Feasibility Study"; EPA 540-R-00-002, OSWER 9355.0-75; U.S. Environmental Protection Agency; Washington, D.C., July 2000.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (Interim Final); EPA/540/G-89/004; October 1988.

FIGURES

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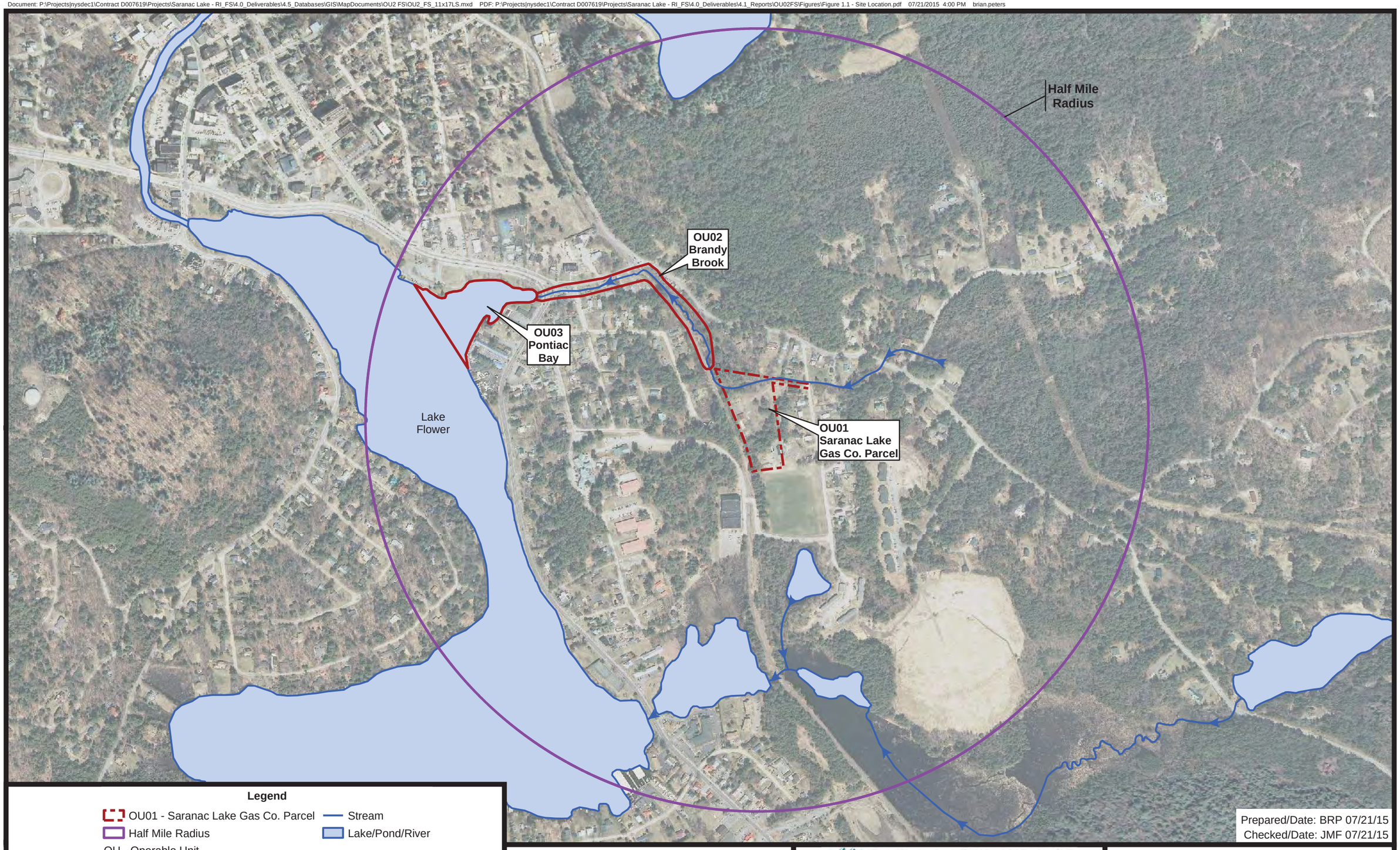

Legend

- OU01 - Saranac Lake Gas Co. Parcel
- Half Mile Radius
- OU - Operable Unit
- Stream
- Lake/Pond/River

N

0 300 600 Feet

Essex and Franklin County color digital orthoimagery (2009) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: BRP 07/21/15
Checked/Date: JMF 07/21/15

NYSDEC Site # 516008
Saranac Lake Gas Co., Inc.
Saranac Lake, New York

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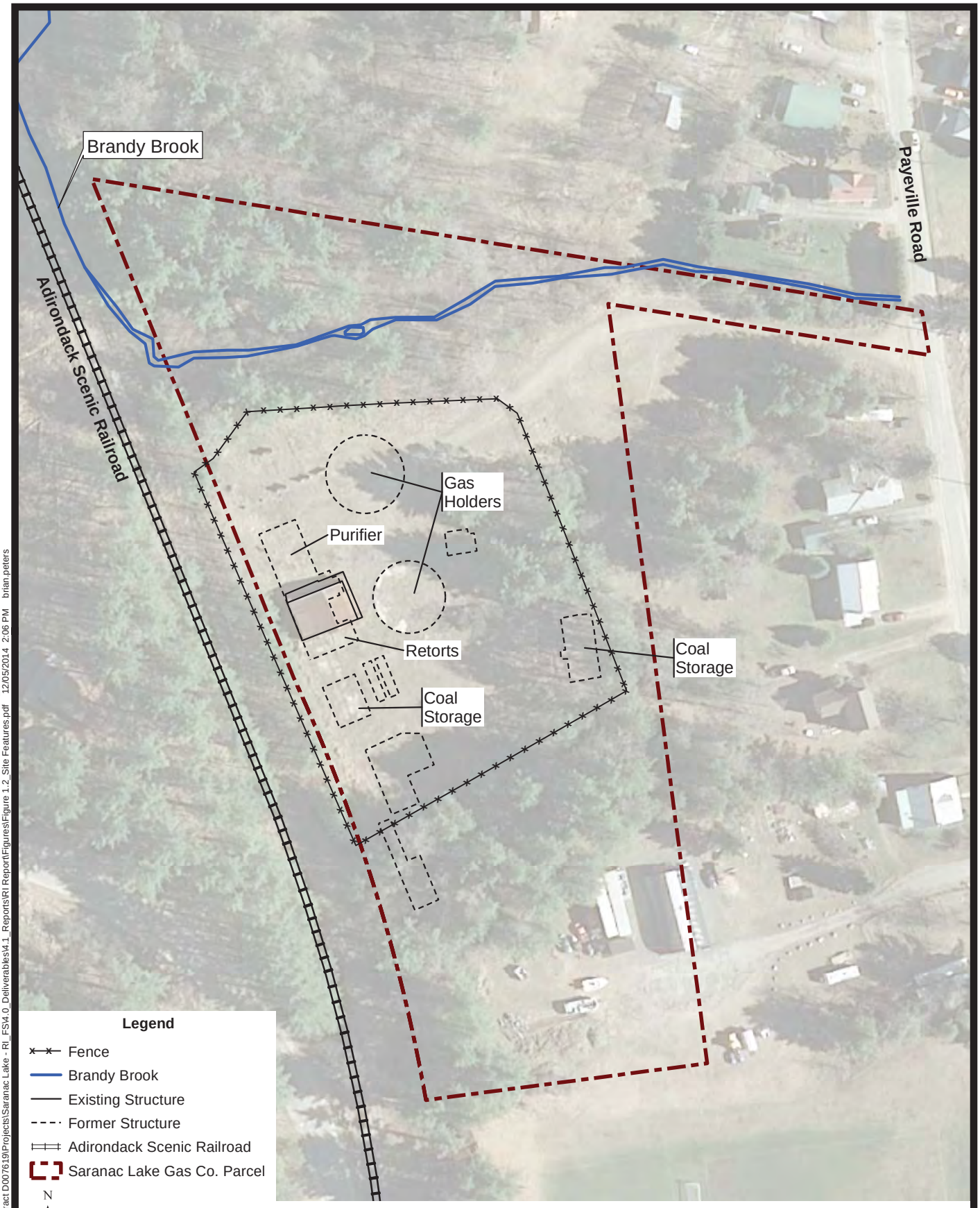
Site Location Map

Project 3612132271 Figure 1.1



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Prepared/Date: BRP 12/05/14
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Site Features

Project 3612132271 Figure 1.2

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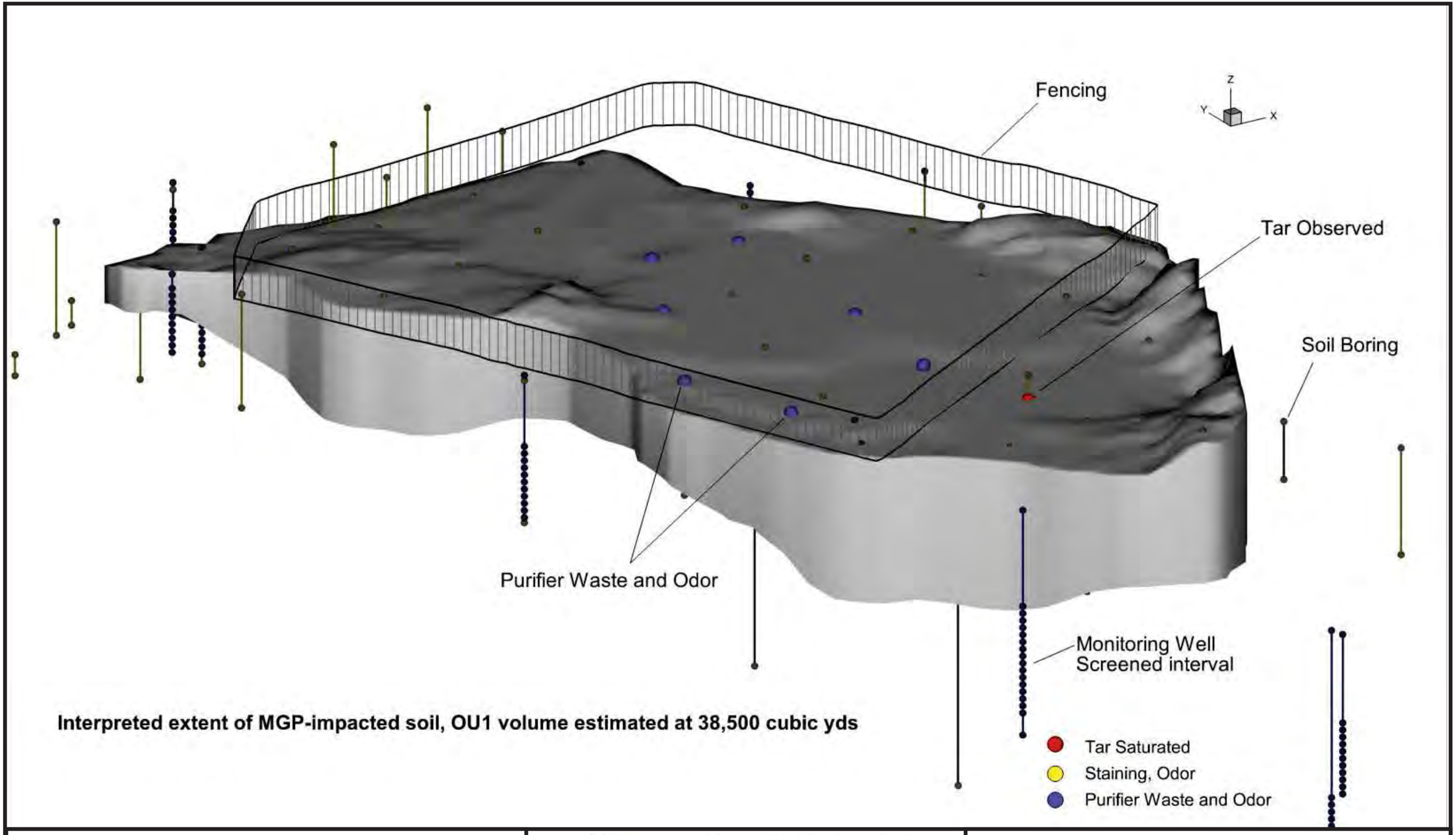
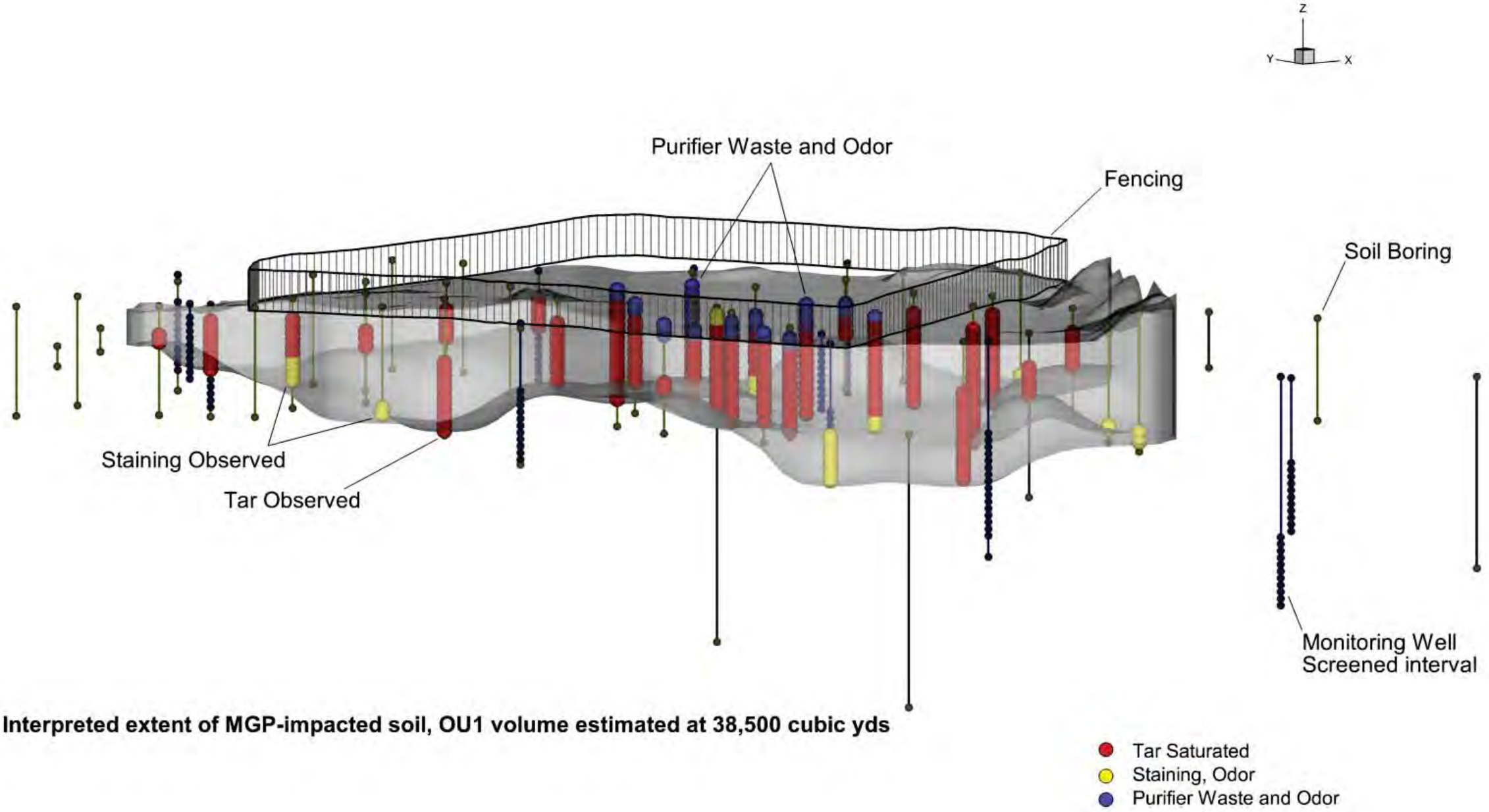


Interpreted extent of MGP-impacted soil, OU1 volume estimated at 38,500 cubic yds

NYSDEC – Site # 516008 **Saranac Lake Gas Company** **Saranac Lake, New York**	MACTEC	**Interpretation of the Volume of MGP- Impacted Soil from OU01** **Project 3612132271** **Figure 2.1A**



NYSDEC – Site # 516008 **Saranac Lake Gas Company** **Saranac Lake, New York**	MACTEC	**Interpretation of the Volume of MGP-Impacted Soil from OU01 (showing translucency)** **Project 3612132271** **Figure 2.1B**

A1
A2
B2
C2
E2
F2
GS-15
E3
F3
GS-01
C3
B3
GS-10
GS-09
E4
F4
GS-11
C4
D4
B4
GS-08
D5
TP-01
E5
GS-02
C5
F5
H6
GS-12
TP-03
E6
F6
GS-03
D6
TP-02
H7
F7
G7
GS-07
D7
E7
TP-04
E7A
GS-04
C7
GS-06
H8
GS-13
F8
G8
E8
GS-05
D8
G9
TP-05
GS-16
F9
E9
D9
F9A
G10
GS-14
E10
F10
E11
F11A
F11
F12A
F12
G12
E12
H13
J14
H15
E16

Legend

MGP-Impacted Soil:
- No Observed Impacts
- Staining, Odor
- Tar Saturated
- Purifier Waste and Odor

Square Position in Stack Indicates Soil Depth:
- 0-4 ft bgs
- 4-8 ft bgs
- 8-12 ft bgs
- 12-16 ft bgs
- > 16 ft bgs

TP-03 2007 SC Data
E5 2013/2014 RI Data
Estimated Extent of Visual MGP-Impacted Soils
Estimated Extent of Visual Purifier Box Waste Material
Estimated Extent Visual/Olfactory MGP-Impacted Soils
Fence
Brandy Brook
Existing Structure
Former Structure
Adirondack Scenic Railroad
Saranac Lake Gas Co. Parcel

N
0 15 30 Feet

Essex County color digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

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Checked/Date: DF 11/23/15

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Saranac Lake, New York

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Visual/Olfactory Extent of MGP-Impacted Soil
Project 3612132271 Figure 2.2

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MW-104 (11)
GW-15 (7) GS-15
MW-105 (15)
F2
F3
GS-01
MW-106 (10) C3
GW-10 (7) GS-10
GS-09
GW-09 (8) E4
MW-107 (10)
GW-11 (6) GS-11
C4
TP-01
E5
GS-08
GW-08 (12)
D5
GW-02 (9.5) GS-02
MW-108 (14)
GW-12 (10) GS-12
TP-03
D6
MW-102 (10) E6
F6
GS-03
TP-02
GW-07 (8) GS-07
D7
F7
TP-04
E7A
GS-04
MW-110 (15)
GW-13 (8) GS-13
GW-06 (8) GS-06
F8
G8
GW-05 (8) GS-05
TP-05
GS-16
E9
D9
MW-101 (8) F9
GW-14 (6) GS-14
G10
MW-103 (15)
MW-109 (10)
MW-204 (17) E12
MW-205S (15)
MW-205D (25) E16
North Country Community College

Legend

PAH Concentrations Detected in Groundwater:
- Not Detected Above the Reporting Limit
- Detected < Class GA Standard
- Exceeds Class GA Standard

PAH Concentrations Detected in Soil:
- Not Sampled
- Not Detected Above the Reporting Limit
- Detected < Restricted Residential Criteria
- Exceeds Restricted Residential Criteria
- Exceeds Commercial Criteria
- Exceeds Industrial Criteria

Square Position in Stack Indicates Soil Depth:
- 0-4 ft bgs
- 4-8 ft bgs
- 8-12 ft bgs
- 12-16 ft bgs
- > 16 ft bgs

TP-03 2007 SC Data
MW-204 2013/2014 RI Data
(12) Sample Depth (ft bgs)
Sample Location; No Analytical Data
Approximate Groundwater Flow Direction
Estimated Extent of Visual MGP-Impacted Soils
Estimated Extent of Visual Purifier Box Waste Material
Fence
Brandy Brook
Existing Structure
Former Structure
Adirondack Scenic Railroad
Saranac Lake Gas Co. Parcel

PAHs - Polycyclic Aromatic Hydrocarbons

Criteria:
Soil Cleanup Objectives Criteria from Subpart 375-6.8(b)

Groundwater Criteria from Technical and Operational Guidance Series 1.1.1

N
0 15 30 Feet

Essex County color digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

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Saranac Lake, New York

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PAHs Detected in Soil and Groundwater Compared to Criteria
Project 3612132271 Figure 2.3

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Temporary NAPL Collection Area

Estimated Areal Extent of Impermeable Surface Cap (100,337 square feet)

Estimated Location of Vertical Barrier Wall (1,300 linear feet)

Legend

- Impermeable Surface Cap
- Temporary NAPL Collection Area
- Vertical Barrier Wall
- Estimated Extent of Visual MGP-Impacted Soils
- Estimated Extent of Visual Purifier Box Waste Material
- Fence
- Brandy Brook
- Existing Structure to be Demolished
- Former Structure/Concrete Slab to be Demolished
- Adirondack Scenic Railroad
- Saranac Lake Gas Co. Parcel

N

0 15 30 Feet

Notes:
1. Locations of the continued site monitoring and potential bioenhancement wells will be determined during the design phase of the project and will be based on pre-design investigations.

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Alternative 2
Capping and Vertical Barrier
Project 3612132271 Figure 7.1

Estimated Extent of In-Situ Solidification for Alternative 3A or Soil Cover for Alternative 3B (94,000 square feet)

Temporary NAPL Collection Area

Estimated Location of In-Situ Solidification for Alternative 3B (34,500 square feet of Purifier Box Waste Impacted Soil)

Estimated Location of NAPL Collection System for Alternative 3B

Legend

- Partial Source Area In-Situ Solidification for Alternative 3B
- Full Source Area In-Situ Solidification for Alternative 3A or Soil Cover for Alternative 3B
- NAPL Collection System for Alternative 3B
- Temporary NAPL Collection Area
- Estimated Extent of Visual MGP-Impacted Soils
- Estimated Extent of Visual Purifier Box Waste Material
- Fence
- Brandy Brook
- Existing Structure to be Demolished
- Former Structure/Concrete Slab to be Demolished
- Adirondack Scenic Railroad
- Saranac Lake Gas Co. Parcel

N

0 15 30 Feet

Notes:
1. Locations of the continued site monitoring and potential bioenhancement wells will be determined during the design phase of the project and will be based on pre-design investigations.

Prepared/Date: BRP 11/23/15
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NYSDEC Site # 516008
Saranac Lake Gas Co., Inc.
Saranac Lake, New York

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Alternatives 3A and 3B
In-Situ Solidification
Project 3612132271 Figure 7.2

Estimated Extent of Excavation for Alternative 4C to Meet Pre-Release Conditions of No Detectable PAHs or Visual/Olfactory Evidence of Contamination (224,000 square feet of Soil)

Estimated Extent of Excavation for Alternative 4A or Soil Cover for Alternative 4B (94,000 square feet of Visually Impacted Soil)

Estimated Location of Excavation for Alternative 4B (34,500 square feet of Purifier Box Waste Impacted Soil)

Temporary NAPL Collection Area

Estimated Location of NAPL Collection System for Alternative 4B

Legend

- Purifier Box Waster Source Area Excavation for Alternative 4B
- Visually Impacted Area Excavation for Alternative 4A or Soil Cover for Alternative 4B
- Excavation to Meet Pre-Release Conditions for Alternative 4C
- NAPL Collection System for Alternative 4B
- Temporary NAPL Collection Area
- Estimated Extent of Visual MGP-Impacted Soils
- Estimated Extent of Visual Purifier Box Waste Material
- Fence
- Brandy Brook
- Existing Structure to be Demolished
- Former Structure/Concrete Slab to be Demolished
- Adirondack Scenic Railroad
- Saranac Lake Gas Co. Parcel

N

0 15 30 Feet

Notes:
1. Locations of the continued site monitoring and potential bioenhancement wells will be determined during the design phase of the project and will be based on pre-design investigations.

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NYSDEC Site # 516008
Saranac Lake Gas Co., Inc.
Saranac Lake, New York

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Alternatives 4A, 4B and 4C
Excavation
Project 3612132271 Figure 7.3

Estimated Extent of In-Situ Solidification (59,500 square feet)

Estimated Location of Excavation (34,500 square feet)

Temporary NAPL Collection Area

Legend

- Excavation
- In-Situ Solidification
- Temporary NAPL Collection Area
- Estimated Extent of Visual MGP-Impacted Soils
- Estimated Extent of Visual Purifier Box Waste Material
- Fence
- Brandy Brook
- Existing Structure to be Demolished
- Former Structure/Concrete Slab to be Demolished
- Adirondack Scenic Railroad
- Saranac Lake Gas Co. Parcel

N

0 15 30 Feet

Notes:
1. Locations of the continued site monitoring and potential bioenhancement wells will be determined during the design phase of the project and will be based on pre-design investigations.

Prepared/Date: BRP 11/23/15
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NYSDEC Site # 516008
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Saranac Lake, New York

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Alternative 5
Excavation and In-Situ Solidification
Project 3612132271 Figure 7.4

TABLES

Table 5.1: Identification and Screening of Potential Remedial Technologies - OU01

Environmental Media	General Response Action	Remedial Technology	Process Option	Applicability to		Screening Status	Comments
				Site-Limiting Characteristics	Waste-Limiting Characteristics		
Soil	No Action	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Retained	Does not meet RGs, will be carried through as a baseline comparison to other alternatives.
	Institutional Controls	Land Use Restrictions	Requires a Site Management Plan	The Site is currently zoned for mixed commercial and residential.	Does not actively treat, contain or remove impacted soil.	Eliminated	Eliminated as a stand-alone alternative, however institutional controls may be required in conjunction with other remedial alternatives.
		Fencing		Fencing requires long term maintenance.			
	Containment	Capping	Soil Cover	On-site buildings and concrete foundations need to be removed or integrated into the capping system.	Prevents direct exposure, but does not reduce toxicity or the volume of contaminated soil. Does not eliminate contaminant migration within groundwater, where much of the soil contamination is located.	Retained	Retained as a viable option to minimize direct exposure to impacted areas left in place.
			Low Permeability Cover System				
	In-Situ Treatment	Biological Treatment	Bioaugmentation	Implementation of the remedial option may be impeded by on-site buildings and concrete foundations.	Biological and Chemical in-situ treatment of coal tar-saturated soil has not been proven to be successful.	Eliminated	
		Chemical Treatment	Chemical Transformation			Eliminated	
		Thermal Treatment	Steam Injection / Extraction	Requires the installation and operation of an on-site treatment system. Also requires a substantial power source.	Steam injections will lower the viscosity of the NAPL allowing it to flow and enable extraction. However, there is potential for NAPL to migrate beyond the extraction points. Groundwater and NAPL would be extracted and would require separation. NAPL would need to be disposed off site and groundwater would be treated prior to discharge which would require a discharge permit and associated sampling. The volume of contaminated soil would be greatly reduced but the cost of the alternative would be prohibitive.	Eliminated	
		Physical Treatment	Solidification	Implementation of the remedial option may be impeded by on-site buildings and concrete foundations.	None	Retained	In-situ solidification of NAPL from MGP waste has been proven effective in subsurface soil to control the mobility of contamination and prevent off-site migration. Retained to be carried through detailed analysis of alternatives.
	Removal	Excavation	Excavate with Off-site Disposal	Requires removal of existing building and concrete foundations. Requires space for stockpile management and possible soil solidification prior to disposal off-site. Odor control will be necessary because the site is located in a mixed commercial/residential area.	None	Retained	Retained to be carried through detailed analysis of alternatives.

Table 5.1: Identification and Screening of Potential Remedial Technologies - OU01

Environmental Media	General Response Action	Remedial Technology	Process Option	Applicability to		Screening Status	Comments
				Site-Limiting Characteristics	Waste-Limiting Characteristics		
Groundwater	No Action	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Retained	Does not meet RGs, will be carried through as a baseline comparison to other alternatives.
	Institutional Controls	Ground Water Use Restrictions	Restrict use/drilling of production wells	Site currently serviced by public water services and groundwater is believed not to be used as a drinking water source.	Will not reduce toxicity, mobility, or volume of contaminated water.	Retained	Viable in conjunction with other remedial alternatives that do not meet all of the RGs.
	Continued Site Monitoring	Groundwater Monitoring	Not Applicable	No site-limiting factors.	Contamination exists as NAPL which will not naturally attenuate in a timely manner.	Retained	Viable in conjunction with other remedial alternatives which remove the NAPL.
	Containment	Vertical Barriers	Sheet pile or Slurry wall	Groundwater flow direction is wide, therefore the vertical barrier would be long.	Vertical barrier alone would minimize off-site migration but does not reduce toxicity, mobility or volume of contaminated water, and the accumulating volume of water inside the barrier would need to be managed.	Retained	Retain a combined vertical barrier and collection system for further screening of remedial alternatives.
		Collection	Extraction Wells and/or Collection Trenches	Based on the size of the site many extraction locations are required to ensure containment of the contamination. This alternative requires long term OM&M.	Collection alone would require significant collection points, large capacity multi-phase treatment facility and long term OM&M.	Retained	
	In-Situ Treatment	Biological Treatment	Bioaugmentation	Implementation of the remedial alternative may be impeded by on-site buildings and concrete foundations. Also access agreements are required to conduct remediation on downgradient properties.	Biological and Chemical in-situ treatment of MGP NAPL is not proven to be successful, however, biological treatment could be effective in downgradient portions of the site where residual PAH concentrations exist after the source area has been effectively removed or contained.	Retained	Retained as a viable option for downgradient/residual contaminant treatment.
		Chemical Treatment	Chemical Transformation			Eliminated	
		Thermal Treatment	Steam Injection / Extraction	Requires the installation and operation of an on-site treatment system. Also requires a substantial power source.	Steam injections would assist in lowering the viscosity of the NAPL allowing it to flow and enable extraction. However, there is a risk that the NAPL could migrate beyond the extraction points.	Eliminated	
	Ex-Situ Treatment	Dual Phase (Groundwater and NAPL) Extraction with On-site Treatment	Phase Separation, Air Stripper, Activated Carbon	Based on the size of the site, many extraction locations are required. This alternative requires long term OM&M.	NAPL separated from the groundwater would have to be transported off-site for disposal.	Retained	Retained in combination with dewatering as required for soil excavation and in combination with the vertical barrier and collection system.

Notes:
DNAPL - Dense Non-Aqueous Phase Liquid
MGP - Manufactured Gas Plant
NAPL - Non-Aqueous Phase Liquid
OM&M - Operation, Maintenance, and Monitoring
RGs - Remedial Goals
GRA - General Response Action

Table 6.1: Screening of Remedial Alternatives - OU01

Remedial Alternative	Effectiveness	Implement ability	Relative Cost	Screening Result
No Action	This alternative is not be effective for reducing contamination concentrations or addressing the identified exposure pathways.	There are no technical issues with implementing this alternative.	No cost associated with this alternative.	Retained as: **Alternative 1 - No Action.** **Use as a baseline for comparison to other alternatives.**
Institutional Controls	This alternative is not effective for reducing contamination concentrations or migration but could be effective in protecting identified exposure pathways.	There are no technical issues with implementing this alternative.	Relative costs for this alternative are low.	Retain for use in conjunction with other alternatives to address restrictions that may be imposed.
Capping	This alternative will minimize direct exposure to impacted soils, and pending of the capping type could minimize storm water through the ground to decrease overall migration. This alternative would not, however, reduce the overall volume of contamination.	This alternative could be implemented relatively easily, however it will require a site management plan that would limit the possible future use of the property.	Relative costs for this alternative is low.	A combined alternative including both a cap and a containment wall within the areas where soil if visually impacted with MGP waste is retained for detailed analysis. **Alternative 2 - Impermeable Cap and Vertical Barrier with Downgradient Continued Site Monitoring (or Continued Site Monitoring with Biological Enhancement)**
Vertical Barrier	This alternative is effective for minimizing contaminant migration and reducing downgradient concentrations in the long term.	This alternative could be implemented relatively easily, however it will require a site management plan during long-term operation and may limit the possible future use of the property.	Relative costs for this alternative are low to medium. The primary items contributing to costs include tree clearing, structure demolition, installation of the vertical barrier, grading, and long-term operations and maintenance.	
Continued Site Monitoring	Contamination exists as NAPL which will not naturally attenuate in a timely manner.	There are no technical issues with implementing this alternative.	Relative costs for this alternative are low.	Continued Site Monitoring or Continued Site Monitoring with Biological Enhancement will be retained for downgradient groundwater in combination with active on-site remediation.
Biological Treatment	Biological and Chemical in-situ treatment of MGP NAPL is not proven to be successful, however, biological treatment could be effective in downgradient portions of the site where residual PAH concentrations exist after the source area has been effectively removed or contained.	There are minimal technical issues associated with implementing this alternative.	Relative costs for this alternative are low.	
Dual Phase Extraction	This alternative could be effectiveness at controlling migration of NAPL and contaminated groundwater, but would not be effective as a stand alone remedial technology.	This alternative could be implemented relatively easily, however it will require a site management plan during long-term operation and may limit the possible future use of the property.	Relative costs for this alternative are medium. The primary items contributing to costs include installation of a extraction wells and a treatment system, off-site transportation and disposal of accumulated NAPL, and long-term operations and maintenance.	This alternative is not retained as a stand alone remedy as it is not likely to meet all of the RAOs in a timely manner. This alternative is, however, retained in combination with excavation alternatives as dewatering would be required and dewatered effluent will require treatment. Additionally, given the timing of remedial implementation, dual phase extraction, or NAPL extraction could be conducted as an interim remedial measure to minimize off-site migration.
In-situ Solidification	In-situ solidification of soil contaminated with MGP waste has been proven effective in the subsurface (both in the saturated and vadose zone) to control the mobility of contamination and prevent off-site migration. In-place solidification will eliminate direct exposure and migration to both downgradient soil and groundwater.	This alternative has been successfully implemented on MGP sites. The existing building, concrete foundations and trees will need to be removed from the Site. Based on the estimated quantity of contamination, in-situ solidification may be extended over a long duration.	Relative costs for this alternative would be medium. The primary items contributing to cost include tree clearing, structure demolition, excavation of clean/re-usable soil, in-situ soil mixing with solidifying agents (typically Portland cement) or other binding agents using an excavator or augers, backfilling and grading. Costs of this remedy is driven by the overall quantity of material requiring stabilization, and the overall costs could be decreased by focusing the treatment on highly impacted areas and placing a vertical barrier and collection system downgradient of the solidified area to capture any remaining NAPL.	This alternative is retained for source areas on the Site (i.e. soil visually impacted with MGP waste). Downgradient groundwater would be left to attenuate naturally or with biological enhancements. **Alternative 3A - In-Situ Solidification within Visually Impacted Areas with Continued Site Monitoring Downgradient (or Continued Site Monitoring with Biological Enhancement)** **Alternative 3B - Partial In-Situ Solidification with NAPL collection and Continued Site Monitoring Downgradient (or Continued Site Monitoring with Biological Enhancement)**

Table 6.1: Screening of Remedial Alternatives - OU01

Remedial Alternative	Effectiveness	Implement ability	Relative Cost	Screening Result
Excavation	Excavation is an effective way to remove contaminated soil which is a continuing source to downgradient groundwater contamination.	This alternative has been successfully implemented on MGP sites. The existing buildings, concrete foundations and trees will need to be removed from the Site. Based on the size of the source area, excavation may need to be phased to allow room for stockpiling soil and ex-situ solidification if required. Sheet pile walls will be required due to the shallow depth of groundwater and the required depth of excavation. Dewatering of the excavation and treatment of water prior to discharge will also be required. There is potential for significant odors to be generated during excavation and from stockpiled materials that will need to be managed.	Relative costs for this alternative is high. The primary items contributing to cost include tree clearing, structure demolition, sheet-pile installation, soil excavation, excavation dewatering and treatment, solidification of excavated soil (if needed), transportation and disposal of contaminated soil, backfilling, compaction and grading. Similar to stabilization, costs of this remedy is driven by the overall quantity of material requiring stabilization, and the overall costs could be decreased by focusing the removal on highly impacted areas and placing a vertical barrier and collection system downgradient of the remediated area to capture any remaining NAPL.	This alternative is retained for source areas on the Site (i.e. soil visually impacted with MGP waste). Downgradient groundwater would be left to attenuate naturally or with biological enhancements. **Alternative 4A - Excavation within Visually Impacted Areas with Continued Site Monitoring Downgradient (or Continued Site Monitoring with Biological Enhancement)** **Alternative 4B - Partial Excavation with NAPL collection and Continued Site Monitoring Downgradient (or Continued Site Monitoring with Biological Enhancement)** **Alternative 4C - Excavation to Meet Pre-Disposal Conditions with Continued Site Monitoring Downgradient (or Continued Site Monitoring with Biological Enhancement)**
Combined Excavation & Solidification	Excavation would be an effective way to remove the most contaminated media from OU01, while solidification would be effective at eliminating migration of remaining MGP NAPL impacted areas.	This combination of alternatives has been successfully implemented on several MGP sites. The technical issues would include issues identified above for both the solidification and excavation alternatives. However, the excavation area would be smaller which would reduce the quantity of sheet piling and groundwater extraction.	Relative costs for this alternative would be medium to high. The primary items contributing to cost include tree clearing, structure demolition, sheet pile installation, excavation dewatering and treatment, soil excavation, in-situ soil mixing with solidifying agents, solidification of excavated soil (if needed), and transportation and disposal of MGP-impacted soil.	This alternative is retained for areas with visually impacted soil, while downgradient groundwater would be left to attenuate naturally or with biological enhancements. **Alternative 5 - Combined Excavation and In-Situ Solidification with Continued Site Monitoring Downgradient (or Continued Site Monitoring with Biological Enhancement)**

Notes:
MGP - manufactured gas plant
NAPL - non-aqueous phase liquid
SGVs - Sediment Guidance Values

Table 7.1: Applicable Location- and Action-Specific Standards, Criteria, and Guidance

Requirement	Consideration in the Remedial Response Process
NYSDEC Division of Fish, Wildlife and Marine Resources - Freshwater Sediment Guidance Values (June 2014)	May be applicable due to the determination of toxicity of sediment contamination in Brandy Brook.
29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response	Applicable to implementation of Health and Safety implementation, enforcement, and emergency response.
6 NYCRR Part 175 - Special Licenses and Permits-Definitions and Uniform Procedures	Applicable to implementation of biota sampling as part of pre-design investigation
6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes (November 1998)	Applicable to the characterization, handling, transportation, and treatment/disposal of soils, sediments, and debris to be removed from the Site.
6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998)	Applicable to the handling, transportation, and treatment/disposal of soils, sediments, and C&D debris to be removed from the Site.
6 NYCRR Part 375 - Environmental Remediation Programs (as amended December 2006)	Applicable to the development and implementation of remedial programs.
6 NYCRR Part 376 - Land Disposal Restrictions	Applicable to disposal of hazardous wastes. Identifies those wastes that are restricted from land disposal.
19 NYCRR Part 600 - Waterfront Revitalization and Coastal Resources	Not Applicable.
19 NYCRR Part 622 - Freshwater Wetlands - Interim Requirements	Applicable as part of construction and restoration activities.
19 NYCRR Part 622 - Freshwater Wetlands - Permit Requirements	Applicable as part of construction and restoration activities.
6 NYCRR Parts 700-706 - Water Quality Standards (June 1998)	Applicable to construction in and adjacent to Brandy Brook and for temporary diversion of the Brook and discharge of treated wastewater if needed.
6 NYCRR Part 750 through 758 - Implementation of NPDES Program in NYS (“SPDES Regulations”)	Applicable to construction in and adjacent to water bodies, temporary diversion of Brandy Brook, and discharge of treated wastewater, if needed.
DER-10 Technical Guidance for Site Investigation and Remediation	Applicable to the development and implementation of remedial programs.
Citizen Participation in New York’s Hazardous Waste Site Remediation Program: A Guidebook (June 1998)	Applicable to the development and implementation of remedial programs.
TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations	Applicable to construction in and adjacent to Brandy Brook and for temporary diversion of the Brook and discharge of treated wastewater if needed.
Solidification/Stabilization and its Application to Waste Materials	Applicable to disposal of wastes generated during implementation of remedial program.
DER-31 - Green Remediation (August 2010)	Applicable to the development and implementation of remedial programs.

Table 7.2: Cost Summary for Alternative 2 - Impermeable Cap and Vertical Barrier

ITEM	COST
DIRECT CAPITAL COSTS	
Pre-Design Investigation	$ 325,000
Full-Scale Implementation of Remedy	$ 1,307,000
Contingency (@ 20 Percent)	$ 327,000
Direct Cost Subtotal	$ 1,959,000
INDIRECT CAPITAL COSTS	
Project Management (@ 6 Percent)	$ 118,000
Remedial Design (@ 12 Percent)	$ 235,000
Construction Management (@ 8 Percent)	$ 157,000
Indirect Cost Subtotal	$ 510,000
TOTAL CAPITAL COSTS	**$ 2,469,000**
ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS*	
Annual Site Inspection and Reporting (years 1-30)	$ 10,000
Continued Site Monitoring (Years 1-2)	$ 52,000
Continued Site Monitoring (Years 3-5)	$ 29,000
5-Year Annual Review Report (Year 5)	$ 24,000
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000
Continued Site Monitoring (Years 7-30)	$ 29,000
PRESENT WORTH OF ANNUAL COSTS (30 yrs)	**$ 797,000**
TOTAL PRESENT WORTH OF ALTERNATIVE (30 yrs)	**$ 3,266,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE (30 yrs)	**$ 3,736,000**

NOTES:

Costs have been rounded to the nearest thousand.

* Costs include additional 20 percent for technical support and contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

Table 7.3: Cost Summary for Alternatives 3A and 3B - In-Situ Solidification

ITEM	Solidification 3A	Solidification 3B
DIRECT CAPITAL COSTS		
Pre-Design Investigation	$ 420,000	$ 420,000
Full-Scale Implementation of Remedy	$ 7,215,000	$ 5,122,000
Contingency (@ 20 Percent)	$ 1,527,000	$ 1,108,000
Direct Cost Subtotal	$ 9,162,000	$ 6,650,000
INDIRECT CAPITAL COSTS		
Project Management (@ 5 Percent)	$ 459,000	$ 333,000
Remedial Design (@ 8 Percent)	$ 733,000	$ 532,000
Construction Management (@ 6 Percent)	$ 550,000	$ 399,000
Indirect Cost Subtotal	$ 1,742,000	$ 1,264,000
TOTAL CAPITAL COSTS	**$ 10,904,000**	**$ 7,914,000**
ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS*		
Annual Site Inspection and Reporting (years 1-30)	$ 10,000	$ 10,000
Continued Site Monitoring (Years 1-2)	$ 52,000	$ 52,000
Continued Site Monitoring (Years 3-5)	$ 29,000	$ 29,000
5-Year Annual Review Report (Year 5)	$ 24,000	$ 24,000
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	$ 56,000
Continued Site Monitoring (Years 7-30)	$ 29,000	$ 29,000
NAPL Extraction O&M	$ -	$ 110,000
PRESENT WORTH OF ANNUAL COSTS (30 yrs)	**$ 797,000**	**$ 2,846,000**
TOTAL PRESENT WORTH OF ALTERNATIVE (30 yrs)	**$ 11,701,000**	**$ 10,760,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE (30 yrs)	**$ 12,171,000**	**$ 12,481,000**

NOTES:

* Costs include additional 20 percent for technical support and contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Costs have been rounded to the nearest thousand.

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

Table 7.4: Cost Summary for Alternatives 4A, 4B and 4C - Excavation

ITEM	Excavation 4A	Excavation 4B	Excavation 4C
DIRECT CAPITAL COSTS			
Pre-Design Investigation	$ 312,000	$ 312,000	$ 372,000
Full-Scale Implementation of Remedy	$ 14,211,000	$ 8,541,000	$ 41,013,000
Contingency (@ 20 Percent)	$ 2,905,000	$ 1,771,000	$ 8,277,000
Direct Cost Subtotal	$ 17,428,000	$ 10,624,000	$ 49,662,000
INDIRECT CAPITAL COSTS			
Project Management (@ 5 Percent)	$ 872,000	$ 532,000	$ 2,484,000
Remedial Design (@ 6 Percent)	$ 1,046,000	$ 638,000	$ 2,980,000
Construction Management (@ 6 Percent)	$ 1,046,000	$ 638,000	$ 2,980,000
Indirect Cost Subtotal	$ 2,964,000	$ 1,808,000	$ 8,444,000
TOTAL CAPITAL COSTS	**$ 20,392,000**	**$ 12,432,000**	**$ 58,106,000**
ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS*			
Annual Site Inspection and Reporting (years 1-30)	$ 10,000	$ 10,000	$ 10,000
Continued Site Monitoring (Years 1-2)	$ 52,000	$ 52,000	$ 52,000
Continued Site Monitoring (Years 3-5)	$ 29,000	$ 29,000	$ 29,000
5-Year Annual Review Report (Year 5)	$ 24,000	$ 24,000	$ 24,000
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	$ 56,000	$ 56,000
Continued Site Monitoring (Years 7-30)	$ 29,000	$ 29,000	$ 29,000
NAPL Extraction O&M	$ -	$ 110,000	$ -
PRESENT WORTH OF ANNUAL COSTS (30 yrs)	**$ 797,000**	**$ 2,846,000**	**$ 797,000**
TOTAL PRESENT WORTH OF ALTERNATIVE (30 yrs)	**$ 21,189,000**	**$ 15,278,000**	**$ 58,903,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE (30 yrs)	**$ 21,659,000**	**$ 16,999,000**	**$ 59,373,000**

NOTES:

* Costs include additional 20 percent for technical support and contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Costs have been rounded to the nearest thousand.

Prepared By/Date: DF 11/23/2015
Checked By/Date: JDW 12/7/2015

Table 7.5: Cost Summary for Alternative 5 - Combined Excavation and In-Situ Solidification

ITEM	COST
DIRECT CAPITAL COSTS	
Pre-Design Investigation	$ 420,000
Full-Scale Implementation of Remedy	$ 9,874,000
Contingency (@ 20 Percent)	$ 1,545,000
Direct Cost Subtotal	$ 11,839,000
INDIRECT CAPITAL COSTS	
Project Management (@ 5 Percent)	$ 592,000
Remedial Design (@ 6 Percent)	$ 710,000
Construction Management (@ 6 Percent)	$ 710,000
Indirect Cost Subtotal	$ 2,012,000
TOTAL CAPITAL COSTS	**$ 13,851,000**
ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS*	
Annual Site Inspection and Reporting (years 1-30)	$ 10,000
Continued Site Monitoring (Years 1-2)	$ 52,000
Continued Site Monitoring (Years 3-5)	$ 29,000
5-Year Annual Review Report (Year 5)	$ 24,000
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000
Continued Site Monitoring (Years 7-30)	$ 29,000
PRESENT WORTH OF ANNUAL COSTS (30 yrs)	**$ 797,000**
TOTAL PRESENT WORTH OF ALTERNATIVE (30 yrs)	**$ 14,648,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE (30 yrs)	**$ 15,118,000**

NOTES:

* Costs include additional 20 percent for technical support and contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.

Costs have been rounded to the nearest thousand.

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

Table 8.1: Summary of Remedial Alternative Costs

Item	Description	Alternative 1	Alternative 2	Alternative 3		Alternative 4			Alternative 5
				A	B	A	B	C	
1	Capital Costs	$ -	$ 2,469,000	$ 10,904,000	$ 7,914,000	$ 20,392,000	$ 12,432,000	$ 58,106,000	$ 13,851,000
2	Present Worth of Annual Costs	$ -	$ 797,000	$ 797,000	$ 2,846,000	$ 797,000	$ 2,846,000	$ 797,000	$ 797,000
3	**Total Present Worth (Item 1 plus 2)**	**$ -**	**$ 3,266,000**	**$ 11,701,000**	**$ 10,760,000**	**$ 21,189,000**	**$ 15,278,000**	**$ 58,903,000**	**$ 14,648,000**
4	Annual Costs (1-30 years)	$ -	$ 42,000	$ 42,000	$ 152,000	$ 42,000	$ 152,000	$ 42,000	$ 42,000
6	Remedial Timeframe (months)	0	2.5	4	3.5	4.5	4	8	4

Notes:

1. Present Worth costs shown above are based upon the assumed Remedial Timeframe.
2. The Annual Costs (Item 4) presented use a weighted average of the annual monitoring cost since it changes after year 2 and again after year five. These are also non-discounted (future) costs.
3. Estimated costs presented in this table are intended to be within the target accuracy range of minus 30 to plus 50 percent of actual cost.
4. The remedial timeframe is for the construction portion of the remedy, monitoring would continue for 30 years.

Alternative Descriptions:

1 = No Further Action
2 = Capping and Vertical Barriers and Continued Downgradient Site Monitoring (and Potential Biological Enhancements)
3 = In-Situ Solidification (ISS) and Continued Downgradient Site Monitoring (and Potential Biological Enhancements)
  3A = ISS within area with visually impacted soil
  3B = ISS within MGP purifier waste area and NAPL collection
4 = Excavation and Continued Downgradient Site Monitoring (and Potential Biological Enhancements)
  4A = Excavation within area with visually impacted soil
  4B = Excavation within MGP purifier waste area and NAPL Collection
  4C = Excavation within areas with detectable PAH concentrations.
5 = Combined Excavation and ISS and Continued Downgradient Site Monitoring (and Potential Biological Enhancements)

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

APPENDIX A

REPRESENTATIVE SOIL BORING LOGS

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	E - 6
Project Location:		Saranac Lake, NY		Page No.	1
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	South of F-11	Refusal Depth:	NA	Total Depth:	20 ft bgs
Weather:	60 F Heavy Rain	Soil Drilled:	20 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/8/2013	Date Completed:	8/8/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	1548.5 ' amsl	Water Level:	3.5 ft bgs	Time:	9/11/2013

Bore Hole ID/OD:	2.5 inch
Casing Size:	NA
Sampler:	Macrocore
Sampler ID/OD:	2.5 inch

Sample Information			Monitoring								
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)			PID				Sample Description and Classification	USCS Group Symbol	Remarks
0.0											
					0.1			Cole Slag	0 - 0.2 Light brown, silty sand and gravel Well sorted, dry, NP, loose	SW	
1					35.8				0.2 - 4.0 Black (stained) F to C sand, some silt Coal and slag at 0.6 - 1.2 '	Fill	
		4.0/3.2			289			Wood	Very strong odor, wood chips and waste at 1 ' and 1.6-2.4'	Waste	Collected soil sample to evaluate direct contact exposure at E-6 from 1.5 to 2 ft 516008-E602 at 0955
2					192				Well sorted, NP, moist, loose to M dense		
					145						
3					201						
								Residual			
4					252						
					39.5			Residual	4.0- 8.0 Black to dk brown, f to m sand Some silt, DNAPL present from 4.5 to 5.9'		
5					285				Residual throughout, poorly sorted		
		4.0/3.8			232				Moist to wet, very strong odor, m dense NP		
6					189			DNAPL		SP	
					122						
7					30.5						
					68.2						
8					45.5			Residual			

NOTES:

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	E - 6
Project Location:		Saranac Lake, NY		Page No.	2
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	South of F-11	Refusal Depth:	NA	Total Depth:	20 ft bgs
Weather:	60 F Heavy Rain	Soil Drilled:	20 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/8/2013	Date Completed:	8/8/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	1548.5 ' amsl	Water Level:	3.5 ft bgs	Time:	9/11/2013
Bore Hole ID/OD:	2.5 inch				
Casing Size:	NA				
Sampler:	Macrocore				
Sampler ID/OD:	2.5 inch				

Sample Information			Monitoring							
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID				Sample Description and Classification		USCS Group Symbol	Remarks
0.0							8 - 12	Brown to olive to black (stained)		
			49.5					Fine sand with some silt, DNAPL present	SP	
9			48.5					From 10 to 12', poorly sorted, NP		
								M dense, moist to wet, very strong odor		
		4.0/3.8	122			Residual				Collected soil sample
10			185							and TCLP at E-6
			335							from 10.4 to 12 for
11			420							product and wate
			532			DNAPL				516008-E612
12			402							at 1115
13			112			DNAPL	12 - 15.5	Black to olive brown, m to f sand with some silt	SP	
14			232					DNAPL present at 12.2		
15			68.5				12.8, 15 -15.3	Poorly sorted, wet to moist, M dense		
								MP/SP, very strong odor		
16		4.0/3.0	24.4			Residual	15.5 - 16	Olive brown silty sand, PS, moist , m dense SP		
17			36.7			DNAPL	16 - 16.8	reddish brown/reddish gray		
								silt, trace f sand, PS, moist, NP		
18			48.5				16.8 - 19	Brown to orange brown to reddish brown		
			150					F sand, some silt, few m sand		
19			89.1			Residual		PS, wet, m dense, NP		
		4.0/2.9	56.1				19 - 20	Brown to greyish brown M to C sand, PS, wet	SC/SP	
20			13.2					Loose NP		
			<0.1			NA			SP	

NOTES:

SOIL BORING LOG

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	E - 7
Project Location:	Saranac Lake, NY			Page No.	1
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	Former gas holder	Refusal Depth:	NA	Total Depth:	16 ft bgs
Weather:	70 F Sunny	Soil Drilled:	16 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/7/2013	Date Completed:	8/7/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	unk	Water Level:	3.2 ft bgs	Time:	9/11/2013
Bore Hole ID/OD:	2.5 inch				
Casing Size:	NA				
Sampler:	Macrocore				
Sampler ID/OD:	2.5 inch				

Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID				Sample Description and Classification		USCS Group Symbol	Remarks
0.0										
			0.1			NA	0 - 0.9	Concrete foundation of former gas holder	NA	
1			0.1				0.9 - 4.0	Dark brown to light brown to black		
		4.0/2.2						Stained at 2 -2.2, f to m sand with some silt		
2			102			Residual		Poortly sorted, SP, wet to moist, slight odor	SP	
								soft/loose		
3			0.1							
			0.1			NA				
4			0.1							
			3.2			Residual	4.0- 8.0	Dk brown to black to brown f sand	SP	
5			23.5					some wood waste (purifier-like saw dust and roots)		
		4.0/4.0						from 4.7 to 4.9, a5.4-6.3		
			16.5			Wood Fragments		residual contamination throughout	Fill	
6			4.3					poorly sorted, odor, wet to moist, NP/SP	SP	
			21.5					m dense to loose	Waste Fill	
7			18.5						SP	
			9.3			Residual				
8			4.9							

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SOIL BORING LOG

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	E - 7
Project Location:		Saranac Lake, NY		Page No.	2
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	Former gas holder	Refusal Depth:	NA	Total Depth:	16 ft bgs
Weather:	70 F Sunny	Soil Drilled:	16 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/7/2013	Date Completed:	8/7/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	unk	Water Level:	3.2 ft bgs	Time:	9/11/2013
Bore Hole ID/OD:	2.5 inch				
Casing Size:	NA				
Sampler:	Macrocore				
Sampler ID/OD:	2.5 inch				

Sample Information			Monitoring								
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID						Sample Description and Classification	USCS Group Symbol	Remarks
0.0											
			70.5			Residual			8 - 10.5 Olive brown to brown to black stained F sand with little silt, DNAPL present from 8.4 - 9.1 and 10.2 - 10.6, poorly sorted wet to moist, NP/SP, m dense	SP	
9			352								
		4.0/3.0	58.3			DNAPL			10.5 - 12 Olive brown silty d sand, PS, moist SP, m dense/dense		
10			92.0								
			29.2			Residual					
11			35.2							SC / SP	
			17.5			Residual					
12			0.7								
			1.5						12 - 16 Olive brown f to m sand, with some silt lenses at 14.5 and 15.2 PS, NP, dense, wet to moist, slight odor	SP	
13			7.5								
			68.3			Residual					
14		4.0/2.7	24.3								
			12.5								
15			7.8							SC/ML	
						NA				SP	
		4.0/2.9								SC/ML	
16			15.3							SP	

NOTES:

SOIL BORING LOG

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F - 3
Project Location:		Saranac Lake, NY		Page No.	1
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	25 ft north of site fence	Refusal Depth:	NA	Total Depth:	16 ft bgs
Bore Hole ID/OD:	2.5 inch	Weather:	70 F Sunny	Soil Drilled:	16 ft
Method:	Direct Push	Casing Size:	NA	Subcontractor:	Geologic NY
Protection Level:	D	Sampler:	Macrocore	Driller:	Dave Lyons
Date Started:	8/12/2013	Date Completed:	8/12/2013	Sampler ID/OD:	2.5 inch
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	1542 ' amsl	Water Level:	1.7 ft bgs	Time:	9/11/2013

Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID	Sample Description and Classification	USCS Group Symbol	Remarks
0.0						
			1.8	0 - 2.0 Dk Brown silty organics, plastic	SC	
1			3.2	Few f gravel, roots, ps, moist, sp		
		4.0/2.0	0.9	Loose/soft		
2				2.0 - 4.0 Olive brown to brown silty f sand	SP/SC	
			1.5	roots and organics. Wet, ps, sp		
3			3.2	Few f gravel, M dense		
4			11.5			
			3.5	4.0 - 8.0 Greyish brown, f sand, few silts, ps	SP	
5			2.5	Wet, organic like odor		
		4.0/3.2	3.8	SP, M dense to dense		
6						
			2.1			
7			3.1			Collect soil sample at F-3 from 6.5 - 7 ft
						516028 - F307
						at 0950
8			4.5			Clean' boundary sample

NOTES:

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F - 3
Project Location:		Saranac Lake, NY		Page No.	2
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	25 ft north of site fence	Refusal Depth:	NA	Total Depth:	16 ft bgs
Bore Hole ID/OD:	2.5 inch	Weather:	70 F Sunny	Soil Drilled:	16 ft
Method:	Direct Push	Casing Size:	NA	Subcontractor:	Geologic NY
Protection Level:	D	Sampler:	Macrocore	Driller:	Dave Lyons
Date Started:	8/12/2013	Date Completed:	8/12/2013	Sampler ID/OD:	2.5 inch
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	1542 ' amsl	Water Level:	1.7 ft bgs	Time:	9/11/2013

Sample Information			Monitoring						
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID				Sample Description and Classification	USCS Group Symbol	Remarks
0.0									
			3.5				8 - 12 Greyish brown f sand, some m sand Little/few silt, ps, M dense sp, wet, no odor	SP	
9			4.7						
		4.0/3.3	5.3						
10							Olive brown to brown silty f sand roots and organics. Wet, ps, sp Few f gravel, M dense		
			6.5						
11			8.9						
12			4.9						
			1.3				12 - 16 Greyish brown, f to m sand, few silts, ps Few silt, NP, wet, M dense, no odor observed	SP	
13			0.6						
			0.9						
14									
			1.2						
15			0.7						
			0.5						
16			1.5						

NOTES:

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F-6
Project Location:		Saranac Lake, NY		Page No.	1
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	East of gas holders	Refusal Depth:	NA	Total Depth:	16 ft bgs
Weather:	75 F Sunny	Soil Drilled:	16 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/10/2013	Date Completed:	8/10/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	unk	Water Level:	2.5 ft bgs	Time:	9/11/2013

Bore Hole ID/OD:	2.5 inch
Casing Size:	NA
Sampler:	Macrocore
Sampler ID/OD:	2.5 inch

Sample Information			Monitoring				Sample Description and Classification		USCS Group Symbol	Remarks
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID							
0.0										
			0.1			NA	0 - 0.5	Dk brown silty sand with some gravel Well sorted, some roots, dry, NP		
1			0.1				0.5 - 1 .5	Black stained soil with little ash, m sand, PS		
		4.0/2.4				Ash and Coal	1.5 - 2	Black coal and ash, fill	Fill	Collected soil sample at F-6 from 1.5 - 2
2			0.1				2.0 - 3.8	Reddish brown to brown, f to m sand PS, moist, odor	Waste	of ash and coal 516008-F602 at 1450
3			0.1			NA				
			0.1							
						Wood	3.8 - 4	Greenish wood chips and m sand and f gravel, odor, possible cyanide, wet		
4			0.1						Fill Waste	
			38.5			Wood Waste	4.0 - 4.8	Similar to 3.8, but more gravel	Fill	
5			214				4.4 - 6.8	Dark brown wood waste and roots, some silt, strong odor, wet, PS		
		4.0/3.1								Collected soil sample and fingerprint from F-6 at 4.6 - 5.4' in wood purifier waste 516008-F605 at 1510
6			258						Fill	
			113							
			98.3							
7			70.5			Residual			SP	
			8.3				6.8 - 8	Brown to olive silty sand F to m, slight odor, wet, PS		
8			<0.1			NA				

NOTES:

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F-6
Project Location:		Saranac Lake, NY		Page No.	2
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	East of gas holders	Refusal Depth:	NA	Total Depth:	16 ft bgs
Weather:	75 F Sunny	Soil Drilled:	16 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/10/2013	Date Completed:	8/10/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	unk	Water Level:	2.5 ft bgs	Time:	9/11/2013
Bore Hole ID/OD:	2.5 inch				
Casing Size:	NA				
Sampler:	Macrocore				
Sampler ID/OD:	2.5 inch				

Sample Information			Monitoring							
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID					Sample Description and Classification	USCS Group Symbol	Remarks
0.0										
			279				Residual	8 - 12 Brown to dark to greenish brown, m to f sand, few silt, DNAPL present in coarser sand lenses at 9.6 - 9.9, 10.2-10.4	SP	
9			322					11.6, PS, wet, m dense		
		4.0/3.0	578					very stron odor		Collected soil sample from DNAPL F-6 at 9.6 - 9.9' in wood purifier waste 516008-F610 at 1530
10			774				DNAPL			
			1590							
11			770							
			39.5				Residual			
12			16.5							
			101				DNAPL			
			70.5					12 - 16 Grey to greyish brown f sands, some silt, DNAPL present at 12.4 - 12.8 Very strong odor PS, m dense, wet	SP	
13			81.5				Residual			
			422							
14		4.0/3.2	62.5				DNAPL			
			34.7							
15			101							
			38.2				Residual			
16			22.5							

NOTES:

SOIL BORING LOG

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F-8		
Project Location:		Saranac Lake, NY		Page No.	1		
Project No.:	3612132271	Client:	NYSDEC	of:	2		
Boring Location:	East of gas holders	Refusal Depth:	NA	Total Depth:	16 ft bgs	Bore Hole ID/OD:	2.5 inch
Weather:	70 F Sunny	Soil Drilled:	16 ft	Method:	Direct Push	Casing Size:	NA
Subcontractor:	Geologic NY			Protection Level:	D	Sampler:	Macrocore
Driller:	Scott Breeds	Date Started:	8/6/2013	Date Completed:	8/6/2013	Sampler ID/OD:	2.5 inch
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL		
Reference Elevation:	unk	Water Level:	4 ft bgs	Time:	9/11/2013		

Sample Information			Monitoring								
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID					Sample Description and Classification		USCS Group Symbol	Remarks
0.0			0.6			NA		0 - 0.2	Light brown silty sand and gravel poorly sorted, dry, NP	SP	
1			6.6					0.2 - 2	Black stained f to c sand and gravel few silt, some slag, ash, well sorted		
		4.0/3.1	17.2			Ash and Coal		2 -2.3	Brock fragment	Fill Waste	
2			22.5					2.3 - 4	Black stained coal/slag/ash concrete with some metal and wood fragments		
			39.5			NA			Few sand and gravel, poorly sorted, moist to wet (possibly DNAPL 3.5 - 4)		Collected soil sample VOC/SVOC
3			68.2						Very strong odor, NP/SP		sample at F-8 from 3.5-4
			98.1			Ash and Coal					of coal/ash/slag waste
4			112							Fill	516008-F804
			522			DNAPL				Waste	at 1745
			98.5			Wood Waste		4 - 4.5	Same as 2.3 - 4, with DNAPL	Fill	
5			90.7					4.5 - 6	Black stained wood fragmentsand wood chips Poorly sorted, waste, wet, very stron odor		
		4.0/3.1	68.8						DNAPL likely present, SP/MP	Fill	
6			70.5					6 - 8	Brown to black stained to olive brown f to c sant, trace fines and f gravel DNAPL present drom 6.6 - 7.2		
			98.1			Residual			Poorly sorted, m dense, very stong odor		
7			354						moist to wet	SP	
			108			DNAPL					
8			79.5								

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SOIL BORING LOG

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F-8
Project Location:		Saranac Lake, NY		Page No.	2
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	East of gas holders	Refusal Depth:	NA	Total Depth:	16 ft bgs
Weather:	70 F Sunny	Soil Drilled:	16 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Scott Breeds	Date Started:	8/6/2013	Date Completed:	8/6/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	unk	Water Level:	4 ft bgs	Time:	9/11/2013

Bore Hole ID/OD:	2.5 inch
Casing Size:	NA
Sampler:	Macrocore
Sampler ID/OD:	2.5 inch

Sample Information					Monitoring						
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)			PID				Sample Description and Classification	USCS Group Symbol	Remarks
0.0											
					38.5			Residual	8 - 12 Olive brown to back stained	SP	
9					40.7				F to m sand, little silt, poorly sorted		
		4.0/3.1			252			DNAPL	DNAPL present at 9 - 9.3 and 11.7 - 12		
10					101				Wet, very strong odor, NP, medium dense		
					71.5						
11					60.5			Residual			
					18.5						
12					306						
					121			DNAPL	12 - 16 Light grey to greyish brown f to m sand, few silt	SP	
13					73.5				poorly sorted, wet, NP, m dense, wet to moist		
					35.4				strong odor		
14		4.0/3.1			22.7						
					30.5			Residual			
15					48.5						
					52.5						
16											

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SOIL BORING LOG

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F - 12
Project Location:		Saranac Lake, NY		Page No.	1
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	South of F-11	Refusal Depth:	NA	Total Depth:	20 ft bgs
Weather:	60 F Heavy Rain	Soil Drilled:	20 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/14/2013	Date Completed:	8/14/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	1548.5 ' amsl	Water Level:	15.8 ft bgs	Time:	9/11/2013
Bore Hole ID/OD:	2.5 inch				
Casing Size:	NA				
Sampler:	Macrocore				
Sampler ID/OD:	2.5 inch				

Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID	Sample Description and Classification	USCS Group Symbol	Remarks
0.0						
			<0.1	0 - 4.0 Dk brown to brown to olive brown	Fill	
1				F to m sand, some c sand, some roots	SP	
		4.0/2.4	<0.1	Asphaly at 3 - 3.5 ft, fill poorly sorted		
2				Moist, np		
			<0.1			
3						
			<0.1		NA	
4					SP	
					NA	
			<0.1	4.0 - 4.8 Olive brown f to m sand, some asphalt, moist, PS	SP	
5			<0.1	4.8 - 8.0 Asphalt, weathered asphalt		
		4.0/2.7		Lense of olive brown m to c sand		
			<0.1	With roots at 7.2 - 7.8; fill		
6				No indication of coal tar	NA	
			<0.1			
7						
			<0.1			
					SP	
8			<0.1			
					NA	

NOTES:

SOIL BORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:	Saranac Lake RI/FS			Boring ID:	F - 12
Project Location:		Saranac Lake, NY		Page No.	2
Project No.:	3612132271	Client:	NYSDEC	of:	2
Boring Location:	South of F-11	Refusal Depth:	NA	Total Depth:	20 ft bgs
Weather:	60 F Heavy Rain	Soil Drilled:	20 ft	Method:	Direct Push
Subcontractor:	Geologic NY			Protection Level:	D
Driller:	Dave Lyons	Date Started:	8/14/2013	Date Completed:	8/14/2013
Rig Type/Model:	6620 DT	Logged By:	BAS	Checked By:	DL
Reference Elevation:	1548.5 ' amsl	Water Level:	15.8 ft bgs	Time:	9/11/2013
Bore Hole ID/OD:	2.5 inch				
Casing Size:	NA				
Sampler:	Macrocore				
Sampler ID/OD:	2.5 inch				

Sample Information			Monitoring									
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	PID							Sample Description and Classification		USCS Group Symbol	Remarks
0.0													
			<0.1							8 - 12	Brown to black to reddish brown F to C sand, few f gravel, trace roots PS, asphalt at 9 - 9.5 ft, moist, m dense, np	SP	
9			<0.1										
		4.0/2.5	<0.1										
10													
			<0.1										
11			<0.1										
12			<0.1										
13			<0.1							12 - 14.5	Brown to olive brown, f to m sand, few f gravel ps, moist, NP, loose	SP	
14			<0.1										
15			<0.1							14.5 - 17	Brown f to c sand with gravel, well sorted Loose to m dense, np, moist		
16													
17			<0.1							17 - 18	Olive brown sandy gravel/gravely sand Few silt, well sorted, slight odor, NP, dense	SW	
18			<0.1								Moist to wet		
			0.1							18 - 19.5	Reddish dk brown to dk brown		
19			0.7								C sand and f gravel, strong odor, coal tar		
			31								Wet, loose some silt	SW	
20			68.5							19.5 - 20	Orange to orange brown, silty c to m sand		
			38.2								Odor, ps, m dense, wet	SP	

NOTES:

APPENDIX B

DETAILED COST ESTIMATE BACKUP

Detailed Cost Estimate
Alternative 2 - Impermeable Cap and Vertical Barrier

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
Pre-Design:						
1.1	**Predesign Investigations**					**$325,495**
1.1.1	Data Gap and Pre-Design Analysis					$119,200
	Drill Rig & Crew (Hollow-Stem)		4	wk	$15,000.00	$60,000
	Monitoring Well Materials		8	EA	$400.00	$3,200
	Field Technician		25	Day	$1,000.00	$25,000
	Sampling Equipment		20	day	$150.00	$3,000
	Soil & GW Analysis (PAHs primarily)		30	EA	$200.00	$6,000
	GeoTech Sample Analysis		10	EA	$500.00	$5,000
	Drill Waste Disposal		25	drums	$150.00	$3,750
	Survey new locations		1	LS	$2,500.00	$2,500
	Lab to support BIO		5	EA	$750.00	$3,750
	Pilot Water Injection		1	EA	$2,000.00	$2,000
	Pilot DNALP Extraction		1	EA	$5,000.00	$5,000
1.1.2	IRM DNAPL Pumping					$193,145
	IRM Design		1	LS	$20,000.00	$20,000
	Drill Rig & Crew (Hollow-Stem)		1	wk	$15,000.00	$15,000
	Extraction Well Materials (4" wells)		2	EA	$800.00	$1,600
	Field Technician for Drilling & Installation		15	Day	$1,000.00	$15,000
	General Subcontractor		10	Day	$3,000.00	$30,000
	DNAPL Pump		2	EA	$2,152.50	$4,305
	Controls (Solar)		2	EA	$7,245.00	$14,490
	Misc. Pipes, fittings, regulators		2	EA	$2,000.00	$4,000
	Enclosed Tank Rental		12	Month	$500.00	$6,000
	Drill Waste Disposal		5	drums	$150.00	$750
	T&D of DNAPL		12,000	gallon	$2.50	$30,000
	Operator		52	Day	$1,000.00	$52,000
1.1.3	In-Situ Slurry Wall Bench Testing					$13,150
	Drill Rig to collect soil columns		1	DAY	$2,000.00	$2,000
	Bench Tests		1	LS	$10,000.00	$10,000
	Field Technician		1	Day	$1,000.00	$1,000
	T&D of Waste		1	drums	$150.00	$150
Full Scale Remediation:						$1,307,299
1.2	**Work Plans, Schedules and Permits**					**$69,795**
1.2.1	Detailed Construction Plan					$15,303
	Project Engineer	24	1	hr	$79.83	$1,916
	Project Manager	72	1	hr	$32.20	$2,318
	QC Officer	12	1	hr	$43.19	$518
	Safety Officer	12	1	hr	$59.33	$712
	Project Control/Scheduler	48	1	hr	$47.31	$2,271
	Administrative Assistant	48	1	hr	$37.91	$1,820
	Site Superintendent	72	1	hr	$79.83	$5,748
1.2.2	H&S Plan Project					$11,680
	Administrative Assistant	96	1	hr	$37.91	$3,639
	Safety Officer	16	1	hr	$59.33	$949
	Project Engineer	32	1	hr	$27.50	$880
	Project Manager	16	1	hr	$32.20	$515
	Safety Tech	96	1	hr	$59.33	$5,696

Detailed Cost Estimate
Alternative 2 - Impermeable Cap and Vertical Barrier

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
1.2.3	Contingency Plan					$11,464
	Project Engineer	80	1	hr	$79.83	$6,386
	Project Manager	20	1	hr	$32.20	$644
	QC Officer	10	1	hr	$43.19	$432
	Safety Officer	10	1	hr	$59.33	$593
	Project Control/Scheduler	40	1	hr	$47.31	$1,892
	Administrative Assistant	40	1	hr	$37.91	$1,516
1.2.4	QA/QC Plan					$4,230
	Administrative Assistant	40	1	hr	$37.91	$1,516
	Project Engineer	4	1	hr	$79.83	$319
	Project Manager	4	1	hr	$32.20	$129
	QC Officer	16	1	hr	$43.19	$691
	QC Tech	40	1	hr	$39.36	$1,574
1.2.5	Traffic Control Plan					$6,689
	Administrative Assistant	24	1	hr	$37.91	$910
	Project Engineer	48	1	hr	$79.83	$3,832
	Project Manager	16	1	hr	$32.20	$515
	Safety Officer	8	1	hr	$59.33	$475
	Site Superintendent	12	1	hr	$79.83	$958
1.2.6	Storm Water Management Plan					$8,429
	Administrative Assistant	10	1	hr	$37.91	$379
	Project Engineer	48	1	hr	$79.83	$3,832
	Project Manager	12	1	hr	$32.20	$386
	Site Superintendent	48	1	hr	$79.83	$3,832
1.2.7	Fees and Permits		1	LS	$12,000.00	$12,000
1.3	**Mobilization & Site Prep**					**$204,275**
1.3.1	Mobilize crew and equipment					$84,122
	Site Foreman	8	1	hr	$30.37	$243
	Heavy Const Skilled Laborer	8	6	hr	$48.54	$2,330
	Equipment Operator	8	3	hr	$59.02	$1,416
	Wheeled Loader	8	1	hr	$105.52	$844
	Dozer	8	1	hr	$95.07	$761
	Roller Compactor	8	1	hr	$105.52	$844
	Track Excavator	8	1	hr	$95.07	$761
	Excavator Jack Hammer Attachment	8	1	hr	$95.07	$761
	Dewind One-Pass System		1	LS	$60,000.00	$60,000
	Truck	8	2	hr	$97.64	$1,562
	Office Trailer		3	Month	$800.00	$2,400
	Job Boxes (2)		6	Month	$400.00	$2,400
	Roll-Off Containers (2)		6	Month	$800.00	$4,800
	Utilities		1	LS	$5,000.00	$5,000
1.3.2	Clearing and Grubbing					$10,407
	Heavy Const Skilled Laborer	12	2	hr	$48.54	$1,165
	Truck	24	1	hr	$97.64	$2,343
	Track Excavator	12	1	hr	$95.07	$1,141
	Equipment Operator	12	1	hr	$59.02	$708
	Dump Truck Driver	24	1	each	$49.31	$49
	Transport Tree Debris for Reuse/Disposal		1	LS	$2,000.00	$5,000

Detailed Cost Estimate
Alternative 2 - Impermeable Cap and Vertical Barrier

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
1.3.3	Sedimentation & Erosion Control (~2,000 ft)					$2,088
	Skilled Laborer	12	2	hr	$48.54	$1,165
	Silt Fence 3ft High		15	Roll	$26.75	$401
	Hay Bales		75	each	$6.96	$522
1.3.4	Stabilized Construction Entrance					$3,313
	Heavy Const Skilled Laborer	4	2	hr	$48.54	$388
	Equipment Operator	4	2	hr	$59.02	$472
	Wheeled Loader	8	1	hr	$105.52	$844
	Dump Truck Driver	8	1	hr	$49.31	$394
	Dump Truck	8	1	hr	$34.41	$275
	Class A Geofabric		55	SF	$1.02	$56
	Crushed stone		50	tons	$17.65	$883
1.3.5	Stockpile Areas					$5,345
	1-1/2" Stone/Aggregate		210	tons	$17.65	$3,707
	Non-Woven Geo-Fabric		3,600	SF	$0.10	$360
	Wheeled Loader	6	1	hr	$105.52	$633
	Heavy Const Skilled Laborer	6	1	hr	$48.54	$291
	Equipment Operator	6	1	hr	$59.02	$354
1.3.6	Survey					$15,000
	Pre-Construction Survey		1	LS	$8,000.00	$8,000
	As-built Survey		1	LS	$7,000.00	$7,000
1.3.7	Construction Fencing		2,000	LF	$12.00	$24,000
1.3.8	General Conditions		1	LS	$50,000.00	$50,000
1.3.9	Engineering Oversight		10	Day	$1,000.00	$10,000
1.4	**Demolition (1-story wood frame building and 5 concrete pads)**					**$74,282**
1.4.1	Demolition of Building					$8,575
	Equipment Operator	20	2	hr	$59.02	$2,361
	Heavy Const Skilled Laborer	20	2	hr	$48.54	$1,942
	Wheeled Loader	20	1	hr	$105.52	$2,110
	Backhoe	20	1	hr	$24.38	$488
	Dump Truck Driver	20	1	hr	$49.31	$986
	Dump Truck	20	1	hr	$34.41	$688
1.4.2	Cut and Breakup Concrete					$8,575
	Equipment Operator	20	2	hr	$59.02	$2,361
	Heavy Const Skilled Laborer	20	2	hr	$48.54	$1,942
	Wheeled Loader	20	1	hr	$105.52	$2,110
	Backhoe	20	1	hr	$24.38	$488
	Dump Truck Driver	20	1	hr	$49.31	$986
	Articulating Truck	20	1	hr	$34.41	$688
1.4.3	Demolition Debris T&D					$52,133
	Wheeled Loader	16	1	hr	$105.52	$1,688
	Equipment Operator	16	1	hr	$59.02	$944
	Transport & Dispose		900	Ton	$55.00	$49,500
1.4.4	Engineering Oversight		5	Day	$1,000.00	$5,000
2.1	**Impermeable Cap & Vertical Barrier**					**$879,897**
2.1.1	Mix Design Compatibility Testing		1	LS	$25,000.00	$25,000
2.1.2	Install Slurry Wall					$420,000
	One-Pass Trenching		1	LS	$345,000.00	$345,000
	Items/Support by Others		1	LS	$75,000.00	$75,000
2.1.3	Temporary Dewatering System		1	LS	$75,000.00	$75,000

Detailed Cost Estimate
Alternative 2 - Impermeable Cap and Vertical Barrier

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
2.1.4	Rough Grading and Compaction					$6,373
	Equipment Operator	20	2	hr	$59.02	$2,361
	Dozer	20	1	hr	$95.07	$1,901
	Compactor	20	1	hr	$105.52	$2,110
2.1.5	Install Geosynthetic Clay Liner		100,300	SF	$0.52	$52,156
2.1.6	Place and compact 6" Clay/Silt					$102,701
	Equipment Operator	60	2	hr	$59.02	$7,082
	Dozer	60	1	hr	$95.07	$5,704
	Compactor	60	1	hr	$105.52	$6,331
	Purchase/deliver Clay		1,857	CY	$45.00	$83,583
2.1.7	Import, Placement, Compact, Grade Clean Fill and Topsoil		3,715	CY	$40.00	$148,593
2.1.8	Hydroseed topsoil		100,300	SF	$0.25	$25,075
2.1.9	Engineering Oversight		25	Day	$1,000.00	$25,000
6.1	**Continued Site Monitoring**					**$79,050**
6.1.1	Well Installation					$59,100
	Drill Rig & Crew (Hollow-Stem)		2	wk	$15,000.00	$30,000
	Monitoring Well Materials		7	EA	$400.00	$2,800
	Field Technician	200	1	hr	$100.00	$20,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Drill Waste Disposal		12	drums	$150.00	$1,800
6.1.2	Replace Socks and GW Monitoring (after 6 months)					$19,950
	Field Technician	150	1	hr	$100.00	$15,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Purge Water Disposal		3	drums	$150.00	$450
Annual & Periodic Costs:						
7.1	**Annual and Periodic Operation, Maintenance and Monitoring**					
7.1.1	Annual Inspection & Report (Applicable to all Alternatives)					$8,400
	Mowing Soil Cover		2	EA	$1,200.00	$2,400
	Onsite Inspection		1	Day	$1,000.00	$1,000
	Inspection Report		1	LS	$5,000.00	$5,000
7.1.2	Continued Site Monitoring (Year 1-2, Semi Annual)					$43,400
	Field Technician		10	Day	$1,000.00	$10,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		30	EA	$200.00	$6,000
	Purge Water Disposal		6	drums	$150.00	$900
	Field Activities Report (1 per year)		1	EA	$5,000.00	$5,000
	Monitoring Report		2	EA	$10,000.00	$20,000
7.1.3	Continued Site Monitoring (Years 3 -5 - Annual)					$24,200
	Field Technician		5	Day	$1,000.00	$5,000
	Sampling Equipment		5	day	$150.00	$750
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Purge Water Disposal		3	drums	$150.00	$450
	Field Activities Plan (1 per year)		1	EA	$5,000.00	$5,000
	Monitoring Report		1	EA	$10,000.00	$10,000

Detailed Cost Estimate
Alternative 2 - Impermeable Cap and Vertical Barrier

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
7.1.3	5-year Monitoring Review Report		1	EA	$20,000.00	$20,000
7.1.2	Bio-Enhancements and Continued Site Monitoring (Year 6, Semi Annual)					$47,000
	Field Technician		10	Day	$1,000.00	$10,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		30	EA	$200.00	$6,000
	Purchase Install ORC Socks		25	EA	$72.00	$1,800
	Purchase Replacement ORC Socks		25	EA	$72.00	$1,800
	Purge Water Disposal		6	drums	$150.00	$900
	Field Activities Report (1 per year)		1	EA	$5,000.00	$5,000
	Monitoring Report		2	EA	$10,000.00	$20,000
7.1.4	Continued Site Monitoring (Years 7-30 - Annual)					$24,200
	Field Technician		5	Day	$1,000.00	$5,000
	Sampling Equipment		5	day	$150.00	$750
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Purge Water Disposal		3	drums	$150.00	$450
	Field Activities Report		1	EA	$5,000.00	$5,000
	Monitoring Report		1	EA	$10,000.00	$10,000

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVES 2

Alternative 2 **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 2,469,000	1	0	$ 2,469,000.00	$ 2,469,000.00
Annual Long Term Monitoring and Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 & 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
Totals				**$ 3,736,000.00**	**$ 3,266,349.56**

*Annual and periodic costs include 20% for technical support contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 20% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 3.4 percent was used as published by the Office of Management and Budge (OMB) in December 2014.

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

Detailed Cost Estimate
Alternative 3 - In-Situ Solidification

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
Pre-Design:						$419,645
1.1	**Predesign Investigations**					**$419,645**
1.1.1	Data Gap and Pre-Design Analysis (See Alternative 2 for Detail)					$119,200
1.1.2	IRM DNAPL Pumping (See Alternative 2 for Detail)					$193,145
1.1.3	In-Situ Solidification Pilot Test					$107,300
	Pilot Design		1	LS	$20,000.00	$20,000
	Drill Rig & Crew (Large Auger)		1	wk	$25,000.00	$25,000
	In-situ Auger Mixing		500	CY	$100.00	$50,000
	Mixing Additives (Water, cement, fly ash, etc.)		17,500	gal	$0.10	$1,750
	Drill Rig to collect stabilized columns		1	DAY	$2,000.00	$2,000
	Collect/Test stabilized columns		5	each	$250.00	$1,250
	Field Technician		7	Day	$1,000.00	$7,000
	T&D of Waste		2	drums	$150.00	$300
Full Scale Remediation: Alternative 3A						$7,214,987
Full Scale Remediation: Alternative 3B						$5,121,838
1.2	**Work Plans, Schedules and Permits (See Alternative 2 for Detail)**					**$79,795**
1.3	**Mobilization & Site Prep**					**$168,275**
1.3.1	Mobilize crew and equipment					$48,122
	Site Foreman	8	1	hr	$30.37	$243
	Heavy Const Skilled Laborer	8	6	hr	$48.54	$2,330
	Equipment Operator	8	3	hr	$59.02	$1,416
	Wheeled Loader	8	1	hr	$105.52	$844
	Dozer	8	1	hr	$95.07	$761
	Roller Compactor	8	1	hr	$105.52	$844
	Track Excavator	8	1	hr	$95.07	$761
	Excavator Jack Hammer Attachment	8	1	hr	$95.07	$761
	Crane & Sheet Piles	24	1	hr	$1,000.00	$24,000
	Truck	8	2	hr	$97.64	$1,562
	Office Trailer		3	Month	$800.00	$2,400
	Job Boxes (2)		6	Month	$400.00	$2,400
	Roll-Off Containers (2)		6	Month	$800.00	$4,800
	Utilities		1	LS	$5,000.00	$5,000
1.3.2	Clearing and Grubbing					$10,407
	Heavy Const Skilled Laborer	12	2	hr	$48.54	$1,165
	Truck	24	1	hr	$97.64	$2,343
	Track Excavator	12	1	hr	$95.07	$1,141
	Equipment Operator	12	1	hr	$59.02	$708
	Dump Truck Driver	24	1	each	$49.31	$49
	Transport Tree Debris for Reuse/Disposal		1	LS	$2,000.00	$5,000
1.3.3	Sedimentation & Erosion Control (~2,000 ft)					$2,088
	Skilled Laborer	12	2	hr	$48.54	$1,165
	Silt Fence 3ft High		15	Roll	$26.75	$401
	Hay Bales		75	each	$6.96	$522
1.3.4	Stabilized Construction Entrance					$3,313
	Heavy Const Skilled Laborer	4	2	hr	$48.54	$388
	Equipment Operator	4	2	hr	$59.02	$472
	Wheeled Loader	8	1	hr	$105.52	$844
	Dump Truck Driver	8	1	hr	$49.31	$394
	Dump Truck	8	1	hr	$34.41	$275
	Class A Geofabric		55	SF	$1.02	$56
	Crushed stone		50	tons	$17.65	$883

Detailed Cost Estimate
Alternative 3 - In-Situ Solidification

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
1.3.5	Stockpile Areas					$5,345
	1-1/2" Stone/Aggregate		210	tons	$17.65	$3,707
	Non-Woven Geo-Fabric		3,600	SF	$0.10	$360
	Wheeled Loader	6	1	hr	$105.52	$633
	Heavy Const Skilled Laborer	6	1	hr	$48.54	$291
	Equipment Operator	6	1	hr	$59.02	$354
1.3.6	Survey					$15,000
	Pre-Construction Survey		1	LS	$8,000.00	$8,000
	As-built Survey		1	LS	$7,000.00	$7,000
1.3.7	Construction Fencing		2,000	LF	$12.00	$24,000
1.3.8	General Conditions		1	LS	$50,000.00	$50,000
1.3.9	Engineering Oversight		10	Day	$1,000.00	$10,000
1.4	**Demolition (See Alternative 2 for Detail)**					**$74,282**
3.1(a)	**Solidification (full Area) - Alternative 3A**					**$6,813,585**
3.1.1a	Treatability Testing		1	LS	$25,000.00	$25,000
3.1.2a	Remove upper 5 feet of soil					$1,641,896
	Soil Excavation, Handling & Screening		17,407	CY	$40.00	$696,296
	Lab testing for Disposal Parameters		7	EA	$800.00	$5,600
	Transportation & Disposal of Excess Soil		10,444	Tons	$90.00	$940,000
3.1.3a	Odor Control		1	LS	$45,000.00	$45,000
3.1.4a	Solidification					$4,819,300
	In-situ Auger Mixing		46,200	CY	$100.00	$4,620,000
	Mixing Additives (Water, cement, fly ash, etc.)		1,617,000	gal	$0.10	$161,700
	Collect/Test stabilized columns		94	each	$250.00	$23,500
	Filter Fabric/Warning layer		94,000	SF	$0.15	$14,100
3.1.5a	Soil Cover					$232,389
	Replace re-usable Soil		6,963	CY	$10.00	$69,630
	Import, Placement, Compact, Grade Clean Fill and Topsoil		3,481	CY	$40.00	$139,259
	Hydroseed topsoil		94,000	SF	$0.25	$23,500
3.1.6a	Engineering Oversight		50	Day	$1,000.00	$50,000
3.1(b)	**Solidification (small Area) - Alternative 3B**					**$4,720,436**
3.1.1b	Treatability Testing		1	LS	$25,000.00	$25,000
3.1.2b	Remove upper 5 feet of soil					$888,637
	Soil Excavation, Handling & Screening		8,593	CY	$40.00	$343,704
	Lab testing for Disposal Parameters		2	EA	$800.00	$1,600
	Transportation & Disposal of Excess Soil		6,037	Tons	$90.00	$543,333
3.1.3b	Odor Control		1	LS	$45,000.00	$45,000
3.1.4b	Solidification					$2,394,425
	In-situ Auger Mixing		23,000	CY	$100.00	$2,300,000
	Mixing Additives (Water, cement, fly ash, etc.)		805,000	gal	$0.10	$80,500
	Collect/Test stabilized columns		35	each	$250.00	$8,750
	Filter Fabric/Warning layer		34,500	SF	$0.15	$5,175
3.1.5b	Soil Cover					$197,130
	Replace re-usable Soil		3,437	CY	$10.00	$34,370
	Import, Placement, Compact, Grade Clean Fill and Topsoil		3,481	CY	$40.00	$139,259
3.1.6b	Hydroseed topsoil		94,000	SF	$0.25	$23,500

Detailed Cost Estimate
Alternative 3 - In-Situ Solidification

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
3.1.7b	Collection Trench					$1,120,244
	Install Sheet Piles for Trench		16,400	SF	$50.00	$820,000
	Lab testing for Disposal Parameters		1	EA	$800.00	$800
	Trench, Excavate and Dispose of soil		1,139	tons	$200.00	$227,778
	Place Collection Wells		3	EA	$300.00	$900
	Backfill with Stone		759	CY	$35.00	$26,574
	DNAPL Pump		3	EA	$2,152.50	$6,458
	Controls (Solar)		3	EA	$7,245.00	$21,735
	Misc. Pipes, fittings, regulators		3	EA	$2,000.00	$6,000
	Enclosed Tank		1	EA	$10,000.00	$10,000
3.1.8b	Engineering Oversight		50	Day	$1,000.00	$50,000
6.1	**Continued Site Monitoring (See Alternative 2 for Detail)**					**$79,050**
Annual & Periodic Costs:						
7.1	**Annual and Periodic Operation, Maintenance and Monitoring (See Alternative 2 for Detail)**					
7.1.1	Annual Inspection & Report					$8,400
7.1.2	Continued Site Monitoring (Years 1 -2 - Semi Annual)					$43,400
7.1.3	Continued Site Monitoring (Years 3 -5 - Annual)					$24,200
7.1.4	5-year Monitoring Review Report		1	EA	$20,000.00	$20,000
7.1.5	Bio-Enhancements and Continued Site Monitoring (Years 6, Semi-Annual)					$47,000
7.1.6	Continued Site Monitoring (Years 7-30 - Annual)					$24,200
7.1.7	Annual Collection Trench Operation and Maintenance (For Alternative 3B)					$92,000
	T&D of DNAPL		12,000	gallon	$2.50	$30,000
	Operator		52	Day	$1,000.00	$52,000
	Miscellaneous Repairs		1	LS	$10,000.00	$10,000

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVES 3A AND 3B

Alternative 3A **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 10,904,000	1	0	$ 10,904,000.00	$ 10,904,000.00
Annual Long Term Monitoring Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 - 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
Totals				**$ 12,171,000.00**	**$ 11,701,349.56**

*Annual and periodic costs include 20% for technical support contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 20% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 3.4 percent was used as published by the Office of Management and Budge (OMB) in December 2014.

Alternative 3B **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 7,914,000	1	0	$ 7,914,000.00	$ 7,914,000.00
Annual Long Term Monitoring Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 - 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
NAPL Extraction O&M	$ 110,000	30	0.034	$ 3,300,000.00	$ 2,048,712.53
Totals				**$ 12,481,000.00**	**$ 10,760,062.09**

*Annual and periodic costs include 20% for technical support contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 20% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 3.4 percent was used as published by the Office of Management and Budge (OMB) in December 2014.

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

Detailed Cost Estimate
Alternative 4 - Excavation

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
Pre-Design:						
1.1 (a&b)	**Predesign Investigations (See Alternative 2 for Detail). Applicable for Alternatives 2a and 2b**					**$312,345**
1.1.1	Data Gap and Pre-Design Analysis					$119,200
1.1.2	IRM DNAPL Pumping					$193,145
1.1 (c)	**Predesign Investigations for Alternative 2c (assume 50% higher for Data Gap & Pre-Design Analysis)**					**$371,945**
Full Scale Remediation: Alternative 4A						$14,210,850
Full Scale Remediation: Alternative 4B						$8,541,398
Full Scale Remediation: Alternative 4C						$41,012,869
1.2	**Work Plans, Schedules and Permits (See Alternative 2 for Detail)**					**$79,795**
1.2.1	Detailed Construction Plan					$15,303
	Project Engineer	24	1	hr	$79.83	$1,916
	Project Manager	72	1	hr	$32.20	$2,318
	QC Officer	12	1	hr	$43.19	$518
	Safety Officer	12	1	hr	$59.33	$712
	Project Control/Scheduler	48	1	hr	$47.31	$2,271
	Administrative Assistant	48	1	hr	$37.91	$1,820
	Site Superintendent	72	1	hr	$79.83	$5,748
1.2.2	H&S Plan Project					$11,680
	Administrative Assistant	96	1	hr	$37.91	$3,639
	Safety Officer	16	1	hr	$59.33	$949
	Project Engineer	32	1	hr	$27.50	$880
	Project Manager	16	1	hr	$32.20	$515
	Safety Tech	96	1	hr	$59.33	$5,696
1.2.3	Contingency Plan					$11,464
	Project Engineer	80	1	hr	$79.83	$6,386
	Project Manager	20	1	hr	$32.20	$644
	QC Officer	10	1	hr	$43.19	$432
	Safety Officer	10	1	hr	$59.33	$593
	Project Control/Scheduler	40	1	hr	$47.31	$1,892
	Administrative Assistant	40	1	hr	$37.91	$1,516
1.2.4	QA/QC Plan					$4,230
	Administrative Assistant	40	1	hr	$37.91	$1,516
	Project Engineer	4	1	hr	$79.83	$319
	Project Manager	4	1	hr	$32.20	$129
	QC Officer	16	1	hr	$43.19	$691
	QC Tech	40	1	hr	$39.36	$1,574
1.2.5	Traffic Control Plan					$6,689
	Administrative Assistant	24	1	hr	$37.91	$910
	Project Engineer	48	1	hr	$79.83	$3,832
	Project Manager	16	1	hr	$32.20	$515
	Safety Officer	8	1	hr	$59.33	$475
	Site Superintendent	12	1	hr	$79.83	$958
1.2.6	Storm Water Management Plan					$8,429
	Administrative Assistant	10	1	hr	$37.91	$379
	Project Engineer	48	1	hr	$79.83	$3,832
	Project Manager	12	1	hr	$32.20	$386
	Site Superintendent	48	1	hr	$79.83	$3,832
1.2.7	Institutional Controls		1	LS	$10,000.00	$10,000
1.2.8	Fees and Permits		1	LS	$12,000.00	$12,000
1.3(a&b)	**Mobilization & Site Prep (See Alternative 3 for Detail). Applicable for Alternatives 4A and 4B**					**$168,275**
1.3(c)	**Mobilization & Site Prep for Alternatives 4C (Assume 50% higher to Stop Work in Winter and Restart in Spring)**					**$252,412**
1.4	**Demolition (See Alternative 2 for Detail)**					**$74,282**

Detailed Cost Estimate
Alternative 4 - Excavation

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
4.1(a)	**Excavation (Visually Impacted Area) - Alternative 4A**					**$13,809,448**
4.1.1a	Install Sheet Pile Wall		65,000	SF	$50.00	$3,250,000
4.1.2a	Dewatering, Treat, Discharge		1	LS	$75,000.00	$75,000
4.1.3a	Odor Control		1	LS	$75,000.00	$75,000
4.1.4a	Excavate, T&D					$8,992,170
	Soil Excavation & Direct Loading		46,200	CY	$40.00	$1,848,000
	Temporarily Stockpile upper 5 ft for reuse		17,407	CY	$50.00	$870,370
	Lab testing for Disposal Parameters		46	EA	$800.00	$36,800
	Transportation & Disposal of Soil		69,300	Tons	$90.00	$6,237,000
4.1.5a	Backfill					$1,349,278
	Replace re-usable Soil		17,407	CY	$10.00	$174,074
	Import, Placement, Compact, Grade Clean Fill and Topsoil		28,793	CY	$40.00	$1,151,704
	Hydroseed topsoil		94,000	SF	$0.25	$23,500
4.1.6a	Engineering Oversight		60	Day	$1,000.00	$60,000
4.1.7a	Confirmation Sampling		40	EA	$200.00	$8,000
4.1(b)	**Excavation (small) - Alternative 4B**					**$8,139,996**
4.1.1b	Install Sheet Pile Wall		33,000	SF	$50.00	$1,650,000
4.1.2b	Dewatering, Treat, Discharge		1	LS	$75,000.00	$75,000
4.1.3b	Odor Control		1	LS	$75,000.00	$75,000
4.1.4b	Excavate, T&D					$4,473,030
	Soil Excavation & Direct Loading		23,000	CY	$40.00	$920,000
	Temporarily Stockpile upper 5 ft for reuse		8,593	CY	$50.00	$429,630
	Lab testing for Disposal Parameters		23	EA	$800.00	$18,400
	Transportation & Disposal of Soil		34,500	Tons	$90.00	$3,105,000
4.1.5b	Backfill Excavation & Soil Cover					$685,722
	Replace re-usable Soil		8,593	CY	$10.00	$85,926
	Import, Placement, Compact, Grade Clean Fill and Topsoil		14,407	CY	$40.00	$576,296
	Hydroseed topsoil		94,000	SF	$0.25	$23,500
4.1.6b	Collection Trench (See Alternative 3B)					$1,120,244
4.1.7b	Engineering Oversight		55	Day	$1,000.00	$55,000
4.1.8b	Confirmation Sampling		30	EA	$200.00	$6,000
4.1(c)	**Excavation (Pre-Disposal Option) - Alternative 4C**					**$40,527,330**
4.1.1c	Install Sheet Pile Wall		140,750	SF	$50.00	$7,037,500
4.1.2c	Dewatering, Treat, Discharge		2	LS	$75,000.00	$150,000
4.1.2c	Odor Control		2	LS	$75,000.00	$150,000
4.1.2c	Excavate, T&D					$28,268,274
	Soil Excavation & Direct Loading		149,000	CY	$40.00	$5,960,000
	Temporarily Stockpile upper 5 ft for reuse		41,481	CY	$50.00	$2,074,074
	Lab testing for Disposal Parameters		149	EA	$800.00	$119,200
	Transportation & Disposal of Soil		223,500	Tons	$90.00	$20,115,000
4.1.5c	Backfill					$4,771,556
	Replace re-usable Soil		41,481	CY	$10.00	$414,815
	Import, Placement, Compact, Grade Clean Fill and Topsoil		107,519	CY	$40.00	$4,300,741
	Hydroseed topsoil		224,000	SF	$0.25	$56,000
4.1.6c	Engineering Oversight		130	Day	$1,000.00	$130,000
4.1.7c	Confirmation Sampling		100	EA	$200.00	$20,000
6.1	**Continued Site Monitoring (See Alternative 2 for Detail)**					**$79,050**
Annual & Periodic Costs:						
7.1	**Annual and Periodic Operation, Maintenance and Monitoring (See Alternative 2 for Detail)**					
7.1.1	Annual Inspection & Report					$8,400
7.1.2	Continued Site Monitoring (Years 1 -2 - Semi Annual)					$43,400
7.1.3	Continued Site Monitoring (Years 3 -5 - Annual)					$24,200
7.1.4	5-year Monitoring Review Report		1	EA	$20,000.00	$20,000
7.1.5	Bio-Enhancements and Continued Site Monitoring (Years 6, Semi-Annual)					$47,000
7.1.6	Continued Site Monitoring (Years 7-30 - Annual)					$24,200
7.1.7	Annual Collection Trench Operation and Maintenance (For Alternative 3B)					$92,000
	T&D of DNAPL		12,000	gallon	$2.50	$30,000
	Operator		52	Day	$1,000.00	$52,000
	Miscellaneous Repairs		1	LS	$10,000.00	$10,000

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVES 4

Alternative 4A **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 20,392,000	1	0	$ 20,392,000.00	$ 20,392,000.00
Annual Long Term Monitoring and Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 - 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
Totals				**$ 21,659,000.00**	**$ 21,189,349.56**

*Annual and periodic costs include 20% for technical support contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 20% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 3.4 percent was used as published by the Office of Management and Budge (OMB) in December 2014.

Alternative 4B **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 12,432,000	1	0	$ 12,432,000.00	$ 12,432,000.00
Annual Long Term Monitoring Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 - 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
NAPL Extraction O&M	$ 110,000	30	0.034	$ 3,300,000.00	$ 2,048,712.53
Totals				**$ 16,999,000.00**	**$ 15,278,062.09**

*Annual and periodic costs include 20% for technical support contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 20% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 3.4 percent was used as published by the Office of Management and Budge (OMB) in December 2014.

Alternative 4C **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 58,106,000	1	0	$ 58,106,000.00	$ 58,106,000.00
Annual Long Term Monitoring Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 - 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
Totals				**$ 59,373,000.00**	**$ 58,903,349.56**

*Annual and periodic costs include 20% for technical support contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 20% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 3.4 percent was used as published by the Office of Management and Budge (OMB) in December 2014.

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

Detailed Cost Estimate
Alternative 5 - Combined Excavation & In-Situ Solidification

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
Pre-Design:						$419,645
1.1	**Predesign Investigations (See Alternative 3 for Detail)**					**$419,645**
1.1.1	Data Gap and Pre-Design Analysis					$119,200
1.1.2	IRM DNAPL Pumping					$193,145
1.1.3	In-Situ Solidification Pilot Test					$107,300
Full Scale Remediation:						$9,873,501
1.2	**Work Plans, Schedules and Permits (See Alternative 2 for Detail)**					**$79,795**
1.3	**Mobilization & Site Prep (See Alternative 3 for Detail)**					**$168,275**
1.4	**Demolition (See Alternative 2 for Detail)**					**$74,282**
5.1	**Combined Excavation & Solidification - Alternative 5**					**$9,472,099**
5.1.1	Treatability Testing (Solidification Mix)		1	LS	$25,000.00	$25,000
5.1.2	Soil Excavation, Handling & Screening		17,407	CY	$40.00	$696,296
5.1.3	Install Sheet Pile Wall		33,000	SF	$50.00	$1,650,000
5.1.4	Dewatering, Treat, Discharge		1	LS	$75,000.00	$75,000
5.1.5	Odor Control		1	LS	$75,000.00	$75,000
5.1.6	Excavate, T&D					$4,043,400
	Soil Excavation & Direct Loading		23,000	CY	$40.00	$920,000
	Lab testing for Disposal Parameters		23	EA	$800.00	$18,400
	Transportation & Disposal of Soil		34,500	Tons	$90.00	$3,105,000
5.1.7	Solidification					$2,425,125
	In-situ Auger Mixing		23,200	CY	$100.00	$2,320,000
	Mixing Additives (Water, cement, fly ash, etc.)		812,000	gal	$0.10	$81,200
	Collect/Test stabilized columns		60	each	$250.00	$15,000
	Filter Fabric/Warning layer		59,500	SF	$0.15	$8,925
5.1.8	Backfill / Restore					$421,278
	Backfill Excavation with Reusable soil		17,407	CY	$10.00	$174,074
	Import, Placement, Compact, Grade Clean Fill and Topsoil		5,593	CY	$40.00	$223,704
	Hydroseed topsoil		94,000	SF	$0.25	$23,500
5.1.9	Engineering Oversight		55	Day	$1,000.00	$55,000
5.1.10	Confirmation Sampling		30	EA	$200.00	$6,000
6.1	**Continued Site Monitoring (See Alternative 2 for Detail)**					**$79,050**
6.1.1	Well Installation					$59,100
	Drill Rig & Crew (Hollow-Stem)		2	wk	$15,000.00	$30,000
	Monitoring Well Materials		7	EA	$400.00	$2,800
	Field Technician	200	1	hr	$100.00	$20,000
	GW Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Drill Waste Disposal		12	drums	$150.00	$1,800
6.1.2	GW Monitoring (after 6 months)					$19,950
	Field Technician	150	1	hr	$100.00	$15,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Purge Water Disposal		3	drums	$150.00	$450

Detailed Cost Estimate
Alternative 5 - Combined Excavation & In-Situ Solidification

Item No	Description	Hours	Quantity	Unit	Unit Cost	Total Cost
Annual & Periodic Costs:						
7.1	**Annual and Periodic Operation, Maintenance and Monitoring (See Alternative 2 for Detail)**					
7.1.1	Annual Inspection & Report					$8,400
	Mowing Soil Cover		2	EA	$1,200.00	$2,400
	Onsite Inspection		1	Day	$1,000.00	$1,000
	Inspection Report		1	LS	$5,000.00	$5,000
7.1.2	Continued Site Monitoring (Years 1 -2 - Semi Annual)					$43,400
	Field Technician		10	Day	$1,000.00	$10,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		30	EA	$200.00	$6,000
	Purge Water Disposal		6	drums	$150.00	$900
	Field Activities Plan (1 per year)		1	EA	$5,000.00	$5,000
	Monitoring Report		2	EA	$10,000.00	$20,000
7.1.3	Continued Site Monitoring (Years 3 -5 - Annual)					$24,200
	Field Technician		5	Day	$1,000.00	$5,000
	Sampling Equipment		5	day	$150.00	$750
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Purge Water Disposal		3	drums	$150.00	$450
	Field Activities Plan (1 per year)		1	EA	$5,000.00	$5,000
	Monitoring Report		1	EA	$10,000.00	$10,000
7.1.4	5-year Monitoring Review Report		1	EA	$20,000.00	$20,000
7.1.5	Bio-Enhancements and Continued Site Monitoring (Years 6, Semi-Annual)					$47,000
	Field Technician		10	Day	$1,000.00	$10,000
	Sampling Equipment		10	day	$150.00	$1,500
	GW Analysis (PAHs primarily)		30	EA	$200.00	$6,000
	Purchase Install ORC Socks		25	EA	$72.00	$1,800
	Purchase Replacement ORC Socks		25	EA	$72.00	$1,800
	Purge Water Disposal		6	drums	$150.00	$900
	Field Activities Plan (1 per year)		1	EA	$5,000.00	$5,000
	Monitoring Report		2	EA	$10,000.00	$20,000
7.1.6	Continued Site Monitoring (Years 7-30 - Annual)					$24,200
	Field Technician		5	Day	$1,000.00	$5,000
	Sampling Equipment		5	day	$150.00	$750
	GW Analysis (PAHs primarily)		15	EA	$200.00	$3,000
	Purge Water Disposal		3	drums	$150.00	$450
	Field Activities Report		1	EA	$5,000.00	$5,000
	Monitoring Report		1	EA	$10,000.00	$10,000

Prepared By/Date: JDW 1/5/2016
Checked By/Date: DF 1/6/2016

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVES 5

Alternative 5 **Year**	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 13,851,000	1	0	$ 13,851,000.00	$ 13,851,000.00
Annual Long Term Monitoring and Reporting (Years 1-30)	$ 10,000	30	0.034	$ 300,000.00	$ 186,246.59
Continued Site Monitoring (Years 1 - 2)	$ 52,000	2	0.034	$ 104,000.00	$ 98,926.63
Continued Site Monitoring (Years 3 - 5)	$ 29,000	3	0.034	$ 87,000.00	$ 73,634.00
Five Year Review (Year 5)	$ 24,000	1	0.034	$ 24,000.00	$ 20,305.26
Bio-Enhancements and Continued Site Monitoring (Year 6)	$ 56,000	1	0.034	$ 56,000.00	$ 45,821.02
Continued Site Monitoring (Years 7-30)	$ 29,000	24	0.034	$ 696,000.00	$ 372,416.06
Totals				**$ 15,118,000.00**	**$ 14,648,349.56**

*Annual and periodic costs include 10% for technical support and 15% contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 25% contingency, as well as project management, remedial design, and construction management costs per DER-10 guidance.
Discount rate of 5% (for 30-years) percent based on NYSDEC PRAP Outline / Instructions.

Prepared By/Date: JW 1/5/2016
Checked By/Date: DF 1/6/2016

APPENDIX C

SUBCONTRACTOR QUOTES

DEWIND
ONE PASS TRENCHING

9150 96th Street
Zeeland, Michigan 49464
616-875-7580
DEWINDONEPASSTRENCHING.COM

August 19, 2015

Jamie D Welch
AMEC Foster Wheeler
207-828-3479
Jamie.welch@amecfw.com

Cost Estimate for the ONE-PASS Trenching installation of a Soil Bentonite Wall.
Site near Saranac NY

Mobilization, assembly and Demobilization
$60,000.00

Installation of 1300 linear feet x 30 feet deep x 27" wide in-situ mixed soil bentonite wall.
$260,000.00 +/-

Assumptions for SB/ SCB Wall Proposals;

1. Native soils to be sands, silts, gravels, clays and/or other non-consolidated materials. No big rocks, boulders, hard bedrock or layers of solid rock to be in the native soil matrix for this proposal. Blow counts of less than 50 are expected.
2. DeWind will provide the bentonite material and the Installation Soil/Bentonite wall to meet permeability specifications required. Maximum of 1 x 10-7.
3. 3% bentonite used for this estimate.
4. DeWind will provide QC and slump testing during the installation of wall.
   The QC for the installation of the wall will be for a One-Pass Trencher not an excavator.
   DeWind will provide the QC program that is designed for the DeWind in-situ mixing technology.
5. Level D working conditions
6. No Bonding required
7. Project to be installed during Mid April thru Mid December.

The following to be provided by others SB walls

Contractor to provide support as needed and support equipment. One 300 sized excavator and on sky track with 9,000 lb capacity.

1. 300 GPM water source for hydrating bentonite. A minimum of a 4" line with pressure sufficient to produce the volume of water needed.
2. All site prep and restoration including spoils handling.
3. Site clearing, leveling, free of any underground or above ground utilities, structures or debris.

CONTINUED ON NEXT PAGE>>

DEWIND
ONE PASS TRENCHING

9150 96th Street
Zeeland, Michigan 49464
616-875-7580
DEWINDONEPASSTRENCHING.COM

1. Site stable and able to withstand 200,000 lb track machine. Ramps provided in areas where the trencher is in a benched area
2. Support equipment; One 4-5 yard loader with forks or crane to help assemble the trencher. One 300 sized excavator and 8000# skystrack for material handeling.
3. Pre-mix and Post permeability testing.
4. Engineer drawing, additional QC and as-built records.
5. Decon if required.

Chute, Bryanna

From: Andy Lowy <ALowy@Regenesis.com>
Sent: Tuesday, August 18, 2015 9:55 AM
To: Welch, Jamie D
Subject: RE: Rough Costs Estimate

Hi Jaime,

The 2" socks cost $60 per one foot section. Each sock is one foot long. A total of 100 socks would cost $6,000 plus shipping and tax. I would estimate and additional 15-20% for shipping and tax.

Thank you,
Andy Lowy

REGENESIS
Technology-Based Solutions for the Environment

Andy Lowy | REGENESIS
Design Specialist
M: 610.655.5259

www.regenesis.com

From: Welch, Jamie D [mailto:jamie.welch@amecfw.com]
Sent: Tuesday, August 18, 2015 9:36 AM
To: Andy Lowy <ALowy@Regenesis.com>
Subject: Rough Costs Estimate

Andy – I working on a feasibility study for an MGP site. Primary treatment will be either excavation or solidification and will likely just do monitoring natural attenuation downgradient for the residual Naphthalene. However, I would like to do a rough cost for bio-enhanced treatment using the ORC Advanced Filter Socks. Do you have a going rate for the socks? I'm thinking that we would use the 2" socks. We would place five socks in 20 wells, for a total of 100 socks initially.

Thank You,

Jamie D. Welch
Amec Foster Wheeler

511 Congress Street, Suite 200
Portland, Maine 04101

D +1 (207) 828-3479
M +1 (207) 400-7576

VOIP #709-3479
E jamie.welch@amecfw.com
www.amecfw.com

XITECH Instruments, Inc.

2014 Price List

REV 1/03/2014

06 Camino De Los Desmontes, Placitas, New Mexico 87043, USA
Phone:505-867-0008 Fax:505-867-0212 Web site:www.xitechinc.com E-mail:xitechinc@xitechinc.com

Free Product Recovery Equipment

ADJ200	2" Smart Skimmer	$2,450.00
ADJ210	2" High Performance Smart Skimmer	2,650.00
ADJ215	2" High Performance Smart Skimmer With Extended Travel	2,850.00
ADJ1000	4" Smart Skimmer	2,450.00
ADJ1005	4" Smart Skimmer With Extended Travel	2,650.00
ADJ1010L	4" High Performance Smart Skimmer	2,800.00
ADJ1010H	4" High Performance Smart Skimmer	2,800.00
ADJ1015L	4" High Performance Smart Skimmer With Extended Travel	2,999.00
ADJ1015H	4" High Performance Smart Skimmer With Extended Travel	2,999.00
ADJ201	2" Smart DNAPL Pump	2,050.00
ADJ1100	4" Smart DNAPL Pump	2,050.00
2500E	Electronic Controller Single Skimmer	795.00
2500ES	Electronic Controller Single Skimmer + Shutoff	1,195.00
2510E	Electronic Control Station Single Skimmer	3,645.00
2510ES	Electronic Control Station Single Skimmer + Shutoff	3,995.00
2550E	Class I Controller Single Skimmer	1,910.00
2550ES	Class I Controller Single Skimmer + Shutoff	2,260.00
REM2500E	Remote Control Station Single Skimmer	4,600.00
REM2500ES	Remote Control Station Single Skimmer + Shutoff	4,950.00
REM3000E	Remote Heavy Oil Control Station Single Skimmer + Heater	6,550.00
REM3000ES	Remote Heavy Oil Control Station Single Skimmer + Heater + Shutoff	6,900.00
REM5000E	Remote Control Station 8 Skimmers	6,645.00
REM5000ES	Remote Control Station 8 Skimmers + Shutoff	6,995.00
3000E	Programmable Controller Single Skimmer	1,445.00
3000ES	Programmable Controller Single Skimmer + Shutoff	1,795.00
3016TE	Programmable Controller Single Skimmer Low Tide	1,741.00
3016TES	Programmable Controller Single Skimmer Low Tide + Shutoff	2,071.00
5000E	Programmable Controller 8 Skimmers	2,345.00
5000ES	Programmable Controller 8 Skimmers + Shutoff	2,695.00
5010E	Programmable Control Station 8 Skimmers	4,850.00
5010ES	Programmable Control Station 8 Skimmers + Shutoff	5,200.00
5016E	Programmable Controller 8 Skimmers Low Tide	2,445.00
5016ES	Programmable Controller 8 Skimmers Low Tide + Shutoff	2,795.00
5500E	Programmable Controller 16 Skimmers	3,345.00
5500ES	Programmable Controller 16 Skimmers + Shutoff	3,695.00

All prices and specifications subject to change without notice. Orders are F.O.B. Placitas, New Mexico

2014 Price List

Free Product Recovery Equipment

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Accessories

400	400 Shutoff for 2500ES	$	378.00
400-02	400 Shutoff for 2550ES		448.00
400-05	400 Shutoff for 5000ES		378.00
401	401 Shutoff for 2500E		594.00
401-05	401 Shutoff for 5000E		594.00
403	3 Port Product Manifold		69.00
403-01	3 Port Product Manifold + Checks		139.00
404	4 Port Product Manifold		77.00
404-01	4 Port Product Manifold + Checks		168.00
408	8 Port Product Manifold		197.00
408-01	8 Port Product Manifold + Checks		393.00
408-05	8 Port Manifold Double Containment		795.00
409	2" Conduit Cap 3/8, 1/2		23.00
409-01	2" Conduit Cap 3/8, 3/8, 1/2		26.00
409-02	2" Conduit Cap 1/2npt, 3/8, 1/2		24.00
410	2" Well Cap Assembly		30.00
410-05	2" Well Head, Shallow Skim + Vac		67.00
410-06	2" Well Head, Deep Skim + Vac		50.00
411	3" Well Cap Assembly		28.00
420	4" Well Cap Assembly		75.00
420-01	4" Well Cap Assembly + 2” Fittings		75.00
420-05	4" Well Head, Shallow Skim + Vac		106.00
420-06	4" Well Head, Deep Skim + Vac		85.00
421	4" Well Cap + 3/8 Heater Port		81.00
422	6" Well Cap Assembly		98.00
424	8" Well Cap Assembly		129.00
426	10" Well Cap Assembly		151.00
427	2" Well Seal Assembly		45.00
428	4" Well Seal Assembly		63.00
429	2" Y-Tee 2-Port Assembly		32.00
430	Nitrogen Tank Regulator		221.00
440	Air Filter - Regulator		221.00
442	Oil-Water Filter		258.00
442-01	Oil-Water Filter, Element		46.00
442-02	Oil-Water Filter, Bracket		26.00
445	ADJ200 Skimmer Assembly		433.00
447	ADJ210 Skimmer Assembly		757.00
448	ADJ215 Skimmer Assembly		865.00
450	ADJ1000 Skimmer Assembly		433.00
451	ADJ1005 Skimmer Assembly		649.00
452	ADJ1010H Skimmer Assembly		816.00
453	ADJ1010L Skimmer Assembly		757.00
454	ADJ1015H Skimmer Assembly		924.00
455	ADJ1015L Skimmer Assembly		865.00
508	1/4" Tubing White Nylon		0.50/ft
509	5/16" Tubing White Nylon		0.57/ft
510	3/8" Tubing White Nylon		0.77/ft
510-10	3/8" Tubing Teflon		6.05/ft

Accessories

511	1/2" Tubing White Nylon	$	1.03/ft
511-10	1/2" Tubing Teflon		7.89/ft
514-02	1/4" Tube Adapter		5.67
514-03	1/4"-3/8" Filter Union		34.61
515-01	5/16" Quickpush Union		7.94
515-02	5/16" Tube Adapter		6.81
516	3/8" Quickpush Tee		10.21
516-01	3/8" Quickpush Union		9.08
516-02	3/8" Tube Adapter		7.94
516-03	3/8" Filter Union		41.20
516-04	1/4" - 3/8" Tubing Union		8.39
517	1/2" Tubing Tee		11.35
517-01	1/2" Tubing Union		10.22
517-02	1/2" Tubing Adapter		9.08
517-03	5/16"-1/2" Tubing Union		12.82
519	5/16"-1/2" Quick Union		63.80
519-01	5/16"-3/4" Quick Union		63.00
519-02	1/2"-1/2" Quick Union		65.00
519-03	1/2"-3/4" Quick Union		62.00
519-04	Quick Union Double Containment		81.00
520	Double Containment Union		39.00
521	Double Containment Tubing 50 Feet		87.00
523	Manifold Check Valve 3/8npt		28.00
525	2-way Valve 3/8" Tubing		28.00
527	1/4" Check Valve		29.00
528	3/8" Check Valve		32.00
529	2-way Valve 1/4" Tubing		28.00
603	Signal Cable for 400 Tank Shutoff		0.33/ft
603-01	Signal Cable for 401 Tank Shutoff		0.44/ft
606	Solar Panel 10 Watt		335.00
610	Solar Panel 20 Watt		448.00
611	Solar Panel Mounting Bracket 20 Watt		96.00
612	Solar Panel Wiring		2.13/ft
613	Solar Panel Mounting Bracket 10 Watt		51.00
618	Solar Panel 130 Watt		741.00
619	Solar Panel Bracket 130 Watt		246.00
621	REM2500 or REM5000 AC Option		541.00
640	1/8" Safety Cable		1.30/ft
641	Safety Cable Clamp		7.00
651	Safety Rope		0.26/ft
652	Battery Box		39.00
654	Finger Heater Assembly 75 Watt /120V		110.00
654-01	Finger Heater Assembly 100Watt/120V		118.00
654-02	Finger Heater Assembly 100Watt/220V		129.00
655	Finger Heater Power Cable		1.19/ft
655-01	Finger Heater Power Wire		0.82/ft
657	Level Pressure Switch		305.00
658	Level Pressure Switch Cable		1.18/ft

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Free Product Recovery Equipment

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Spare Parts

601	2" ADJ200-215 Skimmer Filter	$ 36.00
602	4" ADJ1000 Skimmer Filter	41.00
604	4" ADJ1005-1015 Skimmer Filter	46.00
607	Air Logic Valve	215.00
608	4" Skimmer Diaphragm, Buna	26.00
608-05	4" Skimmer Diaphragm, Viton	36.00
608-06	4" Skimmer Diaphragm, Teflon	36.00

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