New York State Electric & Gas Corporation

Transit Street Former Manufactured Gas Plant
Lockport, New York

FEASIBILITY STUDY

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FEASIBILITY STUDY REPORT

NYSEG – TRANSIT STREET SITE
SITE #9-32-098
LOCKPORT, NEW YORK

Prepared for:

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ABBREVIATIONS

Acres	Acres International Corporation
AES	Atlantic Environmental Services, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, (total) xylenes
Canal	New York State Barge Canal
cf	cubic feet
cm/sec	centimeters per second
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CWG	carbureted water gas
cy	cubic yard
DNAPL	dense non-aqueous phase liquid
FS	feasibility study
ft^3	cubic foot
FWIA	Fish and Wildlife Impact Analysis
gpm	gallons per minute
HDPE	high-density polyethylene
IRM	interim remedial measure
ISCO	in-situ chemical oxidation
ISS	in-situ solidification

ABBREVIATIONS (Continued)

LEL	lowest effect level
META	META Environmental, Inc.
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MGP	manufactured gas plant
MTBE	methyl tert-butyl ether
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NYCRR	New York State Code, Rules, and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSEG	New York State Electric & Gas
NYSTA	New York State Thruway Authority
OM&M	operation, maintenance and monitoring
Order	Order on Consent
OSHA	Occupational Safety and Health Administration
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PESH	NYS Department of Labor's Public Employee Safety and Health
PID	photoionization detector
POTW	publicly-owned treatment works
QHHEA	Qualitative Human Health Exposure Assessment

ABBREVIATIONS (Continued)

RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RSCO	recommended soil cleanup objective
SCGs	standards, criteria, and guidelines
SEL	severe effect level
SMP	Site Management Plan
SPDES	State Pollution Discharge Elimination System
SVOCs	semi-volatile organic compounds
TAGM	Technical and Administrative Guidance Memorandum
TMV	toxicity, mobility or volume
TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
URS	URS Corporation – New York
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WCC	Woodward-Clyde Consultants, Inc.

1.0 INTRODUCTION

1.1 General

On behalf of New York State Electric & Gas Corporation (NYSEG), URS Corporation-New York (URS) has prepared this *Feasibility Study (*FS*) Report* for NYSEG's Lockport Transit Street Former Manufactured Gas Plant (MGP) site (i.e., site) in the City of Lockport, Niagara County, New York. The location of the former MGP site is shown in Figure 1-1. The New York State Department of Environmental Conservation's (NYSDEC's) identification number for the site is 9-32-098. On March 25, 1994, NYSEG entered into an Order on Consent (Order) Index Number D0-0002-9309 with the NYSDEC to investigate and remediate 33 of NYSEG's former MGP sites. The Lockport Transit Street site is covered by this Order.

This FS was prepared by URS and is based on information and data presented in the reports listed in Section 1.4 in addition to information in the *Remedial Investigation (RI) Report, NYSEG – Transit Street Site*, prepared by URS, August, 2007.

1.2 Site Description

The Transit Street site is just under an acre in size and is the location of a former MGP that operated circa 1851 to 1927. The Transit Street site is currently occupied by an active electrical substation containing a transformer area, switch house, and storage building. The site is located adjacent to Transit Street to the west, LaGrange Street to the north, Saxton Street to the east, and residential properties to the south. The Transit Street site is situated approximately 200 feet southeast of the New York State Barge Canal (Canal).

Figure 1-2 depicts the former MGP areas and current setting. The eastern portion of the site is paved (i.e., east of the substation), and the remaining portions are covered with gravel. The ground surface from Saxton Street slopes steeply toward the west onto the site and flattens near the 150,000 cubic foot former gas holder. The ground surface on the site slopes gently toward the north and west.

1.3 Operational/Disposal History

The following site history has been gathered from reports on previous investigations conducted at the site (see Section 1.4). During the first seven years of operation, the facility reportedly used whale oil as a feedstock for gas production. Circa 1857 to 1859, manufactured gas production by coal carbonization began. In the coal carbonization process, bituminous coal was heated in a sealed chamber, causing the distillation of gas from coal and the formation of coke. Carbureted water gas (CWG) was probably produced at the site beginning in 1914, as evidenced by the addition of a water gas department and oil tanks to the 1914 Sanborn Map. Carbureted water gas is fuel gas made from water (as steam) and enriched for candlepower by light "oils" recovered from gas-making residual tars and light petroleum oils. The CWG was created by passing steam through a bed of incandescent coke or coal, resulting in “blue gas”. This was then passed through two chambers containing hot firebrick into which oil was sprayed and the oil cracked into gaseous hydrocarbons and tar. Tars produced during coal carbonization were high in phenols and base neutral organics, whereas tars produced by CWG processes contained much lower amounts of these compounds. Typically, substantial amounts of cyanide and ammonia were produced by coal carbonization, but only trace amounts of cyanide resulted from CWG processes.

The locations of the former MGP structures, as shown on Figure 1-2, are based on Sanborn maps from 1886 to 1928 and the site history presented in the Atlantic Environmental Services, Inc. (AES) *Supplemental Site Investigation Report* from January 1995. In 1886, site structures included a plant building in the western part of the site with retorts, an engine room, and purifiers. Three gasholders were located in the north-central portion of the site. Two private residences were present on what is now the easternmost extent of the site. The westernmost gasholder was removed some time between 1892 and 1898. Between 1898 and 1903, one of the adjacent private residences east of the site was removed and the site boundary was extended eastward to Saxton Street. The other residence, with the addition of a storage shed, was incorporated into the southeastern corner of the site. A new gasholder was added to the eastern portion of the site between 1898 and 1903. The 1909 Sanborn map lists the capacity of the three gasholders as 15,000 cubic feet (cf) for the westernmost holder, 50,000 cf for the central holder, and 150,000 cf for the easternmost holder. An electrical department and storage building replaced the dwelling and storage building in the southeastern corner of the site.

The 1914 Sanborn map indicates the addition of water gas equipment in the southeastern part of the site and three oil tanks between the plant building and the water gas department along the southern site boundary. The water gas department was reportedly relocated from the southeast corner of the site to the southwest corner of the site by 1919. The storage shed remained in the southeastern part of the site and a total of five oil tanks were located along the southern site boundary. The 15,000 cubic foot gasholder and the storage shed in the southeastern site corner were removed between 1919 and 1928, according to the 1928 Sanborn map. A coal pit with northern and southern retaining walls was located in the southeastern corner of the site, and a coal bucket runway extended from the coal pit to the plant. According to the AES report, the last year of gas production at the Transit Street site is believed to have been 1927, based on recollection of present and former employees. All of the MGP structures were removed from the site between 1928 and 1948, according to the 1948 Sanborn map. The dismantling procedures and condition of remaining subsurface MGP structures are unknown.

1.4 Previous Investigations

Previous investigations of the Transit Street site have included a site screening conducted by Woodward-Clyde Consultants, Inc. (WCC) from 1982 through 1985, a supplementary investigation performed by AES from 1991 through 1995, and an air monitoring survey by Galson Corporation in 1992.

Below is a list of site investigation documents prepared for the site, followed by a summary of the findings of the activities performed. Plate 1 and Plate 2 present the previous sampling locations.

1. *Investigation and Assessment of the Lockport Coal Tar Site: Task 1 Report, Preliminary Site Evaluation*, prepared by Woodward-Clyde Consultants, Inc., November 1982.

   A preliminary site evaluation was performed at the Transit Street site by WCC in 1982. The evaluation consisted of a literature review, site reconnaissance, and geophysical surveys. The report indicated that the bedrock surface ranges in depth from 2 to 23 feet in the study area and slopes generally towards the Canal. The bedrock contains northeast and northwest striking joint sets that perhaps influence the flow of groundwater and infiltration water according to the report.

2. *Investigation and Assessment of the Lockport Coal Tar Site: Task 2 Report, Boring and Well Installation*, prepared by Woodward-Clyde Consultants, Inc., February 1983.

   An investigation of the site was performed by WCC in 1983. Four bedrock wells (MW-1 through MW-4), two bedrock/overburden interface wells (IW-1 and IW-2), and three borings (B-1 through B-3) were installed to monitor groundwater conditions and to determine subsurface conditions. It was determined from the investigation that bedrock groundwater flow is towards the Canal to the north-northwest. Coal tar-contaminated soil was observed at MW-3 from 4 to 12 feet. Soil samples were collected from 8 to 10 feet and sent for analysis. Compounds present in the soil included fluoranthene (17 parts per million [ppm]), pyrene (13 ppm), naphthalene (63 ppm) and phenathracene (38 ppm). Oil-coated rock was observed below the Gasport Member at depths ranging from 30 to 38 feet in all borings except B-1 and MW-4.

3. *Results of Groundwater Sampling, Lockport Coal Tar Site*, prepared by Woodward-Clyde Consultants, Inc., August 25, 1983, revised September 9, 1983.

   WCC conducted two rounds of groundwater sampling on February 2-3, 1983 and May 4, 1983. Monitoring wells MW-1 through MW-4 and IW-2 were sampled during both events. Seep 1 and Seep 2 samples and a soil sample from the substation site were collected and analyzed during the February 1983 event.

4. *Investigation and Assessment of the Lockport Coal Tar Site: Task 3 Report, Boring and Well Installation and First Round Groundwater Sampling*, prepared by Woodward-Clyde Consultants, Inc., February 1984.

   A Task 3 field investigation was performed by WCC in 1984. The program included the drilling of six shallow auger borings (AB-1 through AB-6), excavation of five test pits (TT-1 through TT-5), installation of 13 monitoring wells (MW-5 through MW-17), drilling of two inclined bedrock cores (B-3-1 and B-3-2), permeability testing of 16 new and existing wells, and collection of 3 rounds of Canal water samples. Groundwater samples were collected and analyzed from 19 wells.

   Three wooden sumps were discovered during the excavation of TT-2. The wooden sumps were approximately 7 feet by 5 feet by 3.5 feet, filled with a black liquid believed to be coal tar, and covered with stone slabs. Widespread coal tar contamination was observed in site soil. Low concentrations of polychlorinated biphenyls (PCBs) were detected in soil samples from TT-2/S-1, TT-2/S-2 and AB-4/S-1.

5. *Results of Third Round Task 3 Groundwater Sampling, Lockport Coal Tar Site*, prepared by Woodward-Clyde Consultants, Inc., July 31, 1984.

   All 19 site wells were sampled. This event was during high water level conditions in the Canal.

6. *Investigation and Assessment of the Lockport Coal Tar Site: Task 7 Report, Additional Investigations*, prepared by Woodward-Clyde Consultants, Inc., November 1984.

   Additional investigations of the Transit Street site were conducted by WCC in 1984. The then-current status of Canal water use was researched. Information concerning the location and construction of sewer lines, tunnels, and shafts in the site area was collected. Two additional wells (MW-18 and MW-19) were installed in an attempt to bound the northeastern extent of the plume. A minimum thickness of 30 inches of gasoline floating product was observed in well MW-17.

7. *Results of Fourth Round Task 3 Water Sampling, Lockport Coal Tar Site*, prepared by Woodward-Clyde Consultants, Inc., January 11, 1985.

   Samples were collected from all on-site wells except MW-2. Surface water samples were collected from 4 points along the Canal at 2 depths per location.

8. *Results of Fifth Round Task 3 Water Sampling, Lockport Coal Tar Site*, prepared by Woodward-Clyde Consultants, Inc., January 11, 1985.

   Samples were collected from all on-site wells except MW-2. Surface water samples were collected from 4 points along the Canal at 2 depths per location.

9. *Summary Report: Investigations at the Lockport Coal Tar Site, Volume 1*, prepared by Woodward-Clyde Consultants, Inc., February 1985.

This report summarizes all Task 1, 2, 3 and 7 activities including all groundwater sampling results.

10. *Task 5 Report: Conceptual Remedial Design Report for the Lockport Coal Tar Site*, prepared by Woodward-Clyde Consultants, Inc., July 1985.

    This report compares various remedial alternatives for the site, including capping, slurry walls, grout curtain, removal, and pumping.

11. *Transit Street MGP Site, Lockport, New York, Data Review Report*, prepared by Atlantic Environmental Services, Inc. (AES), August 1991.

    AES reviewed all data from previous investigations at the Transit Street site in 1991. It was recommended that additional shallow borings, a soil gas survey, overburden monitoring well installation, sampling and analysis be performed in future investigations.

12. *Environmental Assessment of Former Manufactured Gas Plant Site, Residential Air Monitoring Results, Lockport, New York*, prepared by Galson Corporation, July 20, 1992.

    Galson Corporation performed a residential air monitoring analysis in the vicinity of the Transit Street site in 1992. It was reported that no apparent link was observed between the coal tar contamination and indoor air quality. Results may have been affected by the nearby gas station, which was operational during the survey, and emitted gasoline odors that were quite noticeable in the proximity of the investigation.

13. *Supplemental Site Investigation for Transit Street MGP Site, Lockport, New York,* prepared by Atlantic Environmental Services, Inc., January 1995.

    A site investigation was performed by AES at the Transit Street site in 1995. Field activities during the investigation included a soil gas survey, advancement of 44 shallow subsurface borings (SB-01 through SB-44), analysis of 17 soil samples, installation of 14 monitoring wells (SMW-1S, SMW-1D, SMW-3S, SMW-3D, SMW-4S, SMW-4D, SMW-5, SMW-6S, SMW-6D, and SMW-7 through SMW-11), subsurface soil sampling (10 samples from various depths at 9 monitoring well locations), overburden permeability testing of 5 wells

(SMW-3S, SMW-3D, SMW-4S, SMW-4D, and SMW-6D), groundwater sampling, air quality monitoring of nearby residences, and a site survey.

MGP residuals were observed during drilling of wells SMW-6S, SMW-6D, and SMW-11. Overburden coal tar contamination was also defined at the site.

14. *Removal/Reconstruction Activities, Reid Petroleum Site, LaGrange and Transit, Lockport New York*, prepared by Acres International Corporation, April 1997.

    Coal tar-impacted soils were encountered during construction activities in 1997 at the Reid Petroleum site. The impacted soils were excavated and disposed of off-site. The site is a gas station property, which is located directly north of the Transit Street former MGP, and bounded by LaGrange Street on the south, Transit Street on the west, Genesee Street on the north, and residential homes to the east. The zone of coal tar contamination was observed from 6 to 8 feet below ground surface (bgs).

15. *Remedial Investigation Report, Transit Street Former Manufactured Gas Plant, Lockport, New York*, prepared by URS Corporation, August 2007.

    Following the completion of the RI in 2007, URS conducted the following additional investigation activities:

    - *Additional Sediment Sampling,* conducted by URS Corporation, January 2008.
    - *Non-Aqueous Phase Liquid (NAPL) Monitoring in the New York State Barge Canal,* conducted by URS Corporation, April 2008.

Section 1.2.3 in the RI provides a detailed discussion of the findings of previous investigations prior to the RI. A summary of the interim remedial measure (IRM) is provided below.

1.4.1 Interim Remedial Measure

At the request of NYSEG, Acres International Corporation (Acres) provided construction oversight services as an IRM during tank removal and soil and rock excavation in March 1997 at the Reid Petroleum gasoline station, immediately north of the NYSEG property. Acre's primary objective was to visually identify apparent coal tar-impacted soil and document its proper excavation, segregation, transport, and disposal following the removal of petroleum tanks.

Acres personnel were not on-site to witness the removal or handling of the tanks during removal. Acres arrived on-site once Reid Petroleum had notified NYSEG of the apparent discovery of coal tar-impacted soil during excavation activities. Reid Petroleum reportedly removed a 1,000-gallon diesel above-ground storage tank from behind the former building, two 2,000-gallon and two 4,000-gallon underground storage tanks (USTs) from the IRM excavation limit shown on Plate 2. Reid Petroleum reportedly also removed a 550-gallon waste oil UST, a 1,000-gallon heating oil UST, and a 4,000-gallon gasoline UST outside the main excavation trench. The waste oil and heating oil tanks reportedly contained 20 to 40 gallons of residual waste liquids and originated from the southwest and northeast corners adjacent to the old building structure. The 4,000-gallon gas tank was reportedly removed from adjacent to the north-south guardrail on the east side of the property. Coal tar-contaminated soil was not observed in any of these three individual excavation pits according to Reid Petroleum personnel.

The IRM excavation was anticipated to be L-shaped with overall dimensions of approximately 35 feet by 32 feet by 11 feet deep. The actual excavation had dimensions of approximately 60 feet by 48 feet by 11 feet in an L-shape. In general, a zone of suspected coal tar contamination was found at a depth of 6 to 8 feet bgs (based upon visual observations). Black discoloration of the soil matrix and characteristic coal tar odors were present. The coal tar contamination appeared to be perched upon a clayey silt till unit approximately 1 to 2 feet in thickness, which was underlain by bedrock found at a depth of approximately 8 feet. Excavated soil and rock, which appeared to be clean, was segregated and transported off-site for re-use at another Reid Petroleum facility.

The total volume of excavated materials is estimated to be 875 cubic yards (cy). The total volume of clean excavated material during the project was reportedly to be on the order of 150 to 200 cy.

Approximately 12 dump truck loads of visually-identified coal tar-impacted soil and fill were excavated, loaded, and transported as non-hazardous waste to BFI in Niagara Falls, NY. Each truck bed was lined with sand to contain free liquids. (Approximately 9 loads of clean sand were transported to the site for this purpose). Each truckload was approximated at 40,000 pounds (20 tons). Therefore, approximately 240 tons of sand and coal tar-contaminated soil were transported to BFI. Approximately 3,637 gallons of water collected during excavation activities was transported to Clean Harbors' Baltimore, MD facility for treatment.

1.4.2 Nearby Recent Construction Project

The New York State Department of Transportation (NYSDOT) recently completed a roadway construction project along Transit Street in Lockport (April 2007 – see Appendix A for NYSDOT information). The project involved resurfacing of the road and repair of the Transit Street Bridge abutment. A retaining wall along the west side of Transit Street south of the Canal was reconstructed. Approximately 70.4 tons of soil contaminated with petroleum was transported to and disposed at Modern Landfill. Based on soil analytical results, no other contamination (including MGP) was identified.

1.5 Remedial Investigation

1.5.1 Scope of RI

The focus of the RI was to further define the extent of MGP-related wastes previously identified in soil and in overburden and bedrock groundwater in and around the Transit Street site. The scope of work was developed to fill data gaps identified from previous investigations and included inspections of existing monitoring wells, soil borings and soil sampling, surface soil sampling, bedrock monitoring well installation, repairing/replacing and abandoning existing damaged monitoring wells, groundwater sampling, sediment profiling/surface water and sediment sampling, groundwater monitoring, site surveying, inspection of the Main Interceptor Tunnel, Fish and Wildlife Impact Analysis (FWIA - through Step IIB), Qualitative Human Health Exposure Assessment (QHHEA), and analysis of data and preparation of RI Report. The results of this investigation were used to select appropriate remedial actions to address risks to human health and the environment

1.5.2 Applicable Standards, Criteria, and Guidance

The overall nature and extent of contamination at the site was determined by assessing and evaluating all data collected to date, including results from investigations conducted prior to the RI. All analytical data from the investigations was compared to Standards, Criteria, and Guidance values (SCGs). SCGs are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, or location. Guidance values include non-promulgated criteria and guidelines that are not legal requirements but should be considered if determined to be applicable to the site.

SCGs are categorized as chemical-specific, location-specific, or action-specific as defined below.

Chemical-specific:	Health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values for the chemicals of interest. These values establish the acceptable amount or concentration of a chemical, or combinations of chemicals, that may be found in or discharged to the environment.
Location-specific:	Restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they occur in a specific location (e.g., wetland, floodplain, historic area, etc.).
Action-specific:	Technology- or activity-based requirements or limitations on actions taken with respect to hazardous waste management, site cleanup, or discharge limitations.

The following paragraphs present chemical-specific SCGs that have been identified for the site and are used for the discussions on the nature and extent of contamination (Section 1.5.4). A comprehensive list of all site SCGs is presented in Table 1-1.

For each medium, detected concentrations of individual contaminants were compared to applicable SCGs in the RI; the SCGs were determined as follows:

- The SCGs for soil are the recommended soil cleanup objectives (RSCOs) presented in NYSDEC Technical and Guidance Memorandum (TAGM) #4046, January 1994 (including subsequent memorandums).
- The SCGs for groundwater are the Class GA standards and guidance values presented in NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1, March 1998 (including subsequent revisions).

- For surface water, the most stringent Class C surface water standards and guidance values (as presented in TOGS 1.1.1) for the various types of protection listed are included in the tables for comparison as the SCGs.

- For sediment, sample-specific SCGs for benzene, toluene, ethylbenzene, and (total) xylenes (BTEX), SVOCs, and PCBs, based on the total organic carbon content of each sample, were calculated for the following levels of protection using the procedures provided in *Technical Guidance for Screening Contaminated Sediments*, Division of Fish, Wildlife, and Marine Resources, NYSDEC, 1999: Human Health Bioaccumulation, Wildlife Bioaccumulation, Benthic Aquatic Life Acute Toxicity, and Benthic Aquatic Life Chronic Toxicity. The SCGs for metals in sediment are the lowest effect level (LEL) and severe effect level (SEL) listed in the referenced NYSDEC guidance document.

1.5.3 Geology and Hydrogeology

The site lies in the Erie-Ontario Lowlands physiographic province of New York State, which is characterized by low plains with little relief. Glacial deposition and shoreline deposits have modified the topography of the province. Regionally, the site lies on relatively flat, poorly-drained lowland, termed the Tonawanda Plain. This area is located between two east-west trending, north cliff-facing escarpments, with the Niagara Escarpment to the north. The Niagara Escarpment, a major physiographic feature in Western New York, is underlain by the Lockport Dolomite, and is about 0.5 mile north of the site. Regionally, the rock dips to the south at approximately 40 feet per mile.

The site is underlain by fill materials and reworked native soil. Thickness of overburden at the site ranges from approximately 10 feet along Transit Street to 20 feet in the eastern portion of the site. Thickness of overburden for the entire investigation area ranges from approximately 1.2 to 51 feet. Fill materials typically were characterized as brown to red brown, silt, clayey silt, and silty clay with varying amounts of coal fragments, degraded concrete, and brick fragments and ranged from 3 to 11 feet thick. Native soil, consisting of red brown silty fine sand with some coarse gravel, was only encountered in approximately two-thirds of the soil borings advanced during the RI.

The underlying bedrock at the site is dolomite and shale of Silurian age. The Gothic Hill Member of the Gasport Dolomite (i.e., Lockport Group) is the uppermost bedrock unit observed beneath the site. It consists of thick- to massive-bedded, coarse-grained, dark olive-gray to light-pink dolomitic limestone that weathers to a light olive-gray. The Gasport Dolomite ranges from not present (i.e., excavated away) to 17.3 feet thick at the site. A sharp contact separates the Gasport Member from the underlying DeCew Member of the Clinton Group. The DeCew Dolomite consists of variably bedded, dark-gray to olive-gray, argillaceous to sandy, fine-grained dolomite that is non-fossiliferous. It weathers to a distinctive light olive-gray. The DeCew Member ranges from not present to 6.35 feet thick near the site and grades into the Rochester Shale Member of the Clinton Group. The Rochester Shale is divided into two members, the upper Burleigh Hill Member and the lower Lewiston Member and is estimated to have a total thickness of approximately 60 to 90 feet in the site vicinity. The Burleigh Hill Member consists of uniform dark- to medium-gray, pale- and platy-weathering, highly calcareous shale to dolomitic mudstone. It is considered to be a transitional unit between the overlying dolomitic units above and the Lewiston Shale below. The Burleigh Hill was observed to be approximately 40 feet thick in the site vicinity. The Lewiston Member of the Rochester Shale consists of medium- to dark-gray, calcareous mudstone with interbedded fossiliferous lenses and beds. The Lewiston Member was never fully penetrated at the site, but is estimated to be between 30 to 50 feet thick. There is a sharp contact between the Burleigh Hill and the Lewiston Members of the Rochester Shale, indicated by a thick bryozoan and brachiopod rich packstone (i.e., Unit E of the Lewiston Member). The upper portion of the bedrock sequence (the Gasport, DeCew, and Burleigh Hill Members) is exposed in the sidewalls of the nearby Canal. Adjacent to the site the floor of the Canal is excavated in the Burleigh Hill Member.

The Transit Street site lies on a relatively flat local bedrock surface (i.e., Gasport Dolomite). Bedrock appears to be slightly higher beneath the southwest corner of the property and just south of the site. The bedrock surface elevation slopes steeply to the west-northwest, and slightly towards the north and east. There is a bedrock ridge that forms from the differing slopes. Locally, the bedrock bedding planes/units generally dip slightly to the south and west, although there appears to be a localized low elevation for the contact at the Gasport Formation and the DeCew Member in the vicinity of MW-10. Very few vertical fractures were observed in rock cores during the RI field activities, but some are reported to be present in the area. Several vertical joint sets trending approximately N40E and N84E were observed in the rock face within the Canal, however, these vertical joint sets were observed to be prevalent in the Gasport and DeCew Members and appear to decrease in aperture in the Rochester Shale units.

The overburden water table in the vicinity of the Transit Street site is generally within the fill between 6 to 9 feet bgs. Southeast and upgradient of the site, where the overburden is significantly thicker, the groundwater is much deeper at approximately 21 to 25 feet bgs. North of the site as the overburden thins out between the site and the Canal, some of the overburden wells have a very thin saturated zone or are seasonally dry. However, the saturated thickness appears to increase slightly behind the retaining walls adjacent to the Canal. The hydraulic conductivity in the overburden, based on slug tests, ranged from 1.83 x 10^{-5} to 1.25 x 10^{-4} centimeters per second (cm/sec). Hydraulic conductivity in the overburden/bedrock interface ranges from 2.68 x 10^{-4} to 1.11 x 10^{-2} cm/sec. Lower hydraulic conductivities were typically measured in the Rochester Shale units as compared to the Gasport and DeCew bedrock units.

Groundwater elevation data indicate that groundwater in the bedrock flows northwest toward the Canal, and tends to discharge into it. Changes in the hydraulic gradient near the Canal appear to be reflective of seasonal changes in the Canal water elevation. Hydraulic gradients in the bedrock units are highest during periods when the Canal water elevation is at its seasonal low (i.e., November through April), indicating dewatering of the nearby bedrock units. Conversely, the hydraulic gradients are flatter when the Canal water elevation is at its seasonal high (i.e., May through October). The effect is most apparent in monitoring wells situated near the Canal walls.

1.5.4 Overall Nature and Extent of Contamination

1.5.4.1 Soil Quality

In the vicinity of the site, there is little exposed surface soil due to metropolitan development. A few surface soil samples were collected as part of the RI and results indicate that several SVOCs (primarily polycyclic aromatic hydrocarbons [PAHs]), including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenz(a,h)anthracene, exceeded their respective SCGs in at least one sample location. The sampling locations were adjacent to the Transit Street and LaGrange Street curb lines, and therefore, the PAH detections above SCGs are likely attributable to urban sources such as vehicle exhaust. No PCB compounds were detected in any surface soil sample collected during the RI.

Beryllium, chromium, copper, iron, mercury, nickel, and zinc were detected at concentrations that exceeded SCGs in at least one of the RI surface soil samples. Total cyanide was detected in one of the RI surface soil samples. Very little of the cyanide detected is of the more toxic free cyanide.

The major findings of the subsurface soil sampling from the RI indicate that VOCs, primarily BTEX compounds, were detected in the subsurface soil samples at concentrations above SCGs. RI Figure 4-4 and Table 4-4 summarize the results and are included in Appendix A. Other VOCs exceeding SCGs at one or more locations include methylene chloride, acetone, and isopropylbenzene. The highest concentration for total BTEX detected during the RI, 181.4 mg/kg, was located at GB-09 (from 10-12 feet bgs) in the northwest corner of the site. Reported concentrations of 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene exceeded their respective SCGs at one or more locations (Appendix A). Total SVOCs were detected above 500 mg/kg in 6 of the samples collected during the RI (GB-05, 6-8 feet, GB-09, 10-12 feet, GB-09, 12-13.8 feet, GB-15, 2-3 feet, GB-16, 0.5-1.5 feet, and GB-26, 9.5-10.75 feet). All of these samples, with the exceptions of GB-05 and GB-25, were from within the fenced in substation; GB-05 was located in the right-of-way (ROW) on the north side of the substation property, and GB-26 was located across LaGrange Street, north of GB-05. Most of the maximum exceedances during the RI were detected in boring GB-09 (12 to 13.8 feet bgs) and boring GB-16 (0.5 to 1.5 feet bgs). GB-09 was advanced in the northwest corner of the site, in the vicinity of the former purifier rooms. GB-16 was advanced at the southern edge of the concrete pad of the former 150,000 cubic foot gasholder. PCBs (Aroclors 1248, 1254, and/or 1260) were detected in 4 samples collected during the RI or previous investigations, but all concentrations were below SCGs. Barium, beryllium, cadmium, chromium, copper, iron, mercury, nickel, selenium, and zinc were detected at concentrations that exceeded SCGs in at least one of the subsurface soil samples collected during the RI or during previous investigations. Total cyanide was detected in several of the subsurface soil samples collected during the RI. The highest concentration detected during the RI was at boring GB-10 (34.4 mg/kg from 6 to 6.2 feet bgs), which was advanced in the approximate vicinity of the wooden tar sumps. All soil samples in which total cyanide was detected were sent to Clarkson University for further analysis to determine the amount of free cyanide and the various cyanide species present. The majority of the cyanide was found to exist as stable iron cyanide complexes and not as free cyanide. Total recoverable phenolics were detected in 6 of the subsurface soil samples collected during the RI or during previous investigations. The highest concentration was detected at location TT-02 (previous investigation), which was a test trench near the wooden tar sumps.

1.5.4.2 Soil Vapor Intrusion Investigation

In March 2006, URS conducted a soil vapor intrusion investigation to:

- Determine if soil and groundwater contamination in the vicinity of the site is resulting in the presence of indoor air contamination via vapor intrusion, and
- Determine to the extent practical, the nature and degree of soil gas contamination in the vicinity of the site.

The study was initially developed to include sampling at 5 nearby residences. These area residences were selected by the NYSDEC, New York State Department of Health (NYSDOH), and NYSEG based on proximity to the site. The study was to include sampling of indoor air, outdoor air and soil vapor at each of the residences to evaluate the potential exposure to site-related contaminants. However, access agreements could not be obtained from 2 of the homeowners (both south of the site - one of these locations was later sampled in March 2007 when access was eventually permitted), resulting in a revised proposal to sample the 3 residences north of the site, and collect sub-slab and soil vapor samples from the southern portion of the substation to evaluate whether soil vapor has been impacted in this area and, hence, potentially impacted residences south of the site. Also, during the investigation, access could not be obtained (during the winter heating months) at one of the 3 residences north of the site.

Samples were collected at 2 residences north of the site and sample locations are shown on RI Figure 4-49, which is included in Appendix A. One residence is a foreclosed property and is currently vacant; consequently, only a sub-slab soil vapor sample was collected. The indoor air investigation program of the occupied property included the following: (1) an interview with the homeowner using air quality questionnaires developed by the NYSDOH; (2) a survey of household chemicals present and an evaluation of their potential to affect air sample results; (3) collection of one air sample from the breathing zone of the first floor and one air sample from the breathing zone of the basement area; (4) collection of one soil vapor sample from beneath the basement concrete slab; and (5) collection of an outdoor ambient air sample from an upwind location. Outdoor ambient air samples were collected from upwind locations central to the points sampled each day, at a rate of one per day of sampling, per sampling area. Two soil vapor points were installed and sampled along the southern fence line of the site, near one of the residences south of the site. In addition, one sub-slab sample was collected from NYSEG's maintenance warehouse building, which is also adjacent to one of the residences south of the site.

The results for the soil gas samples, sub-slab samples, indoor and outdoor ambient air samples are summarized on RI Table 4-28 and included in Appendix A. The results for 1,1,1-trichloroethane, BTEX, and naphthalene are presented for all locations on RI Figure 4-49 (Appendix A). The compound 1,1,1-trichloroethane is included on the figure because the concentration was elevated in the on-site sub-slab sample collected from beneath the on-site warehouse building. The elevated result for naphthalene in sample H-03-IA-B was attributed to the presence of mothballs in this basement location. Sampling results indicate that indoor air has not been impacted by MGP-related vapors, and therefore, there is no exposure pathway.

1.5.5 <u>Groundwater Quality</u>

1.5.5.1 <u>Overburden/Bedrock Interface</u>

Volatile organic compounds (VOCs) detected at concentrations exceeding SCGs in the overburden/bedrock interface monitoring wells consist primarily of BTEX. Other VOCs that were detected at concentrations exceeding SCGs during the RI include styrene, methylene chloride, and methyl tert-butyl ether (MTBE). The highest total BTEX concentrations in samples collected during the RI were at locations MW-10S and SMW-11, both of which are located north (downgradient) of the site. BTEX was not detected in the upgradient and side gradient monitoring well samples collected during the RI. RI Figure 4-10 and Table 4-8 summarize the results and are included in Appendix A. SVOCs detected above SCGs in the overburden/interface monitoring well samples collected during the RI consisted primarily of PAHs. The highest SVOC concentrations were at location SMW-11, which is located north (downgradient) of the site. No SVOCs were detected at concentrations exceeding SCGs in the upgradient and side gradient monitoring well samples collected during the RI (Figure 4-10 and Table 4-8 in Appendix A). No PCBs were detected in the overburden/interface monitoring well samples. Arsenic, cadmium, chromium, iron, lead, magnesium, manganese, nickel, and sodium were detected at concentrations exceeding SCGs in one or more overburden/interface monitoring well samples. Total cyanide was detected in 4 of the 12 overburden and interface monitoring well samples, but all concentrations were below the SCG for this parameter. All 4 wells in which total cyanide was detected are located downgradient from the site along the north side of LaGrange Street. All concentrations of total cyanide detected in samples collected during previous investigations were also below the SCG. Total recoverable phenolics were detected at concentrations above SCGs in 6 of the 12 overburden/bedrock interface well samples. Total recoverable phenolics were not detected in the upgradient, side gradient, or far downgradient overburden/bedrock interface wells.

1.5.5.2 Shallow Bedrock

VOCs detected at concentrations exceeding SCGs in the shallow bedrock monitoring well samples collected during the RI consist primarily of BTEX, but also include styrene and MTBE. The highest total BTEX concentration (20,000 μg/L) in samples collected during the RI was at location MW-10, located north (downgradient) of the site. RI Figure 4-12 and Table 4-10 summarize the results and are included in Appendix A. BTEX concentrations were three orders of magnitude less at all other shallow bedrock monitoring well locations. MTBE was detected at a concentration above the SCG at upgradient well MW-05, although BTEX was not detected at this location. SVOCs detected in the shallow bedrock monitoring well samples consist primarily of PAHs. Naphthalene was typically detected at the highest concentrations. MW-10, located north (downgradient) of the site, on the north side of LaGrange Street, contained the highest concentration of total SVOCs at 23,570 μg/L, 14,000 μg/L of which was naphthalene. Eleven SVOCs were detected at concentrations exceeding their respective SCG at MW-10. No SVOCs were detected at concentrations exceeding SCGs in upgradient monitoring well MW-05 or downgradient well MW-11. However, low levels of SVOCs, including exceedances for naphthalene and 2-methylnaphthalene, were detected in upgradient well BMW-04-08, which is located in close proximity to the southern site boundary. No PCBs were detected in the shallow bedrock monitoring well samples. The metals cadmium, chromium, copper, iron, lead, magnesium, manganese, nickel, selenium, sodium, and zinc were detected at concentrations exceeding SCGs in one or more shallow bedrock monitoring well samples collected during the RI. Total cyanide was detected in only one of the 6 shallow bedrock wells; however, the concentration was below the SCG. Total recoverable phenolics were detected at concentrations above SCGs in only one of the 6 shallow bedrock well samples at location MW-10, which is located immediately downgradient and north of the site, on the north side of LaGrange Street.

1.5.5.3 Intermediate Bedrock

VOCs detected at concentrations exceeding SCGs in the intermediate bedrock monitoring well samples collected during the RI consist primarily of BTEX. Other VOCs detected at concentrations exceeding SCGs include 1,2-dichloroethene(cis), isopropylbenzene, MTBE, styrene, tetrachloroethene, trichloroethene, and vinyl chloride. The highest total BTEX concentrations (22,000 μg/L and 14,700 μg/L in wells MW-07 and MW-03, respectively) were detected on-site in the vicinity of the wooden tar sumps. RI Figure 4-14 and Table 4-12 summarize the results and are included in Appendix A. The BTEX contamination plume in the intermediate bedrock appears to extend from the site primarily to the north and west, and as far east as MW-09 and as far south as MW-04. The chlorinated VOCs were all detected in well MW-15, which is located northeast of the site and is likely impacted by non-MGP-related sources of contaminants. MTBE was detected in 3 intermediate bedrock monitoring wells. MTBE is not associated with MGP waste; therefore, its presence at these locations is indicative of other non-MGP related sources of contaminants. SVOCs detected in the intermediate bedrock monitoring well samples consist primarily of PAHs. The highest concentration of total SVOCs (78,975 μg/L) was at location MW-07, 31,000 μg/L of which was naphthalene. MW-07 is located along the western boundary of the site. No PCBs were detected in the intermediate bedrock monitoring well samples. The metals iron, magnesium, manganese, and sodium were detected at concentrations exceeding SCGs in one or more intermediate bedrock monitoring well samples. Total cyanide was detected in 5 of the 20 intermediate bedrock well samples collected, but the concentrations were all below the SCG. Total recoverable phenolics were detected at concentrations above the SCG in 8 of the 20 intermediate bedrock well samples. The highest concentration was in MW-07.

1.5.5.4 Deep Bedrock

VOCs detected at concentrations exceeding SCGs in the deep bedrock monitoring well samples collected consist primarily of BTEX. Other VOCs that were detected at concentrations exceeding SCGs include cyclohexane, isopropylbenzene, MTBE, styrene, and vinyl chloride. The highest total BTEX concentrations during the RI (2,360 μg/L and 787 μg/L in wells BMW-

04-09 and MW-02, respectively) were detected west of the site near the Canal. RI Figure 4-16 and Table 4-14 summarize the results and are included in Appendix A. Low concentrations of BTEX in wells BMW-04-10 and BMW-04-13 indicate the dissolved phase plume in the deep bedrock extends beneath the Canal, although low levels of chlorinated VOCs at these locations indicate impacts by other non-MGP sources as well. SVOCs detected in the deep bedrock monitoring well samples consist primarily of PAHs. Naphthalene was typically detected at the highest concentrations. Overall, SVOC concentrations detected in deep bedrock are much lower than those detected in the shallow and intermediate bedrock groundwater, which is attributable to fewer fractures and lower hydraulic conductivities measured in the deep bedrock. No SVOCs were detected in the deep bedrock monitoring well BMW-04-13 located west of the site on the north side of the Canal. No PCBs were detected in the deep bedrock monitoring well samples. The metals chromium, iron, lead, magnesium, manganese, nickel, sodium, and zinc were detected at concentrations exceeding SCGs in one or more RI deep bedrock monitoring well samples. Total cyanide was detected in 2 of the 5 deep bedrock well samples, but the concentrations were all below the SCG. Total recoverable phenolics were detected at a concentration above the SCG in only one of the 5 deep bedrock well samples.

1.5.5.5 Groundwater Summary

Groundwater contamination in the overburden is relatively contained around the site and extends off-site where the dissolved phase plume co-mingles with another source associated with the gasoline station. Contaminants within the overburden have migrated with the groundwater downward into fractures in the shallow and intermediate bedrock, and have migrated through the fractures (secondary porosity). Groundwater contamination in the bedrock aquifer appears to be more widespread vertically and laterally, and is impacted with fuel-related contaminants in the vicinity of the gasoline station. In the shallow and intermediate bedrock, the Canal appears to be the receptor of groundwater passing through the site. In the deep bedrock, it is possible that a component of groundwater flow migrates beneath the Canal with some discharge into the Canal. Trace quantities of MGP-related contaminants were detected in bedrock wells located on the north/west side of the Canal. This area probably represents the northern extent of dissolved-phase groundwater contamination.

1.5.6 Surface Water and Sediment Quality

1.5.6.1 Surface Water

VOCs were detected at concentrations in exceedance of the SCGs in surface water samples collected during the RI. SVOCs were not detected in any surface water at any concentration. RI Figure 4-20 and Table 4-21 summarize the results and are included in Appendix A. PCBs were not detected in any surface water samples at any concentration. The concentrations of iron in 5 of the surface water samples exceeded the SCG. The concentration of total recoverable phenolics at location SW-08 exceeded the SCG for this parameter. This location is a considerable distance upstream of the site, and is likely not impacted by waste generated during former site operations. Total recoverable phenolics were not detected in any of the remaining surface water samples.

1.5.6.2 Sediment Quality

The major findings of the sediment sampling during the RI indicate that benzene was detected in one of the 53 sediment samples collected at a concentration below the SCGs for all categories of protection. Toluene, ethylbenzene, and xylene were not detected in any of the RI sediment samples. Acetone was the only VOC detected in the 3 sediment samples collected during previous investigations. Several SVOCs, primarily PAHs, were detected in sediment samples collected during the RI. RI Figures 4-21 through 4-24 and Table 4-29 summarize the results and are included in Appendix A. Reported concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene exceeded their respective SCG for the Human Health Bioaccumulation Level of Protection at one or more locations. All reported SVOC/PAH concentrations were below the SCGs for the Wildlife Bioaccumulation Level of Protection. Reported concentrations of benzo(a)anthracene exceeded the SCG for the Benthic Aquatic Life Acute Toxicity Level of Protection at one or more locations. Reported concentrations of benzo(a)anthracene, bis(2-ethylhexyl)phthalate, phenanthrene, and fluorene exceeded their respective SCG for the Benthic Aquatic Life Chronic Toxicity Level of Protection at one or more locations. Sediments at locations SED-06, SED-08, SED-16, SED-17, SED-18, and SED-25, which are located downgradient of the site in the Canal, have likely been impacted by waste generated during operations at the site. NAPL stains were observed in the Canal near these locations. The presence of SVOCs/PAHs at the remaining sediment locations are likely due to other sources not related to former site operations. PCB compounds (Aroclors 1242, 1248, 1254, and/or 1260) were detected in all of the sediment samples collected during the RI. Reported concentrations of Aroclors 1242, 1248, 1254, and 1260 exceeded their respective SCGs for the Human Health Bioaccumulation, Wildlife Bioaccumulation, and Benthic Aquatic Life Chronic Toxicity Levels of Protection at one or more locations. Reported concentrations of Aroclor 1242 exceeded the SCG for the Benthic Aquatic Life Acute Toxicity Level of Protection. The presence of PCBs in the sediments is not related to operations at the Transit Street Former MGP site.

Arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc were detected at concentrations that exceeded the LEL SCGs in one or more of the sediment samples. Copper, lead, manganese, mercury, nickel, silver, and zinc were detected at concentrations that exceeded the SEL SCGs in one or more of the sediment samples. The presence of these metals in the sediments does not appear to be related to operations at the site. Total cyanide was detected in 4 of the 53 sediment samples collected during the RI, all of which were from locations adjacent to/downgradient of the site. There are no established SCGs for cyanide. Cyanide was not detected in the sediments collected upstream or downstream of the site. The majority of the cyanide detected was determined to exist as stable iron cyanide complexes. Total recoverable phenolics were not detected in any of the sediment samples collected during the RI.

1.5.6.2.1 Additional Sediment Sampling Results – January 2008

Based upon comments from the NYSDEC on RI sediment data, the sediment in the area of RI bucket auger samples BA-01 through BA-04 needed to be more adequately investigated during the Feasibility Study (Figure 1-3). Undifferentiated petroleum odors were noted in this area during the initial investigations and these impacts needed to be more adequately quantified and characterized. A complementary forensic analysis was performed to help determine whether these impacts are associated with the former MGP or with recent boating traffic or other potential sources.

As part of the additional sediment sampling, 10 sediment core locations were sampled in the Canal adjacent to the locks (Figure 1-3). The sediment cores were advanced by manually driving a Geoprobe macrocore sampler through the sediment column, to the bedrock surface, approximately 5 to 7 feet deep. Two samples were collected from each core location, for a total of 20 primary samples. Samples were selected based upon qualitative appearance (e.g., petroleum odors and/or staining) and based upon photoionization (PID) readings. The selected samples were analyzed for BTEX, PAHs, total phenols; total cyanide; and total organic carbon (TOC). In addition, ten of the samples were selected for forensic analysis and extended PAH profiles by META Environmental Inc. (META). The 10 sediment samples were analyzed for hydrocarbon fingerprint by EPA Method 8100 and extended PAH profiles by modified EPA Method 8270. The purpose of these environmental forensic parameter analyses was to evaluate whether there are sources other than the former MGP site for the PAHs found in the sediment in the Canal. The ratios of PAHs from the sediment samples were compared to the ratios of PAHs from various tar samples from META's in-house source library, that include coke oven tar, coal carbonization tar, and CWG tar as well as the analytical results of soil samples collected from the site.

Qualitative Findings

The various sediment conditions encountered across the study area are summarized below. Sediment sampling locations SED-01 to SED-10 are shown on Figure 1-3. Table 1-2 summarizes the sediment samples collected, sediment characteristics, and analyses.

In general, sediment thickness ranged from 3 to 6 feet in the sample area before refusal was met. The sediments were generally characterized as brown, gray-brown, black, gray-black, and dark gray silts and clayey silts with varying amounts of organic material, sand, and gravel. As seen in Table 1-2, sediment samples from all locations except SED-06 and SED-08 exhibited undifferentiated petroleum odors at varying depths. Samples SED-09 and SED-10 exhibited a moderate and slight sheen. All PID readings of these sediment cores and headspace samples were non-detect or at background levels.

Quantitative Findings

The analytical results for 20 sediment samples are summarized and compared to SCGs in Table 1-3. One or more SVOCs were detected in the 20 sediment samples collected. Figure 1-3 summarizes the results. Reported concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene exceeded their respective SCGs for the Human Health Bioaccumulation Level of Protection at one or more locations. All reported SVOC concentrations were below the SCGs for the Wildlife Bioaccumulation Level of Protection. Reported concentrations of benzo(a)anthracene exceeded the SCG for the Benthic Aquatic Life Acute Toxicity Level of Protection at one or more locations. Reported concentrations of benzo(a)anthracene, bis(2-ethylhexyl)phthalate, phenanthrene, and fluorene exceeded their respective SCG for the Benthic Aquatic Life Chronic Toxicity Level of Protection at one or more locations.

Most of the SVOCs detected were PAHs. The detected concentrations of total PAHs ranged from 849 µg/kg at location SED-07 (4.0-6.0 feet) to 8,381 µg/kg at location SED-05 (2.0-3.0 feet). Total carcinogenic polycyclic aromatic hydrocarbons (cPAHs) concentrations ranged from 458 µg/kg at location SED-07 (4.0-6.0 feet) to 4,200 µg/kg at location SED-05 (2.0-3.0 feet). Overall, the total PAH concentrations are generally low and are similar to total PAH concentrations measured in upstream background samples in the Canal as part of the RI.

Forensic Evaluation of Sediments

Hydrocarbon fingerprints and extended PAH analyses/diagnostic PAH ratios, as well as site history and observations made during the RI, were evaluated during the forensic analysis. Dense non-aqueous phase liquid (DNAPL) and soil samples from suspected contaminant source areas were also sent to META for analysis so that PAHs in the sediments could be compared to those from the suspected source areas.

Based on a comparison of the sediment data to forensic data obtained from site-related DNAPL and soil samples, META concluded that most of the sediment samples collected during the RI from the Canal do not appear to be impacted by CWG tar or related PAH sources. Rather, the sediments all contain varying mixtures of pyrogenic, petrogenic, and biogenic PAH sources, which is consistent with sediments in many urban waterways. However, META also concluded that sediment samples SED-06 (0-1 feet), SED-08 (0-1 feet), SED-16 (0.5-1.5 feet), SED-17 (0.5-1.5 feet), SED-18 (0-1 feet), and SED-25 (0-1 feet) (i.e., samples collected near the south wall of the Canal from approximately the Transit Street bridge crossing extending downstream approximately 500 feet from the Transit/West Street intersection) appeared to have been impacted by former NAPL discharges into the Canal from the Transit Street site. Several of these sampling locations coincide with qualitative NAPL observations made in sediments along the Canal face and NAPL stains/seeps on the Canal rock face. META's Report is included in the RI.

For the additional sediment sampling study, META also concluded that most of the sediment samples collected do not appear to be impacted by CWG tar or related PAH sources and contain varying mixtures of pyrogenic, petrogenic, and biogenic PAH sources, which is consistent with the previous findings.

1.5.7 NAPL Observations

Soil boring descriptions and field observations were summarized on RI Tables 3-1 and 3-2 and are included in Appendix A. NAPL in the form of staining or blebs was observed at 12 of the 31 overburden borings advanced during the RI. Sheens attributable to NAPL also were noted at two locations (GB-12 and GB-16). In the overburden soil, NAPL blebs were primarily observed beneath the western portion of the site extending northward beneath LaGrange Street, and extends a short distance beneath the gasoline station property. NAPL was not observed in the soil south or east of the site boundary, along the west side of Transit Street, or north of the Canal. Gasoline-like odors or sheens were observed in the soil at BMW-04-02, GB-17, GB-18, GB-22, and GB-24, which were advanced at the gasoline station property. RI Figures 4-18 and 4-19 (Appendix A) summarize the qualitative observations made at boring, test pit, and monitoring well locations and Figure 2-3 provides the NAPL thickness by location and estimated volume of NAPL-impacted soils for the on-site and off-site areas.

NAPL was observed within the fractures of bedrock cores in several of the monitoring wells installed during the RI. NAPL was not observed in the fractures of cores collected directly south of the site at BMW-04-08 and BMW-04-14; however, sheens and/or odors were present. NAPL appears to have advanced within the bedrock primarily north and west of the site. NAPL was observed in several fractures at monitoring well BMW-04-09 (west-southwest of the site), but the presence of NAPL was not noted when MW-16 was installed in 1983.

Small quantities of NAPL were observed in core samples from all bedrock monitoring wells installed directly north of the site. NAPL seeps/stains have been observed at the base of the south Canal wall, which is also north of the site. The Canal effectively stops the migration of NAPL further northward in the shallow and intermediate bedrock. In the deep bedrock, NAPL was not observed when coring at BMW-04-10 located north of the Canal; however, during well development, tiny coal tar blebs entered the well, indicating NAPL is present in the vicinity. The groundwater sample from BMW-04-10 reported low concentrations of dissolved-phase constituents.

To the east and northeast, NAPL was observed in trace amounts in a single fracture at MW-09 (approximately 47.5 feet bgs), and reportedly seen in wells MW-13 and MW-15 when they were originally installed. Because the original MW-15 could not be located during the RI, it subsequently was replaced and NAPL was not observed in the replacement well MW-15. Therefore, NAPL in the bedrock appears to be present slightly northeast of MW-13, and extends slightly east in the vicinity of MW-09.

Several rounds of NAPL measurements were performed during the RI using a weighted string. NAPL was observed to accumulate in one well (BMW-04-11) at recoverable quantities. Approximately 13.5 liters of DNAPL were recovered from BMW-04-11 through 2006 (RI Table 4-17 and Appendix A). Traces of NAPL (at unrecoverable quantities) were also observed in wells BMW-04-03, BMW-04-12, MW-01, MW-02, MW-03, MW-06, MW-08, and MW-10. However, small quantities of NAPL were recovered from these wells when removing large amounts of water during well development activities and there was enough NAPL from MW-02 to obtain a sample for forensic analysis (RI Table 4-17 and Appendix A).

To the west, some NAPL component is migrating into the unlined Shaft #3 of the Main Interceptor Tunnel. NAPL was observed coating the eastern wall of the shaft. Also, within the tunnel at approximately 75 feet bgs and north of the site, a NAPL seep was observed on the north side of the tunnel, in the vicinity of where NAPL stains were observed on the southern rock face in the Canal.

NAPL Characterization

Samples of NAPL were collected in 2005 from bedrock monitoring wells at locations BMW-04-11 and MW-02 and sent to META for environmental forensic analyses, which included petroleum fingerprint and extended PAH analyses (i.e., the typical 8270 analysis plus additional derivative compounds). A sample from BMW-04-11 also was analyzed for VOCs, TCLP VOCs, reactive cyanide and sulfide, ignitability, pH, percent sulfur, specific gravity, and viscosity. The results from these samples are presented on RI Tables 4-18 and 4-19 and are included in

Appendix A. The NAPL was observed to have a flash point of 130 degrees Fahrenheit, a specific gravity of 1.1, and a kinematic viscosity of 9.9 centiStokes.

The results from the forensics analysis indicate that NAPL samples collected from monitoring well locations BMW-04-11 and MW-02 contained PAH ratios consistent with CWG tar, and the NAPL collected at location MW-02 also appeared to contain weathered gasoline. Only 2 of the soil samples collected during the RI, GB-07 (5.0-5.2 feet) and GB-08 (12-14 feet), appeared to be impacted by CWG tar; the remaining soil samples submitted for forensics analysis had hydrocarbon fingerprints and diagnostic PAH ratios consistent with coal carbonization or coke oven derived materials and/or urban background.

NAPL Seep Study in Canal – March/April 2008

There are a number of NAPL stains on the southern rock face of the Canal beginning at approximately the eastern side of the Transit Street bridge crossing and extending approximately 200 feet eastward (i.e., downstream). The NAPL stains are generally characterized as small black vitreous and hardened discharges typically ¼" to ½" wide and a couple inches long and were most commonly observed approximately 5 to 10 feet above the Canal floor. The stains appear to be hardened onto the rock face, primarily the upper Rochester Shale Formation (i.e., Burleigh Hill Member), and are accessible from the Canal during the fall and winter months when the water level in the Canal is low.

Field monitoring was conducted to investigate whether the NAPL seeps are active or inactive by removing the NAPL from the bedrock face using hand tools (i.e., rock hammer/pick, chisel, etc.) and then monitoring the locations periodically to determine if the seeps recur. Individual stain locations were identified with a numbering scheme and photographed. The locations were tied to a reference baseline that was established with a nail driven into the rock face beneath the Transit Street bridge crossing identified as 'Measuring Point PK-1' (Figure 1-4). The seeps/stains were labeled with waterproof paint and photographed. After each seep/stain was identified, it was removed with a rock hammer/chisel and the rock chips were collected for off-site disposal. Each location was photographed after the NAPL was removed from the rock face. These steps were repeated at a total of 22 locations.

Figure 1-4 identifies the baseline and seep/stain locations. Photographs of individual seep/stain locations showing before cleaning, after cleaning, and approximately 3 weeks later are included in Appendix A. Monitoring results revealed that at least 5 seeps/stains re-formed after three weeks (i.e., Seep 3, Seep 12, Seep 16, Seep 18, and Seep 20). The water level in the Canal was raised shortly after the April 10, 2008 monitoring inspection. The Canal water level will remain above the seeps/stains levels until fall, when the water is lowered to its winter level. Another round of inspection and monitoring will take place at that time. Based upon the observations made as part of the NAPL Seep Study, at least five of the seeps are active; however, the quantity of discharge is very small (i.e., on the order of a few drops per seep after 3 weeks post cleaning).

1.5.8 Main Interceptor Tunnel

The City of Lockport has a sewer system that utilizes tunnels excavated in bedrock as interceptor sewers. The Main Interceptor Tunnel extends along the northern shoulder of State Road to Transit Street, along Transit Street, under the Canal, and on to Williams Street, where it joins a pipeline connecting it to the City Wastewater Treatment Plant on Jackson Street (Figure 1-2). The Main Interceptor Tunnel is excavated in bedrock (the Lewiston Member of the Rochester Shale) and is 8,526 feet long. It is 6 to 9 feet high and approximately 75 feet below grade near the site, approximately 65 feet below the top of bedrock. An access shaft is situated near the site.

The shaft and tunnel were inspected during the RI. The shaft was unlined, allowing for groundwater flow down to the tunnel floor, which is approximately 72 feet below street level. The tunnel is gunite-lined and observed to be in reasonably good condition, with the exception of 3 or 4 areas approximately 10 to 20 feet long, which had significant amounts of spalling primarily from the tunnel ceiling. There was approximately 1 to 2 feet of moving water throughout most of the tunnel. NAPL was observed coating the eastern wall of the entrance shaft (i.e., Shaft #3 – Figure 1-3) beginning at approximately the overburden/bedrock interface, and on the north side of the tunnel wall (i.e., NAPL stain/seep through cracks in the gunite lining) in the vicinity of where NAPL stains were observed in the Canal (i.e., near BMW-04-11).

1.5.9 Qualitative Human Health Exposure Assessment (QHHEA)

The previous use of the site was industrial/commercial. The site is currently an electrical substation. A locked 8-foot high chain link fence with 2 access gates for vehicular traffic and 2 man gates enclose the entire property. During the RI fieldwork, no evidence of trespassing at the site was observed. There are no water supply wells used for domestic or livestock purposes within a 1-mile radius of the site. The primary source of drinking water for the City of Lockport is the East Branch of the Niagara River, approximately 13 miles west. It is pumped from the River to the City of Lockport Water Treatment Plant where it is treated prior to distribution.

Under the current use scenario, potentially exposed receptors include industrial and utility maintenance workers (i.e., those employed by or working for the current site owner), trespassers, and nearby residents. Since no surface water contaminants were detected in the Canal, no completed exposure pathway is present for recreational users of the Canal. However, trespassers in the Canal during the winter season may potentially be exposed to contaminated sediments. It is not anticipated that the site will be redeveloped for any other use. In addition, transfer of ownership of any part or all of the property is not expected due to the presence of major underground gas mains, electrical conduits, and high voltage overhead electrical lines at the site. Therefore, potentially exposed receptors for future use scenarios are the same as those for the current use scenario, and include industrial and utility maintenance workers (i.e., those employed by or working for the current site owner), trespassers, nearby residents, and trespassers in the Canal during the winter season.

Currently, the site is primarily gravel-covered with some structures and concrete pads of former/existing structures. Since surface soil is not exposed and no intrusive activities that could lead to potential exposure are anticipated, the exposure pathway for surface soil is considered to be incomplete under both current and future use scenarios.

Under the current use scenario, the exposure pathways for subsurface soil are considered to be incomplete because no intrusive activities that could lead to potential exposure are anticipated. Similarly, the exposure pathway for the future use scenario is considered to be incomplete, as it is not anticipated that the current owner will develop the site or transfer property ownership. However, industrial and utility maintenance workers (i.e., those employed by or working for the current site owner) may engage in activities that potentially lead to potential exposure via excavation for maintenance of subsurface utilities. If any excavation to perform subsurface utility maintenance occurs either on-site or adjacent to the site (i.e., in street right-of-way) in the future to the extent that intrusive activities could result in potential exposure to MGP-contaminated subsurface soil, a Site Management Plan (SMP) with soil excavation protocols will be developed to provide specific procedures for controlling and/or eliminating exposure to potentially contaminated subsurface soil.

Exposure via inhalation of soil vapor is considered a viable, potentially complete exposure pathway under both the current and future use scenarios for only industrial and utility maintenance workers (i.e., those employed by or working for the current site owner) that engage in excavation activities for maintenance of subsurface utilities as discussed above. If any excavation to perform subsurface utility maintenance occurs in the future to the extent that intrusive activities could result in potential exposure to subsurface soil vapor, a Site Management Plan (SMP) with protocols to mitigate potential exposure to soil vapor will be developed to provide specific procedures for controlling and/or eliminating exposure to soil vapor.

Under the current and future use scenarios, the exposure pathway for air is considered to be incomplete because indoor air sampling at selected residences indicate no indoor air contaminants were present, and therefore, no exposure pathway exists.

Under the current use scenario, groundwater near the site is not known to be used as a potable water supply. Because of the extensive public water supply system in the area, it is not anticipated that groundwater will be used as a source of potable water in the future. The exposure pathways for the current and future use scenarios are therefore considered to be incomplete.

Under the current and future use scenarios, the only exposure pathway for sediment is considered to be potentially complete is for trespassers in the Canal during the winter season. The exposure pathway for surface water is considered to be incomplete.

1.5.10 Fish and Wildlife Impact Analysis

A Fish and Wildlife Impact Analysis (FWIA) was conducted during the RI using information collected during the URS 2005 field investigation, together with data collected as part of previous investigations. Because of its location in an urbanized area, the majority of the site does not provide suitable habitat for wildlife. Wildlife in the City of Lockport is limited primarily to urban dwelling birds and rodents. The highest value habitats within the 0.5 mile radius are the Canal itself, the vegetated spoil areas along the strip of land along the top of banks adjacent to the Canal and, in particular, the wooded Canal banks. These banks not only provide food and cover to many species, but also serve as a riparian corridor, facilitating the movement (especially nocturnal) of wildlife species seeking food, cover and prospective mates, and facilitating the dispersal of juveniles. Habitat resources in the immediate site vicinity are very limited due to human disturbance.

Wildlife resources within the 0.5-mile radius of the site provide very limited value to humans. The majority of the area is highly urbanized with residential, institutional, commercial, transportation and industrial land uses. Limited seasonal fishing occurs along portions of the Canal. Walks along the Canal banks provide opportunities for bird watching and general natural viewing as well as general recreation.

Results of the FWIA indicate that the only ecological resources that may be impacted by contamination associated with the site are a few nearby wetlands; however, there are no direct connections between the site and these areas.

1.6 Conceptual Site Model

The migration of contaminants from the source areas to other areas in the site vicinity is controlled by the nature of the source areas, surface features, and hydrogeologic conditions. The former MGP structures (particularly the former gasholders and the wooden tar sumps) appear to be the primary potential source areas of contamination at the site. Former releases of MGP-related contaminants from the source areas could potentially have: remained in surface/subsurface soil and/or bedrock as NAPL within and near the former MGP structures; migrated downward into groundwater contained in the overburden and/or bedrock beneath the site; or migrated as NAPL vertically and laterally via the bedrock fracture network and through the bedrock groundwater in the dissolved phase before being discharged into the Canal.

The horizontal extent of the contamination in the overburden is relatively contained to the MGP-related structures themselves and extends into the overburden across LaGrange Street to the gasoline station property north of the site. At and downgradient of the site, NAPL is likely present on the bedrock surface and has entered the bedrock through fractures. NAPL may be transported along the top of bedrock and through bedrock fractures, primarily toward the north with some component extending to the Canal. NAPL was observed in the subsurface at the gasoline station immediately north of the site when USTs were removed and replaced as part of the IRM. Contaminants from the site also have the potential for downward migration into the Main Interceptor Tunnel.

RI Figures 5-4, 5-5, 5-6, 5-7, and 5-8 depict: the extent of PAHs greater than 500 ppm in the overburden; 3D model of PAHs greater than 500 ppm in the overburden; the maximum depth by location where NAPL was encountered in the overburden; and 3D models of NAPL-impacted soil and bedrock (included in Appendix A).

2.0 REMEDIAL GOAL AND REMEDIAL ACTION OBJECTIVES

2.1 Goal and Objectives

The remedial action goal for the Transit Street Former MGP site is to eliminate or mitigate to the extent practicable, significant threats to human health and/or the environment, due to former MGP activities. In order to meet this goal, remedial action objectives (RAOs) have been established to protect human health and the environment, which provide the basis for selecting appropriate technologies and developing remedial alternatives. RAOs were established based on contaminated media, SCGs identified for the site, and results of the QHHEA and FWIA.

To address the remedial action goal, this FS will evaluate technologies and alternatives for contaminated soil, NAPL, groundwater, and sediments with respect to the following cleanup levels:

Source and Exposure Pathway Elimination: involves remediation to levels that may exceed SCGs, but still creates conditions that are protective of human health and the environment by reducing or eliminating the contamination source or exposure pathways. This approach recognizes that it may not be warranted or feasible to implement remedies that attain SCGs in cases where alternative approaches can be implemented that will be protective of human health and the environment. The term "source" as referred to in this document is consistent with the NYSDEC definition contained in 6 NYCRR PART 375-1.2 which includes concentrated solid or semi-solid hazardous substances, NAPL, or grossly contaminated media. Grossly contaminated media, as defined in 6 NYCRR 375-1.2, refers to soil, sediment, surface water, or groundwater which contains sources or substantial quantities of mobile contamination in the form of NAPL that is identifiable either visually, through strong odor, by elevated contaminant vapor levels, or is otherwise readily detectable without laboratory analysis.

Media-Specific Remedial Action Objectives: considers media-specific SCGs:

Soil Remedial Action Objectives

- Prevent ingestion/direct contact with contaminated soil.

- Prevent inhalation of, or exposure from, contaminants volatilizing from contaminants in soil.
- Prevent, to the extent practicable, migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with impacted soil.

Groundwater Remedial Action Objectives

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.
- Restore the groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent, to the extent practicable, the discharge of contaminants to surface water.
- Remove, to the extent practicable, the source of groundwater or surface water contamination.

Sediment Remedial Action Objectives

- Prevent direct contact with contaminated sediments.
- Prevent, to the extent practicable, releases of contaminant(s) from sediments that would result in surface water levels in excess of ambient water quality criteria.
- Prevent impacts to biota from ingestion/direct contact with impacted sediments.
- Prevent, to the extent practicable, resuspension/transportation of impacted sediments.

2.2 Remediation Areas and Volumes

Based on site characterization information provided in the RI, remediation areas and volumes have been developed for soil and sediments. A discussion of the distribution of MGP contaminants in soil and sediments, and NAPL in groundwater is presented below.

2.2.1 Soil

A sizeable portion of the site is occupied by the NYSEG substation which contains active above-ground and subsurface infrastructure (Figure 2-1). Several utility lines are present in the vicinity of the site (Appendix A). Following discussions with NYSEG, three options are feasible when evaluating on-site soil remediation:

1) Complete substation relocation to an off-site location followed by remediation;
2) Partial substation relocation - the Control House and 12 kV switchgear in the northwestern portion of the site could be relocated to the eastern portion of the site; and
3) Site remediation without any substation relocation.

NYSEG has no operational need to replace/relocate the Transit Street substation. The useful life of the substation is indefinite because the equipment comprising the substation is regularly monitored and maintained, and individual components are upgraded as conditions are warranted. This substation is necessary at this location to reliably serve NYSEG's commercial and residential customers. Without substation relocation, existing substation infrastructure within Area B on Figure 2-2 would remain in-place and energized during remediation activities. Contaminated soil within Area B would remain after remediation. The size of Area B is based on an assumed setback of 15 feet from existing infrastructure. NYSEG has indicated that the existing grounding system could be relocated on-site during remediation, and that the overhead electric lines on the eastern portion of the site could be raised and/or relocated temporarily. NYSEG has indicated that the on-site storage building (in the southeast corner) could be removed, and the Control House and 12 kV switchgear in the northwestern corner could be relocated onsite. Difficulties may arise from relocation of the Control House, switchgear, and existing overhead electrical lines in the northwestern area, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. These substation considerations will be incorporated in the discussion on the limitations of remedial alternatives.

Figure 2-3 presents a compilation of the locations of total PAHs > 500 ppm and > 1,000 ppm and borings where NAPL was observed as derived from RI Figures 5-4 and 5-6 (provided in Appendix A). This figure presents the maximum areal and vertical extent of where either NAPL was observed or PAHs were detected. The limit of the 1997 IRM excavation at the Reid Petroleum property north of the NYSEG property is also shown on Figure 2-3. Based on observations presented in the boring logs and subsurface information provided during the IRM excavation efforts, the majority of NAPL-contaminated soil is found within a relatively thin layer near the overburden/bedrock interface. The volumes depicted on Figure 2-2 represent the areal extent of impacts multiplied by the thickness from the ground surface to the bottom of the overburden. Figure 2-4 presents the estimated volume of tar-contaminated soil for the areas within the NYSEG property (i.e., on-site) (1,704 cy) and off-site (611 cy), of which 458 cy is within LaGrange Street and 153 cy is within the Reid Petroleum property. Off-site, NAPL was observed but no total PAH concentrations were detected above 1,000 ppm. The volumes depicted on Figure 2-4 represent the areal extent of impacts multiplied by the thickness from the ground surface to the bottom of observed impacts.

In order to access the contaminated soil near the overburden/bedrock interface during remediation, the overlying "clean" soil will be disturbed. For remediation purposes, the vertical extent of potentially impacted soil within the NYSEG property is assumed to be the full overburden thickness (average 15 feet). This conservative assumption considers the depth variability at which source material was encountered during the RI, limited access to on-site former MGP structures below ground during sampling, and the accessibility of soil at the overburden/bedrock interface during remediation that will disturb overlying "clean" soil. The on-site area includes the contents of 3 existing wooden tar sumps located during the RI in the western portion of the site. Figure 2-2 presents the volumes of potentially impacted soil on-site (23,800 cy), and off-site (4,835 cy), of which 3,200 cy is within LaGrange Street and 1,635 cy is within the Reid Petroleum property.

By comparing the estimated tar-contaminated soil volumes with estimated potentially impacted soil volumes it can be assumed that:

- On-site, of the 23,800 cy of potentially impacted soil, 1,704 cy is tar-contaminated and 21,736 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that half (12,000 cy) will meet criteria for on-site re-use as backfill material.

- Off-site, of the 4,835 cy of potentially impacted soil, 611 cy is tar-contaminated and 4,224 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that approximately half (2,500 cy) will meet criteria for on-site re-use as backfill material.

- Within LaGrange Street, of the 3,200 cy of potentially impacted soil, 458 cy is tar-contaminated and 2,742 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that half (1,600 cy) will meet criteria for on-site re-use as backfill material.

- Within the Reid Petroleum property, of the 1,635 cy of potentially impacted soil, 153 cy is tar-contaminated and 1,482 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that approximately half (900 cy) will meet criteria for on-site re-use as backfill material.

- Within the western portion of the site, if the Control House and 12 kV switchgear were relocated to an alternate on-site location, approximately 3,960 cy of potentially impacted soil could be remediated as indicated on Figure 2-5. Approximately 3,210 cy would be to the overburden/bedrock interface in the northwestern portion of the site, and approximately 750 cy would be to an estimated tar-impacted depth of approximately 7 feet in the southwestern portion of the site.

2.2.2 NAPL/Groundwater

NAPL is present on-site at the overburden/bedrock interface and in the bedrock fracture network beneath the site. The shallow and intermediate bedrock (i.e., depths up to approximately 50 feet) were determined to be the most fractured and transmissive. NAPL appears to be transported along the top of bedrock at the site and through bedrock fractures beneath the site and off-site. Figure 2-6 provides a summary of the locations of NAPL (tar and tar blebs) in bedrock groundwater monitoring wells. The slope of bedrock surface has induced NAPL migration towards the north, west-northwest, and to a lesser degree toward the north-northeast from the site through the bedrock fracture network. NAPL seeps are present in a limited area of the Canal as discussed below.

Groundwater contamination in the overburden is relatively contained around the site and extends into the Reid Petroleum property immediately north of the site where the dissolved-phase plume co-mingles with another source associated with the gasoline station. Both NAPL phase and dissolved-phase contaminants within the overburden have migrated downward through fractures into the bedrock. In the shallow and intermediate bedrock, the Canal appears to be the receptor of groundwater passing through the site. Relatively small quantities of NAPL (i.e., NAPL smears on drilling and sampling equipment and blebs and droplets of NAPL) discharge on the Canal's southern bedrock face and dissolved-phase MGP-related contaminants were detected in bedrock monitoring wells adjacent to the Canal. The NAPL discharges along the Canal's southern rock face were identified in an approximately 200-foot length extending from the eastern edge of the Transit Street bridge crossing downstream. The discharges can be characterized as *de minimus* volumes, essentially small stains on the rock face typically ¼" to ½" wide and a couple inches long. The NAPL discharges were observed in the Burleigh Hill Member of the Rochester Shale Formation (i.e., upper Rochester Shale Formation) and were most commonly observed approximately 5 to 10 feet above the Canal floor. Trace quantities MGP-related contaminants (i.e., NAPL bleb and low concentration dissolved phase contaminants) were also observed in the bedrock well adjacent to the north face of the Canal face potentially representing the northern extent of dissolved-phase groundwater contamination.

2.2.3 Sediments

As concluded during the RI, sediments at locations SED-06, SED-08, SED-16, SED-17, SED-18, and SED-25 appear to have been impacted by NAPL discharges into the Canal. NAPL seeps were detected in 2007 and 2008 along a 200-foot length of the Canal face in the area of several of these sediment samples (Figure 2-7), and the NAPL source appears to be coal tar. The impacted sediments and Canal face are within the southern half of the Canal. The presence of contaminants at the remaining sediment locations were determined to be likely due to other urban and industrial sources not related to former MGP operations. In March 2008, a NAPL Seep Study was initiated to determine if the seeps were active as discussed above (Figure 1-4). A very low rate of discharge was determined to be present. A photo log depicting conditions prior to cleaning, immediately after cleaning, and approximately three weeks after cleaning is presented in Appendix A.

MGP-impacted sediments occur within the Canal as shown on Figure 2-7, from the centerline of the Canal to the south wall and incorporate the sampling locations discussed above. The MGP-impacted length is approximately 500 feet. The depths of sediments were determined during the RI in January 2005 when the Canal water level was low. Sediment thickness was measured at 10-foot interval transects using a ½ -inch diameter steel probe approximately 7 feet long. The probe was physically pushed until refusal. Transects (TS-09, TS-10, TS-11, TS-21) were used to determine the approximate volume of sediments within the proposed remediation area and are presented on Figure 2-7. The approximate volume of impacted sediments proposed for remediation is 1,200 cubic yards.

3.0 IDENTIFICATION AND INITIAL SCREENING OF REMEDIAL TECHNOLOGIES

Remedial technology identification and screening presented in this section consists of: identification of general response actions to satisfy the site-specific RAOs; identification of potentially applicable remedial technologies that fall within the general response categories; and screening of those technologies with respect to their relative effectiveness, technical implementability and cost in meeting the objectives for the site. Technologies identified for this MGP site have been selected from the host of technologies considered potentially effective for use at MGP sites in general, and include primarily those technologies that have been previously implemented successfully at other MGP sites. The most promising technologies are retained and carried forward into the development of on-site and off-site alternatives.

3.1 General Response Actions

General response actions are broad categories of remediation approaches capable of satisfying RAOs. Some response actions may be sufficiently broad to be able to satisfy all RAOs for the site as a whole. Other response actions must be combined to satisfy RAOs for impacted media: soil, NAPL/groundwater, and sediments. Remedial technologies have been identified which correspond to the general response actions of no action, containment, source removal, and in-situ treatment. A brief description of each of the general response actions follows:

- **No Action** - The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that a no action alternative be evaluated as part of the Feasibility Study process. This alternative will be used as the baseline for comparison of remedial alternatives.
- **Containment** - Containment measures are those remedial actions whose purpose is to contain and/or isolate contaminants. These measures provide protection to human health and the environment by reducing exposure or migration of contaminants, but they do not treat or remove the contamination.
- **Source Removal** - Excavation of MGP-impacted and contaminated soil, MGP-impacted sediments, and removal of the tar sumps is a remedial action whose purpose is to remove contaminants from the site and vicinity. Combined with off-site

treatment and/or disposal, source removal provides protection to human health and the environment by reducing exposure or migration of contaminants. NAPL/groundwater collection or recovery technologies provide protection to human health and the environment by removing NAPL and reducing contaminant mass in the subsurface.

- **In-situ Treatment** – Treatment measures include technologies whose purpose is to reduce the toxicity, mobility, or volume of contaminants by directly altering, isolating, or destroying those contaminants. Soil that is not excavated may be treated in place (in-situ). In-situ soil treatment could potentially utilize biological, chemical/physical, solidification, or thermal processes.

3.2 Identification and Screening of Remedial Technologies for Soil

This section identifies and provides an initial screening of remedial technologies for contaminated soil at the site in a two-step approach. In the first step, potentially applicable remedial technologies within each general response action which could meet the remedial action objectives are identified. In the second step, identified technologies are screened with respect to their effectiveness, technical implementability and relative cost. This evaluation is based on the site characterization, which includes the types and concentrations of contaminants, and geology and hydrogeology of the area. Table 3-1 provides a summary of the general response actions and the results of the remedial technology identification and screening.

3.2.1 Site Management Plan

A Site Management Plan (SMP) would include institutional controls and engineering controls (IC/ECs) to:

- manage potential exposure to residual contaminated soil both on-site and adjacent to the site, including procedures for soil characterization, handling, disposal, and health and safety of workers and the community;

- provide for disposal/reuse in accordance with applicable NYSDEC regulations and procedures; and

- maintain use restrictions regarding site development and groundwater use.

Effectiveness: An SMP would be effective in identifying residuals and controls required for those residuals.

Implementablity: An SMP with long-term monitoring for the NYSEG property would not be difficult to implement considering the continued future ownership and use of the site by NYSEG. Implementation of an SMP for off-site properties may be difficult, requiring agreements and/or deed notifications with other property owners.

Cost: The cost for an SMP would be relatively low.

Conclusion: An SMP is retained for use at the site and vicinity.

3.2.2 Containment

Capping the surface of the site and vertical and horizontal subsurface barriers are potential containment technologies. A cap covering site areas not already covered by a structure or slab would limit infiltration from precipitation and reduce contaminant leaching and subsequent migration. Containment methods such as vertical barriers and horizontal bottom liners are used to prevent or significantly reduce the migration of NAPL and contaminants in soil.

3.2.2.1 Capping

A low permeability geomembrane cap could be constructed over areas of the site not already covered by a structure or slab. The geomembrane would be placed on the ground surface in order to limit infiltration. Crushed stone would be placed over the geomembrane to promote drainage and provide protection.

Effectiveness: A geomembrane cap would limit infiltration and reduce contaminant leaching and subsequent migration.

Implementability: The cap would require special health and safety measures to install beneath active substation structures. Seam integrity with existing structures and appropriate sloping for surface drainage would have to be maintained over the long-term.

Cost: The cost of a geomembrane cap over the site is considered to be relatively low.

Conclusion: A geomembrane cap is retained for consideration for the site.

3.2.2.2 Vertical Barriers

Vertical barriers considered potentially applicable for the site are sheet piling, soil cement walls, and jet grouting.

- Sheet piling- Sheet pile cutoff walls are constructed by driving interlocking steel or HDPE into the ground. The joints between individual sheets are typically plugged with slurry (when using steel sheets) or an expanding gasket (when using HDPE). Sheet piling may be used for structural support and soil and groundwater containment applications.

- Soil Cement Wall – A soil cement wall consists of a mixture of cement and native materials. The cement is introduced into the subsurface by augering through the overburden to the top of bedrock or by slurry trench methods. A soil cement wall may be designed for structural excavation support and soil and groundwater containment applications.

- Jet (pressure) Grouting – Jet grouting injects cementitious reagents under pressure into the ground. Under high pressure, the injected grout is blended with the soil and solidifies, reducing the hydraulic conductivity of the formation. Pressure grouting can also be effective within the bedrock.

Effectiveness: Sheet piling, soil cement walls, grouting and grout curtains are effective technologies which may provide structural support and containment to prevent groundwater, NAPL and contaminant migration.

Implementability: The three vertical barriers under consideration present a variety of implementation issues.

- Sheet piling, which must be keyed into bedrock, may pose adverse vibration impacts when installed near active substation structures.

- A soil cement wall would not have to extend into the bedrock, however, in order to be effective as structural excavation support, its width must be approximately seventy-five percent of its height. For this site, the required thickness to provide structural support would be on the order of 8 to 12 feet.

- Jet grouting of the overburden can be hampered by the presence of debris and unknown subsurface structures. Grouting of bedrock fractures can be influenced by the bedrock permeability and bedrock quality.

Cost: The relative cost of vertical barriers is considered to be moderate depending on the depth and location.

Conclusion: Depending on the objective, location, extent, and depth of vertical barriers required, either sheet piling, a soil cement wall, or jet grouting may be used. All three technologies will be retained for use and included as appropriate for containment and/or structural support within the remedial alternatives. As vertical barriers would most likely be utilized for containment purposes, they will hereafter be referred to as containment walls.

3.2.2.3 Horizontal Barrier

A horizontal barrier (i.e., bottom liner) could be installed in the bedrock beneath the source material at the site to contain on-site soil and NAPL.

Effectiveness: Angled fracture grouting could be utilized to install a bottom liner within the bedrock.

Implementability: Bedrock quality, fracture apertures and orientation, and fracture continuity affect the grout hole spacing, grout volume and type, angle of boring and grout staging. Angled fracture grouting is an established technology, however, costs can be highly variable based upon site-specific conditions. Implementation of the bottom liner may be difficult due to surface and subsurface obstructions.

Cost: The cost is estimated to be moderate to high.

Conclusion: A bottom liner is retained for use as part of site containment.

3.2.3 Excavation and Off-Site Disposal/Treatment

Excavation could occur either following substation relocation, in portions of the site if the substation was not relocated, or in the impacted off-site areas. Excavating contaminated soil and remnant MGP structures is a proven and reliable technology for contaminant removal. Contaminated soil would be excavated by conventional equipment, using specialized health and safety measures for remediation in the vicinity of active substation equipment. Excavated materials would be subject to waste characterization testing to identify whether they would meet the requirements for disposal in an appropriate landfill, or require transportation to a thermal desorption facility.

Effectiveness: Excavation of contaminated soil and off-site disposal/treatment would be effective in removing the source of contamination and meeting the RAOs for soil.

Implementability: This technology is widely used for remediation and would be implementable for the entire site if the substation were relocated, for portions of the site if the substation were not relocated, or in off-site areas. Structural retaining walls would have to be constructed, and/or slope stability measures undertaken to excavate at depth. Dewatering and/or drying may be required for saturated soil. Excavation in the vicinity of active substation areas would have to be carefully undertaken to limit vibrations that might negatively impact the electrical circuits and potentially cause interruptions in the power supply. Worker health and safety during remediation activities would be of the utmost concern and dictate the sequencing and scheduling of activities if the substation were to remain active during remediation.

Cost: The cost of excavating contaminated soil using proper health and safety measures and disposing/treating excavated material off-site is considered to be relatively high.

Conclusion: Excavation and off-site disposal/treatment of contaminated soil is an effective and implementable technology. Excavation and off-site disposal/treatment will be retained.

3.2.4 Excavation and On-Site Ex-situ Treatment

Utilizing this method, contaminated soil is excavated by conventional equipment, treated on-site above ground, and then replaced on the site. Given the small size of the site and ongoing and active use of the property, this technology is not considered appropriate.

3.2.5 In-situ Treatment

In-situ soil treatment technologies include chemical/physical processes designed to destroy or increase the mobilization of contaminants, stabilization/solidification processes that reduce the mobility of the contaminants, or biological and thermal processes designed to destroy the contaminants. These technologies may be combined with recovery technologies and containment systems.

3.2.5.1 Biological Treatment

Naturally occurring microorganisms in the soil promote the breakdown and detoxification of organic contaminants. In-situ biological treatment such as bioremediation may enhance that process in soil and groundwater. Water enhanced with nutrients, oxygen, and other amendments is delivered to contaminated soil to enhance biological degradation of target contaminants. An infiltration gallery or injection wells can be utilized for the saturated and unsaturated zones.

Establishing a healthy microbial community able to actively degrade contaminant species will likely require biostimulation and/or bioaugmentation. Biostimulation is the addition of an amendment (i.e., a food source) and/or nutrients needed to create an environment supporting microbial growth. Bioaugmentation is the introduction of laboratory-grown microbes to introduce specific bacteria with the ability to degrade target contaminants or to strengthen an existing microbial community to speed up biodegradation. Contaminants present can be degraded via multiple pathways, aerobically (in the presence of oxygen), anaerobically (in the absence of oxygen), or co-metabolically (combination of aerobic in anaerobic conditions).

As with other in-situ applications, subsurface distribution is a key component in the potential success of bioremediation. In general, microbial communities are fixed to the soil matrix. Additionally, once a hospitable aquifer is established, microbes may 'bloom' or grow randomly in all directions, which can increase subsurface distribution where surface access is limited or unavailable (i.e., below structures, utilities, etc.).

Effectiveness: This technology has had limited success on PAHs. However, given the volume of soil source material, the presence of NAPL, and the concentrations of contaminants present, bioremediation would require a long time period and significant amendment materials to effectively remediate site soil.

Implementability: Construction of an infiltration gallery or injection wells to effectively remediate source soil would be difficult with the presence of an active substation facility. Subsurface distribution is required for contaminant treatment. Surface access is required for delivery of materials to establish aquifer conditions conducive to biodegradation. Effective delivery of materials in the overburden may be difficult to implement due to the amount of fill and debris present creating heterogeneous conditions. Unsaturated conditions throughout portions of the source area would complicate the delivery system. Bench-scale laboratory analysis can be used to evaluate aquifer conditions and the amendments and/or additional microbial culture are needed.

Cost: The cost is considered to be moderate to high depending on the operation period and quantities of amendment materials required.

Conclusion: Biological treatment is not retained for use at the site.

3.2.5.2 Chemical/Physical Treatment

Treatment using in-situ chemical oxidation (ISCO) involves the delivery of a chemical oxidant to contaminated media to destroy target contaminants and convert them to non-toxic compounds. The rate and extent of degradation of organics using chemical oxidation are dictated by the properties of the contaminants and their susceptibility to oxidation. In addition, soil and groundwater matrix conditions (e.g., pH, temperature), and the concentration of other oxidant-consuming substances, such as natural organic matter and reduced minerals, affect the transport and reactions of both the oxidant and the target contaminants. Chemical oxidation reactions occur only with dissolved-phase contaminant materials and require contact between the oxidant and the contaminant. Therefore, ISCO is heavily dependent upon subsurface distribution and contact with target contaminant mass. For the unsaturated zone, an infiltration gallery would be used.

Potential chemical oxidants can be used for NAPL remediation of BTEX and PAH compounds include permanganate, Fenton's reagent (i.e., peroxide and chelated iron), ozone, and activated persulfate. Based upon oxidative potential of the oxidation reactions, Fenton's chemistry is the most effective, followed by activated persulfate, permanganate and ozone.

Effectiveness: ISCO using traditional and modified Fenton's reagents have been proven effective for remediation of petroleum but are somewhat less effective for MGP-related compounds in soil and groundwater. ISCO using ozone has been proven to be effective in lowering the toxicity and volume of petroleum but also has been less effective on MGP-related compounds in soil and groundwater. Enhanced ISCO using activated persulfate and co-solvent and/or surfactant materials may also increase the availability of the target contaminants for oxidation with the vadose and/or saturated zones. ISCO use on sites with significant NAPL is limited. While ISCO can enhance NAPL recovery efforts, the high oxidant demand and multiple applications required limit its effectiveness.

Implementability: ISCO reactions are aqueous in nature and adequate subsurface distribution is required for contaminant treatment. Surface access is required to allow adequate delivery of materials. Based upon the permeability and lithology at the site, implementation of Fenton's reagent or ozone would likely be ineffective. Both involve the use or production of gases, which will likely prevent delivery of required quantities and/or subsurface distribution during implementation. Subsurface mixing and distribution are the primary implementation challenges with activated persulfate and enhanced ISCO using activated persulfate and co-solvent and/or surfactant mixtures.

Cost: The relative costs of all ISCO processes are assumed to be moderate to high due to large quantities of oxidant materials required.

Conclusion: ISCO using traditional or modified Fenton's, ozone, or activated persulfate will not be retained.

3.2.5.3 Solidification

In-situ solidification (ISS) is the process of mechanical injection of a solidification mixture into contaminated subsurface soil in order to immobilize and contain the contaminants in a low permeability monolith. The solidification mixture is typically a combination of Portland cement and ground-granulated blast furnace slag with other additives to enhance chemical binding, improve pumpability, auger lubrication, or cohesive soil shearing as needed. Contaminants are immobilized primarily by incorporating contaminated soil into a low permeability mass, reducing groundwater flow through the soil, and binding the contaminants in a soil-cement matrix. While the overall mass of contaminants is not reduced, the mobility and the dissolution of contaminants to groundwater are largely eliminated. ISS also eliminates the NAPL phase by binding the NAPL with surrounding soil.

ISS most commonly consists of a crane-operated auger system which pumps the grout mixture into a large diameter mixing blade that blends the grout with subsurface soil as the blade is turned. At this site, however, overhead clearance is an issue and the use of cranes would have to be evaluated. This approach requires removal of subsurface structures and debris prior to solidification. On relatively shallow sites (i.e., less than 20 feet) such as this site, an excavator can be used to blend solidification reagents with impacted soil. The excavator and a hydraulic hammer can be used in combination during solidification to address subsurface structures, debris, or obstructions. A grout batch plant is constructed on-site where the grout is formulated from dry reagents and water. Permeabilities of treated soils are typically less than 10^{-6} cm/sec, with the goal of achieving several orders of magnitude reduction in permeability as compared to surrounding soil. Solidified soil strengths are typically between 50 and 250 pounds per square inch (psi) unconfined compressive strength, which is capable of supporting a wide variety of post-remediation development construction, yet remains excavatable and drillable for the purpose of utility installation or support pile installation.

Effectiveness: This technology would be effective in reducing source and exposure pathways and the mobility of all site-related contaminants in soil in a relatively short time frame. The process improves the soil bearing capacity. This technology has been applied to numerous MGP sites nationwide. Bench-scale testing is necessary to develop a site-specific mix design.

Implementability: Dewatering and/or groundwater control would not be required. An increase in the volume of the mixture may occur requiring appropriate site grading and potentially some off-site disposal of swell material. VOCs, which may be present in the subsurface, may be released to the atmosphere during treatment; however, this can be managed with an air monitoring program and engineering controls. Implementation of this technology would require the removal of remaining subsurface abandoned MGP infrastructure within the remediation area, which would be disposed off-site or size-reduced and incorporated into the solidified soil if determined to be acceptable. Solidification adjacent to active substation infrastructure may require consideration of alternate application methods such as jet grouting. Overhead clearance issues for equipment would have to be evaluated for proposed equipment.

Cost: The cost is considered to be moderate.

Conclusion: Solidification using either standard excavator buckets, jet grouting, or a combination of both is retained for use at the site.

3.2.5.4 In-situ Thermal Treatment

In-situ thermal treatment methods employ heat to increase the mobilization of contaminants via volatilization for recovery and for thermal destruction of contaminants. Thermal treatment can also be used to weather the coal tar by removing the more volatile compounds, leaving a more viscous, less soluble residual tar. Heat added to the subsurface, through steam injection, electrical resistance heating, radiofrequency heating, or thermal desorption, induces remedial processes that, depending on the level of heating, soil and groundwater conditions, and the nature of the wastes, can partially or fully remediate the wastes. Among other processes, it can break down or volatilize the organic compounds, and reduce the viscosity of remaining source material to allow it to be more easily captured. Vacuum extraction wells would be installed within the heating wells to collect steam or contaminant vapors generated during heating. For optimal effectiveness, groundwater inflow should be minimized within the treatment area.

Effectiveness: Under favorable conditions, thermal treatment can remediate sites to cleanup criteria. The presence of groundwater at this site, however will limit the effectiveness of the technology at and below the water table without groundwater containment. In the absence of groundwater containment, thermal treatment will drive off lighter-weight VOCs, but not destroy the heavier-weight PAHs. During heating, increased solubilization of contaminants could occur which may increase the mobility of coal tar in the shallow bedrock during treatment.

Implementability: In the presence of active substation facilities, thermal treatment methods are not considered appropriate in light of health and safety concerns for on-site workers. Groundwater containment would be required to increase the effectiveness of thermal treatment. If thermal treatment were implemented following substation relocation, VOCs would have to be captured through an aboveground vacuum extraction system.

Cost: The cost is estimated to be high due to power requirements.

Conclusion: In-situ thermal treatment is not retained for use at the site.

3.3 Identification and Screening of Technologies for NAPL/Groundwater

This section identifies and provides a screening of remedial technologies for NAPL and groundwater at the site in the same two-step approach as the identification and screening of technologies for soil discussed above. Table 3-1 includes a summary of the remedial technology identification and screening process for NAPL/groundwater.

3.3.1 Site Management Plan with Monitoring

As a component of the SMP, long-term monitoring would be implemented for off-site overburden and bedrock groundwater to assess the degree to which natural processes were reducing contaminant concentrations. Natural processes which would be expected to occur include physical processes such as hydrodynamic dispersion and dilution by infiltration, and microbial degradation, which transform the contaminants into typically less toxic daughter products and, ultimately, to carbon dioxide and water. Given sufficient time, a plume undergoing natural processes will stabilize after reaching a size where all of the mass delivered by the source is either diluted to very low concentration or destroyed. Further, if the source is removed or isolated from the aquifer through remediation, natural processes will cause the remaining plume to collapse with time, as the contaminant mass residing within the plume is diluted and destroyed, assuming no new mass is introduced.

Groundwater on-site and in the vicinity of the site is not utilized for potable purposes. Currently, potable water is supplied by municipal sources to all residents in and downgradient of the site vicinity. An SMP, which maintains use restrictions regarding groundwater and a monitoring plan to assess future groundwater conditions, would be protective of human health and the environment. Monitoring would consist of periodic sampling of select existing monitoring wells, and analysis for VOCs, SVOCs and indicator parameters (i.e., such as dissolved oxygen and oxidation reduction potential).

Effectiveness: An SMP would be effective identifying residuals and controls required for those residuals at the site. Long-term monitoring will indicate whether contaminant levels are being reduced following soil source remediation.

Implementablity: An SMP with monitoring would not be difficult to implement. Access agreements for off-site properties would be needed for monitoring.

Cost: The annual cost for the SMP and sampling, analysis, and reporting would be relatively low.

Conclusion: An SMP with monitoring is retained for use at the site.

3.3.2 Grout Curtain

A bedrock grout curtain could be installed downgradient of the site either within LaGrange Street, or near the Canal face to intercept NAPL and prevent it from seeping into the Canal. NAPL recovery wells with sumps would be necessary on the upgradient side and at the edges of the grout curtain to collect NAPL.

Effectiveness: A grout curtain, if properly installed to below the depth of the Canal, could eliminate migration and most or all of the NAPL migration and seeps in the Canal when combined with strategically placed NAPL recovery wells.

Implementability: Bedrock fracture grouting to create a grout curtain is an established technology. Grout boring spacing and grout volume can be highly variable depending the characteristics of the fractures. Construction of the grout curtain could be difficult due to spatial constraints and subsurface utilities. A grout curtain near the Canal would difficult due to the proximity of the Canal and its impact on grout requirements.

Cost: The cost of a grout curtain for a length of several hundred feet at a depth of approximately 75 feet would be moderate.

Conclusion: Grout curtains downgradient of the site within LaGrange Street and near the southern bedrock face of the Canal will be retained. Grout curtains must be coupled with NAPL collection on the upgradient side.

3.3.3 NAPL Migration Barrier

A NAPL migration barrier could be constructed immediately downgradient of the site and consist of::

- a permeable trench within the overburden to the top of bedrock installed within LaGrange Street and within the sidewalks along Transit and Saxton Streets;
- a grout curtain immediately downgradient of the trench from the bedrock/overburden interface into the bedrock to intercept NAPL and prevent it from migrating to the north; and
- NAPL recovery wells within the bedrock upgradient of the grout curtain to collect NAPL.

Effectiveness: A NAPL migration barrier with sumps and NAPL recovery wells would collect NAPL at the interface and in the bedrock and prevent its migration through the overburden.

Implementability: NAPL recovery wells, interceptor trenches, and grout curtains are established technologies. Construction of the NAPL migration barrier within the sidewalks along Transit and Saxton Streets and within LaGrange Street would be necessary due to the presence of utilities and electrical conduits (especially within the sidewalk immediately north of the site). Construction of the barrier would not be difficult in these locations due to the relatively shallow depth for the trench and easier accessibility.

Cost: The cost of a NAPL migration barrier with a trench to an approximate depth of 15 feet and NAPL recovery wells and a grout curtain to an approximate depth of 75 feet would be low.

Conclusion: A NAPL migration barrier along the downgradient edge of the site will be retained.

3.3.4 Containment Walls

Containment walls considered potentially applicable for the site to produce hydraulic control are similar to those considered for soil (Section 3.2.2) and include sheet piling, soil cement walls, and jet grouting as discussed.. Depending on the objective, location, extent, and depth of containment wall required, either sheet piling, a soil cement wall, or jet grouting may be used. All three containment wall technologies will be retained for use and included as appropriate within the remedial alternatives.

3.3.5 Horizontal Barrier

A horizontal barrier (i.e., bottom liner) could be installed in the bedrock beneath the source material on-site to contain NAPL and groundwater from migrating downward and off-site.

Effectiveness: Angled fracture grouting could be utilized to install a bottom liner within the bedrock. NAPL extraction wells with/without sumps would have to be installed to collect NAPL contained above the liner.

Implementability: Bedrock quality, fracture apertures and orientation, and fracture continuity affect the grout hole spacing, grout volume and type, angle of boring and grout staging. Angled fracture grouting is an established technology, however, costs can be highly variable based upon site-specific conditions. Implementation of the bottom liner may be difficult due to surface and subsurface obstructions.

Cost: The cost is estimated to be moderate to high.

Conclusion: A bottom liner is retained for use as part of site containment.

3.3.6 Groundwater Extraction Wells

Groundwater extraction could be coupled with soil containment walls) to provide hydraulic control of the site. Containment walls in the overburden would aid in reducing the groundwater extraction rate necessary to provide hydraulic control by limiting horizontal inflow to the site. The presumptive remedy for groundwater extraction is either extraction wells or well points. Individual extraction wells can be located as needed within the remediation area and installed to the required depths in the overburden or bedrock. Well points would most likely be used in areas of reduced saturated thickness (i.e., west side of the site).

Groundwater modeling was performed to estimate on-site extraction rates necessary to: 1) induce inward flow gradients into the site for containment options; and 2) prevent, to the greatest extent, off-site migration of on-site groundwater from contained areas. Results are presented in Appendix B and summarized below.

It is estimated that in order to provide full hydraulic control of a containment cell on-site (i.e., to induce an inflow from the bedrock and limit downward flow into the bedrock without a bedrock bottom liner), approximately 30 extraction wells across the site would be needed to hydraulically contain the site following the installation of containment walls and a site cap. Due to the conservative assumptions in the calculations and the heterogeneous nature of the fill material, this approximation is sufficient for both full and partial site containment. Due to the relatively low flow rates through the cap and containment walls, collected water would be treated in batch mode at an estimated 15 gallons per minute (gpm) within the proposed groundwater treatment system. In the presence of an additional bottom liner below the contained area (i.e., within the bedrock), it is estimated that approximately 6 extraction wells/well points would be required to induce an inward gradient within the capped, on-site contained area (Area B). Due to the relatively low flow rates, collected water would be treated in batch mode at an estimated average rate of 2 gpm in the proposed groundwater treatment system.

3.3.7 Groundwater Treatment

Once collected, contaminants present in groundwater could be treated in-situ through a relief gate or collected and treated either on-site or off-site prior to discharge.

- Relief Gate – A hydraulic relief gate on the downgradient side of a vertical barrier system could be included. The gate would include passive treatment (e.g., activated carbon) windows for groundwater treatment within the overflow relief area.

- Groundwater Treatment On-site – An on-site water treatment facility could be constructed to treat collected groundwater. A site-specific process train would have to be developed to remove contaminants to appropriate standards and meet permit requirements for effluent to be re-injected into the groundwater system or discharged to the nearest surface water system – the Canal.

- Groundwater Pretreatment On-site – Collected groundwater could be pre-treated on-site to meet influent standards and either conveyed in either tanker trucks or via gravity to existing sanitary sewer lines to the publicly owned treatment works (POTW) or a commercial facility.

Effectiveness: Groundwater treatment on- or off-site would provide greater effectiveness than a passive treatment relief gate since discharge levels could be measured and compared against discharge criteria.

Implementability: Groundwater treatment off-site with on-site pretreatment would be the most implementable groundwater treatment technology under consideration. Implementation and long-term maintenance of a relief gate with passive treatment may be difficult depending on its location and the frequency of carbon changeouts required.

Cost: The relative cost for on-site pretreatment and off-site treatment of small quantities of extracted groundwater is considered to be higher than for a relief gate, but less than on-site (full) treatment. On-site treatment to meet NYSDEC groundwater (GA) standards for re-injection or surface water discharge (Class A) standards would be difficult and relatively expensive.

Conclusion: On-site pretreatment to meet POTW influent requirements with off-site treatment at the POTW will be retained for use at the site.

3.3.8 Passive NAPL Recovery Wells

Technologies that would meet the RAO of removing NAPL from the subsurface and considered implementable at this site are the use of existing groundwater monitoring wells to collect NAPL by passive methods such as hand bailing or installing new recovery wells. NAPL has been recovered from existing monitoring well BMW-04-11. Recovery wells would be installed using bedrock-drilling methods with a 6-inch diameter opening to the depth where NAPL was previously detected in the general vicinity (approximately 60 to 75 feet bgs). Wells would remain as open boreholes until it is determined if the well would be suitable for NAPL recovery purposes. If the well produces significant recoverable NAPL, it could be retrofitted with a mechanical pump, such as a Blackhawk electric or pneumatic piston pump. A flush-mounted, watertight lockable manhole cover would be placed over a pre-cast concrete chamber at each recovery well. This will facilitate future screen and casing installation if it is determined that sufficient NAPL can be recovered. The frequency of NAPL recovery operations is anticipated to be on a regular basis (e.g., monthly). Collected NAPL would be disposed off-site.

Effectiveness: NAPL has been detected in the existing monitoring wells as indicated on Figure 2-6. NAPL has been recovered by hand bailing from existing monitoring wells. Continued monitoring and recovery efforts would be effective in removing small quantities of NAPL from the subsurface.

Implementability: Existing monitoring wells could be used for NAPL recovery and construction of new NAPL recovery wells would be feasible.

Cost: The cost of passive recovery of NAPL in existing monitoring wells and new recovery wells is low.

Conclusion: Regular monitoring and passive recovery in existing monitoring wells and new NAPL recovery wells will be retained. Screens, casings and pumps may be added if recoverable quantities of NAPL are encountered.

3.3.9 Enhanced NAPL Recovery Wells

Bailing and/or pumping alone may not be effective in recovering NAPL as a result of its relatively low solubility and the large capillary forces that can reduce the mobility of the non-aqueous phase. NAPL recovery, especially within the soil source area, may require enhancements to increase recovery effectiveness. Enhanced NAPL recovery may be conducted through dual-phase extraction, addition of surfactants, or by thermally enhancing the process.

3.3.9.1 Dual-Phase Extraction

On-site dual-phase extraction wells could be installed to the bottom of the overburden or within the bedrock within the source areas to pump groundwater and NAPL to the surface for treatment and to maintain hydraulic control (i.e., induce inward hydraulic gradient). The recovered emulsion of groundwater and NAPL would be passed through an oil/water separator. These wells would be most efficient when combined with source containment due to the amount of groundwater that could be collected. Collected NAPL would be directed to holding containers and disposed of off-site. Collected water would be treated as discussed in Section 3.3.7.

Effectiveness: A dual-phase extraction system could be effective in increasing the mobility and recovery of NAPL within the radius of influence of the wells. A large number of wells may be required to effectively lower the groundwater level given the relatively low saturated thickness across much of the site and to maintain hydraulic control.

Implementability: An adequate well system would have to be developed in the subsurface. Implementation of this system would be difficult at this site if the substation were not relocated. Groundwater treatment would also be required.

Cost: The cost of an effective dual-phase extraction system with groundwater treatment is considered to be relatively moderate.

Conclusion: Dual-phase extraction is retained for use at the site.

3.3.9.2 Surfactant-Enhanced NAPL Recovery

Surfactants can be used to lower interfacial tensions between water and NAPL, increasing solubility and thus the mobility of the NAPL. Surfactants are selected on the degree of solubilization, toxicity, biodegradability, surfactant sorption and solubility.

Effectiveness: The addition of site-specific surfactants could be effective in increasing the solubility and mobility of NAPL within the radius of influence where they were added to the subsurface, although surfactants may not be effective on the degree of NAPL present at this site.

Implementability: An adequate subsurface distribution system would be required for surfactant addition. Loss of hydraulic control over surfactant addition could result in increased mobility of NAPL in bedrock. Implementation of this system would be difficult at this site due the anticipated large number of injection wells.

Cost: The cost of an effective surfactant-enhanced NAPL recovery system is considered to be relatively moderate to high, depending on the amount of materials and time frame required.

Conclusion: Surfactant-enhanced NAPL recovery is not retained for use at the site.

3.3.9.3 Thermal-Enhanced NAPL Recovery

Similar to in-situ thermal treatment methods for soil, thermal-enhanced NAPL recovery would employ heat within individual NAPL recovery wells to increase the mobilization of contaminants and viscosity reduction.

Effectiveness: The addition of heat within the recovery wells could be effective in increasing the mobility and recovery of NAPL within the radius of influence of the wells. Groundwater containment would be required. In addition to the NAPL collected in the recovery well, however, more-mobile NAPL may also migrate downward into the bedrock.

Implementability: An adequate recovery well system would have to be developed to collect the more-mobile NAPL in the subsurface. Implementation of this system would be difficult at this site due the anticipated large number of wells.

Cost: The cost of an effective thermal-enhanced NAPL recovery system is considered to be relatively high due to groundwater containment needed and depending on the amount of power and time frame required.

Conclusion: Thermal-enhanced NAPL recovery is not retained for use at the site.

3.4 Identification and Screening of Technologies for Sediments

This section identifies and provides a screening of remedial technologies for impacted Canal sediments. Table 3-1 includes a summary of the remedial technology identification and screening process.

3.4.1 Sediment Cap

A low permeability cover over MGP-impacted sediments within the Canal would eliminate the source and exposure pathway for MGP-contaminated sediments. Within the Canal, an armor cap would be the most effective capping technology with regard to the potential for erosion due to Canal currents. The cap would include low permeability and armor elements to effectively contain impacted sediments and prevent erosion of the cap.

Effectiveness: The armor cap would include an organoclay layer to mitigate NAPL sheens that may migrate from sediments into surface water. The cap would also eliminate the exposure pathways for contact with contaminated sediments.

Implementability: The resulting elevation of the top of the cap would be designed to meet the requirements of the NYS Thruway Authority (NYSTA) of a minimum 12-foot draft for boats. Implementation is subject to authorization and coordination with the NYSTA.

Cost: The cost of an armor cap within the Canal is considered to be moderate.

Conclusion: An armor cap is retained for containment of Canal sediments.

3.4.2 Excavation and Off-Site Disposal/Treatment

Excavating contaminated sediments is a proven and reliable technology for contaminant removal. Once Canal access was obtained, contaminated sediments could be excavated by conventional equipment, using specialized health and safety measures and environmental protection measures for downstream habitats. Excavated materials would be subject to waste characterization testing to identify whether they would meet the requirements for disposal in an appropriate landfill, or need transportation to a thermal desorption facility.

Effectiveness: Excavation of contaminated sediments and off-site disposal/treatment would be effective in removing the source of contamination and meeting the RAOs for sediments.

Implementability: Canal access for equipment will require authorization and coordination among agencies (e.g., NYSTA, NYS Canal Corporation, NYS Department of Transportation). Dewatering and/or moisture conditioning may be required for saturated sediments prior to off-site transportation. Proposed excavation activities would be scheduled during the winter season when the water level in the Canal is low and sediments are more accessible.

Cost: The cost of excavating contaminated sediments using proper health and safety measures, and disposing/treating the excavated material off-site is considered to be moderate given the relatively low volume of sediment material.

Conclusion: Excavation and off-site disposal/treatment of contaminated sediments is an effective and implementable technology. Excavation and off-site disposal/treatment will be retained.

3.5 Summary of Technologies Surviving Screening

Substation relocation to an off-site location, partial substation relocation on-site, and no substation relocation will be considered when remediating soil at the site. Technologies retained to remediate soil include:

- Site Management Plan.
- Geomembrane cap.
- Containment walls (combination of sheet piling, soil cement wall, jet grouting) for containment and structural support as appropriate.
- Horizontal barrier (jet-grouted bottom liner).
- Excavation and Off-site Disposal/Treatment.
- In-situ solidification.

Technologies retained to remediate NAPL/groundwater at the site include:

- Site Management Plan with monitoring.
- Passive NAPL recovery through existing monitoring wells and new NAPL recovery wells.
- Grout curtain.
- Grouted bottom liner.
- Containment walls.
- NAPL migration barrier.
- Hydraulic control through dual-phase extraction of NAPL and groundwater.
- Groundwater pretreatment on-site with off-site treatment at the POTW.

Technologies retained to remediate impacted sediments in the Canal include:

- Sediment Cap.
- Excavation and Off-site Disposal/Treatment.

4.0 DEVELOPMENT OF ALTERNATIVES

This section combines the remedial technologies considered feasible for each media (soil, NAPL, groundwater, sediments) into remedial alternatives for the site. For the purpose of evaluating remedial alternatives, and considering that remediation of on-site and off-site areas could progress on different schedules due to access agreement negotiations and logistical considerations, alternatives are developed and evaluated separately for on-site (NYSEG property) and off-site areas. This will allow the recommendation of an off-site remedy to consider the benefits achieved by the recommended on-site remedy in meeting remedial action objectives. The alternatives are described in this section with regards to: size and configuration, time for remediation, spatial requirements, options for disposal, permitting requirements, limitations, and ecological impacts.

4.1 Development of Alternatives

On-site and off-site alternatives have been developed separately to address contamination present on-site (NYSEG property) and remaining off-site remediation areas (LaGrange Street, Reid Petroleum property, downgradient groundwater and NAPL, Canal sediments). On-site and off-site alternatives will be described and evaluated separately. Following the evaluation and comparative analysis, the most promising on-site and off-site alternatives will be combined into site-wide remedial alternatives. Site-wide remedial alternatives are presented in Section 5.18.

The general response actions identified for the site include: no action, containment, source removal and treatment. The No Action alternatives serve as a baseline comparison and include implementing only an SMP or monitoring where applicable. Remedial alternatives other than No Action include combinations of technologies for soil, NAPL, groundwater, and sediments for on-site and off-site areas.

All off-site alternatives except the No Action alternative include excavation and off-site disposal/treatment as the presumptive remedy for potentially impacted off-site soil. Excavation is effective in protecting human health and the environment, implementable within a relatively short time frame, and considered to be the preferred remediation strategy for off-site soil. Remedial alternatives have been developed which consider excavation of the full extent of potentially impacted off-site soil within LaGrange Street and the Reid Petroleum property, or which consider excavation within LaGrange Street only (and the sidewalk to the north) as shown on Figure 2-2.

The following soil remediation volumes were determined in Section 2.2.1:

- On-site, of the 23,800 cy of potentially impacted soil, 1,704 cy is tar-contaminated and 21,736 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that half (12,000 cy) will meet criteria for on-site re-use as backfill material.

- Off-site, of the 4,835 cy of potentially impacted soil, 611 cy is tar-contaminated and 4,224 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that approximately half (2,500 cy) will meet criteria for on-site re-use as backfill material.

- Within LaGrange Street, of the 3,200 cy of potentially impacted soil, 458 cy is tar-contaminated and 2,742 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that half (1,600 cy) will meet criteria for on-site re-use as backfill material.

- Within the Reid Petroleum property, of the 1,635 cy of potentially impacted soil, 153 cy is tar-contaminated and 1,482 cy may meet cleanup criteria and be used as backfill. As a more conservative assumption, it is assumed that approximately half (900 cy) will meet criteria for on-site re-use as backfill material.

- Within the western portion of the site, if the Control House and 12 kV switchgear were relocated to an alternate on-site location, approximately 3,960 cy of potentially impacted soil could be remediated.

Two on-site alternatives include substation relocation in order to evaluate the cost-benefit of relocation that would allow full access to on-site source material for removal or treatment. If the substation is relocated, then the entire soil source area within the NYSEG property could either be excavated with off-site disposal/treatment, or solidified without the need for containment or on-site NAPL/groundwater extraction and treatment.

If the Control House and 12 kV switchgear on the northwestern portion of the site were relocated to the eastern portion of the site, then the western portion of Area A shown on Figure 2-5, which includes the highest levels of NAPL contamination, could be excavated.

If the substation was not entirely relocated, then the entire on-site soil source area could not feasibly be subject to excavation or ISS. However, a portion of the site could be excavated or solidified (Figure 2-2 Area A). The remaining on-site source area (Area B) beneath the active substation would require some form of partial or full containment. Alternatively, the entire on-site area could be contained without excavation or solidification to address NAPL migration. Within the containment area, a cap and hydraulic containment through dual-phase NAPL/groundwater extraction wells could be implemented. Collected groundwater would be pretreated on-site prior to discharge to the POTW. In order to increase the degree of containment, a bottom liner could be installed by grouting bedrock fractures through angled borings.

Downgradient of the overburden soil source areas, NAPL has migrated through fractures in bedrock and has reached the Canal in several active seeps. All off-site alternatives except No Action include a NAPL migration barrier upgradient of the Canal seep areas and NAPL recovery wells to intercept the NAPL before discharge in the Canal can occur.

Sediments impacted by the NAPL seeps (based upon visual indicators including sheens and NAPL blebs) will be addressed by either capping or by excavation once the NAPL seeps are mitigated. All off-site alternatives except No Action include sediment remediation of MGP-impacted sediments.

Off-site excavation within LaGrange Street only would be protective of human health and the environment and would present fewer impacts to off-site property owners and customers. Residual tar-contaminated soil would be an extremely small volume estimated at approximately 153 cy. Residual contaminated soil would generally be near the overburden/bedrock interface and would not present a completed human health exposure pathway except in the scenario of future excavation activities to the overburden/bedrock interface within identified contamination areas. If, in the future, excavation within the Reid Petroleum property were to be conducted within the identified contamination areas, NYSEG would implement and ensure that the components of the SMP, which would include managing potential exposure to residual contaminated soil on-site and adjacent areas, including procedures for soil characterization, handling, disposal, and health and safety of workers and the community, were enforced.

The alternatives developed for on-site and off-site areas include a comprehensive range of options from No Action to complete source removal. Alternatives were specifically developed in a manner to progressively attain RAOs with increasing complexity. This will allow the recommended remedy to consider the cost-benefit of alternatives that address exposure pathways, as compared to alternatives that go beyond addressing exposure pathways only and more fully address RAOs for each media.

From the list of remedial technologies retained (Table 3-1), the following list of on-site and off-site remedial alternatives has been developed:

On-Site Alternatives

- On-Site Alternative 1 – No Action, SMP
- On-Site Alternative 2 – NAPL Migration Barrier
- On-Site Alternative 3 – Partial On-Site Source Removal and Containment and NAPL Control
- On-Site Alternative 4 – Partial On-Site Containment and Hydraulic Control without Bottom Liner, Partial On-Site Source Removal
- On-Site Alternative 5 – Partial On-Site Containment and Hydraulic Control without Bottom Liner, Partial On-Site ISS
- On-Site Alternative 6 – Partial On-Site Containment and Hydraulic Control with Bottom Liner, Partial On-Site Source Removal
- On-Site Alternative 7 – Substation Relocation, On-Site Source Removal
- On-Site Alternative 8 – Substation Relocation, On-Site ISS.

Off-Site Alternatives

- Off-Site Alternative 1 – No Action, Monitoring
- Off-Site Alternative 2 – LaGrange Street Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Excavation
- Off-Site Alternative 3 – Off-Site Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Excavation
- Off-Site Alternative 4 – LaGrange Street Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Cap
- Off-Site Alternative 5 – Off-Site Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Cap

A summary of the remedial alternatives including their elements is provided in Table 4-1.

4.1.1 On-site Alternative 1 – No Action, SMP

Alternative 1 is the No Action alternative that includes no active remediation and maintains exposure controls through an SMP.

Size and Configuration

- An SMP would be developed to include IC/ECs to: manage residual contaminated media on-site and in adjacent areas, potential exposures to contaminated media, including procedures for future intrusive activities including soil characterization, handling, disposal, and health and safety of workers and the community; provide for disposal/reuse in accordance with applicable NYSDEC regulations and procedures; and maintain use restrictions regarding site development and groundwater use.
- An annual report and Five-Year Review would evaluate site conditions, operation, maintenance and monitoring (OM&M) activities and recommend any changes necessary to the OM&M program.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for annual reports.

Spatial Requirements

- There are no spatial requirements for this alternative.

Options for Disposal

- No disposal will be required for this alternative.

Permit Requirements

- Work and traffic permits may be required for off-site areas.

Limitations

- There are no limitations associated with this alternative.

Ecological Impacts

- There would be no change from existing conditions.

4.1.2 On-site Alternative 2 – NAPL Migration Barrier

Alternative 2 is a NAPL collection and control alternative that allows the substation to remain in place. It includes the following remediation elements as well as an SMP:

- NAPL migration barrier immediately downgradient of the site with NAPL recovery.

The conceptual layout of this alternative is depicted on Figure 4-1.

Size and Configuration

- Approximately 400 linear feet of interceptor (gravel) trench would be constructed in the overburden to approximately the overburden/bedrock interface within LaGrange Street and within the sidewalks along Transit and Saxton Streets as shown in Figure 4-1. A conceptual detail of the barrier is shown on Figure 4-2. Sumps and approximately 4 NAPL recovery wells (or a collection pipe with recovery risers) would be installed within the lined trench to collect NAPL.
- Approximately 400 linear feet of grout curtain in the bedrock would be constructed on the downgradient side of the interceptor trench. It would extend from 1 to 2 feet above the overburden/bedrock interface to an approximate depth of 75 feet to eliminate migration in the more permeable bedrock zones overlying the relatively

impervious lower Rochester Shale. Ten new NAPL recovery wells would be installed on the upgradient side and endpoints of the grout curtain into the bedrock.

- Excavation and off-site disposal of the 3 existing wooden tar sumps and their contents located on-site during the RI, estimated to be approximately 14 cy of material.
- An annual report and Five-Year Review would evaluate site conditions, operation, maintenance and monitoring (OM&M) activities and recommend any changes necessary to the OM&M program.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for NAPL recovery.
- Construction would require less than one year.

Spatial Requirements

- Off-site space would be required for necessary equipment. LaGrange Street would be closed during portions of construction activities.
- Traffic control on Transit Street may be necessary during construction activities on the western portion of the barrier.
- Saxton Street may be affected by remediation construction.

Options for Disposal

- Asphalt and concrete would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either transported off-site to a thermal desorption facility or an appropriate landfill. Tar from the 3 existing wooden tar sumps would be disposed off-site as a liquid waste.
- Collected NAPL would be disposed of off-site.

Permit Requirements

- NYSDEC approval of the remedial alternative.
- Access agreements will be required for long-term operation of the NAPL recovery system.

- Work and traffic permits may be required for off-site areas.

Limitations

- Due to subsurface electrical conduits and utilities, the NAPL migration barrier would be placed within the sidewalks along Transit and Saxton Streets and within LaGrange Street.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.3 On-site Alternative 3 – Partial On-Site Source Removal and Containment, and NAPL Control

Alternative 3 is a partial source removal and containment alternative with NAPL collection and control that allows the majority of the substation to remain in place. It includes the following remediation elements as well as an SMP:

- Partially-penetrating containment walls (i.e., walls that would not extend to the ground surface, but would be constructed to a height approximately half the saturated thickness of the overburden) in the overburden surrounding the on-site area on 3 (west, south, east) sides to contain NAPL and contaminants in soil
- Geomembrane cap over the containment area to limit infiltration..
- Relocation of the Control House and 12 kV switchgear from the northwestern portion of the site to the eastern portion of the site.
- Excavation and off-site disposal/treatment of source soil and remnant subsurface MGP structures within the western portion of Area A in Figure 4-3.
- NAPL migration barrier as presented in on-site Alternative 2.

The conceptual layout of this alternative is depicted on Figure 4-3.

Size and Configuration

- Approximately 450 linear feet of partially-penetrating containment walls would be constructed and keyed into the bedrock surface around the site (Areas A, B) on the west, south and east as shown in Figure 4-3. Walls would not extend to the ground surface, but would be constructed to a height approximately half the saturated thickness of the overburden. Containment walls would provide low permeabilityand contain soil contaminants and NAPL present at the overburden/bedrock interface..
- A geomembrane cap overlain with crushed stone would cover the surface of the contained area and be sealed around substation equipment slabs to limit infiltration.
- Excavation and off-site disposal of the 3 existing wooden tar sumps identified on-site, estimated to be approximately 14 cy of material.
- Approximately 3,960 cy of potentially impacted soil would be excavated from the western portion of the site. Approximately 3,210 cy would be to the overburden/bedrock interface in the northwestern portion, and approximately 750 cy would be to the tar-impacted depth of approximately 7 feet in the southwestern portion. Temporary excavation support is assumed along the excavation limits (sloped/benched excavation faces may be utilized but may result in greater excavation volumes).
- Approximately 400 linear feet of interceptor (gravel) trench would be constructed from approximately the overburden/bedrock interface within LaGrange Street and within the sidewalks along Transit and Saxton Streets as shown in Figure 4-3. aA conceptual detail for the barrier is shown on Figure 4-2. Sumps and approximately 4 NAPL recovery wells (or a collection pipe with recovery risers) would be installed within the lined trench to collect NAPL.
- Approximately 400 linear feet of grout curtain in the bedrock would be constructed on the downgradient side of the interceptor trench. It would extend from 1 to 2 feet above the overburden/bedrock interface to an approximate depth of 75 feet to eliminate migration in the more permeable bedrock zones overlying the relatively impervious Rochester Shale. Ten new NAPL recovery wells would be installed on the upgradient side and endpoints of the curtain into the bedrock.

Time for Remediation

- For the purpose of this report a 30-year period is assumed for NAPL extraction.
- Construction would require less than one year.

Spatial Requirements

- On-site and off-site space would be required for necessary equipment. LaGrange Street would be closed during portions of construction activities.
- Traffic control on Transit Street may be necessary during construction activities on the western portion of the site.
- Saxton Street may be affected by remediation construction.

Options for Disposal

- Asphalt and concrete would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either transported off-site to a thermal desorption facility or an appropriate landfill. Tar would be disposed off-site as liquid waste.

Permit Requirements

- NYSDEC approval of the remedial alternative.
- Work and traffic permits may be required for off-site areas.

Limitations

- Due to the presence of subsurface electrical conduits and utilities, the NAPL migration barrier would be placed within the sidewalks along Transit and Saxton Streets and within LaGrange Street.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.4 On-site Alternative 4 – Partial On-Site Containment and Hydraulic Control without Bottom Liner, Partial On-Site Source Removal

Alternative 4 removes source material to the greatest extent without relocating the majority of the substation. Residual source material is contained on-site. Dual-phase extraction wells for NAPL/groundwater would be installed within the contained area to provide hydraulic control. Additional NAPL recovery wells would be installed on-site into the bedrock. It includes the following remediation elements as well as an SMP:

- Relocation of the Control House and 12 kV switchgear from the northwestern portion of the site to the eastern portion of the site.
- Excavation and off-site disposal/treatment of source soil and remnant subsurface MGP structures outside the active substation infrastructure on the site (Area A in Figure 4-5).
- Containment walls to the top of bedrock surrounding the remaining source soil within the Site (Area B).
- A geomembrane cap over Area B.
- On-site NAPL/groundwater collection for hydraulic control within the contained area with on-site pretreatment and disposal at the POTW.
- On-site bedrock NAPL collection within the contained area.

The conceptual layout of this alternative is depicted on Figure 4-5.

Size and Configuration

- Excavation of source material and remnant on-site subsurface MGP structures to bedrock, outside of the substation (Area A on Figure 4-5). A total estimated in-place volume of 15,500 cy would be excavated. Excavated soil would be stockpiled and tested; soil which meets criteria would be re-used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled and compacted to existing grade. Temporary excavation support would be required along the excavation limits.

- Approximately 525 linear feet of containment walls to the top of bedrock would be constructed around the active portion of the site (outline of Area B as depicted in Figure 4-5). Walls bordering the excavation areas would be designed for low permeability and excavation support.
- A geomembrane cap overlain with crushed stone would cover the surface of the contained area and be sealed around substation equipment slabs to limit infiltration.
- Hydraulic control (i.e., maintain inward hydraulic gradient toward containment cell) would be maintained on-site via collection of NAPL/groundwater from 30 dual phase (i.e., NAPL and groundwater) extraction wells within Area B. Based upon groundwater modeling calculations included in Appendix B, the extraction wells would be installed in the overburden. Collected liquid would be treated at an on-site pretreatment facility (see Figure 4-4 for conceptual pretreatment system). Conceptually, the pretreatment system is anticipated to operate 8 hours per day, 5 days per week in batch mode at 15 gpm and may include the following components:
  - NAPL collection with on-site storage.
  - An oil/water separator for the separation of groundwater and NAPL, and the settling of suspended solids.
  - An equalization/storage tank to store extracted groundwater over evenings, weekends and other system downtimes.
  - A filtration system (e.g., bag filters, organoclay, sand) for the removal of solids and NAPL not captured by the oil/water separator.
  - An air stripper for the removal of volatile organic contaminants.
  - An aqueous phase carbon adsorption system and/or organophylic clay for the removal of the PAH and other SVOC contaminants.
  - A chemical feed system to prevent iron fouling and scaling of the air stripper and/or adjustment of the water pH as required for discharge.
  - An air treatment system for the removal of vapor phase from the air stripper. The air treatment would consist of either vapor phase carbon adsorption, or thermal treatment such as a catalytic oxidizer.

  - Various storage tanks, pumps, controls, and other appurtenances as required for the efficient operation of the treatment system.
- Conveyance of treated water through a gravity sewer main to the local POTW.
- Approximately 4 bedrock NAPL recovery wells would be installed on-site within the contained area.
- Off-site disposal of collected NAPL.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for NAPL recovery and operation of the groundwater pretreatment facility.
- Construction would require approximately one and one half years.

Spatial Requirements

- On-site and off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Traffic control on Transit Street would be necessary for off-site transportation of excavated soil and during excavation on the western portion of the site.
- Saxton Street may be affected by remediation construction.

Options for Disposal

- Asphalt would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either re-used on-site as backfill if criteria are met, or transported off-site to a thermal desorption facility or an appropriate landfill. Tar would be disposed off-site as a liquid waste.
- Water pretreated on-site would be disposed of at the nearby POTW if acceptable.
- Collected NAPL would be disposed of off-site.

Permit Requirements

- An industrial wastewater discharge permit may be required for discharge to the POTW.
- The discharge from the groundwater treatment air stripper may require a permit.

- NYSDEC approval of the remedial alternative.

Limitations

- NYSEG would be required to relocate the Control House and 12 kV switchgear, some overhead electrical lines, and grounding wires during remediation.
- Subsurface electrical conduits along the sidewalk along the north side of the site may require the northern containment wall to be placed in the LaGrange Street, or relocation of electrical conduits may be required.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.5 On-site Alternative 5 – Partial On-Site Containment and Hydraulic Control without Bottom Liner, Partial On-Site ISS

Alternative 5 provides containment of overburden soil, groundwater, and NAPL beneath the substation through a combination of solidification (south and east sides) and containment walls (north and west sides) while leaving the substation in-place. Source soil on-site outside the substation would be treated through in-situ solidification. Alternative 5 includes the following remediation elements as well as an SMP:

- Relocation of the Control House and 12 kV switchgear from the northwestern portion of the site to the eastern portion of the site.
- In-situ solidification of source soil outside the active substation infrastructure of the property (Area A as depicted in Figure 4-6).
- Containment wall in the overburden along the north side of the site.
- A geomembrane cap over Area B.
- On-site NAPL/groundwater collection for hydraulic control within the contained area with on-site pretreatment and disposal at the POTW.

- On-site bedrock NAPL collection within the contained area.

The conceptual layout of this alternative is depicted on Figure 4-6.

Size and Configuration

- The size and configuration of hydraulic control and NAPL recovery elements within the substation areas would be similar to Alternative 4.
- In-situ solidification would be performed in Area A shown on Figure 4-6. The estimated in-place volume of the solidification area is 15,500 cy. Remnant subsurface structures would be demolished and either removed for off-site disposal, or size-reduced on-site and incorporated into the solidification. Some excess swell material resulting from solidification would be disposed off-site.
- Approximately 160 linear feet of containment walls to the top of bedrock would be constructed along the north side of the site, as shown on Figure 4-6. The wall bordering LaGrange Street would be designed for low permeability and excavation support.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for NAPL recovery and operation of the groundwater pretreatment facility.
- Construction would require approximately one and one-half years.

Spatial Requirements

- Spatial requirements would be similar to Alternative 4.

Options for Disposal

- Asphalt would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either re-used on-site as backfill if criteria are met, or transported off-site to a thermal desorption facility or an appropriate landfill. Tar would be disposed off-site separately.
- Excess swell material from ISS would be subject to characterization and either be re-graded on-site if feasible, or disposed of off-site.
- Water pretreated on-site would be disposed of at the nearby POTW.

- Collected NAPL would be disposed of off-site.

Permit Requirements

- Permit requirements would be similar to Alternative 4.

Limitations

- Subsurface electrical conduits along the sidewalk on the north side of the site may either be relocated or require the northern containment wall to be placed in LaGrange Street.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.
- NYSEG would need to relocate the Control House and 12 kV switchgear, overhead lines and grounding wires during remediation.
- Remnant MGP structures would have to be removed in remediation areas prior to implementing ISS.
- ISS creates an increase in the soil volume and off-site disposal may be required.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.6 On-site Alternative 6 – Partial On-Site Containment and Hydraulic Control with Bottom Liner, Partial On-Site Source Removal

Alternative 6 removes source material to the greatest extent without relocating the entire substation. Residual source material is contained on-site with a combination of containment walls and horizontal barriers. It includes the following remediation elements as well as an SMP:

- Relocation of the Control House and 12 kV switchgear from the western portion of the site to the eastern portion of the site.
- Excavation and off-site disposal/treatment of source soil and remnant subsurface MGP structures outside the active substation infrastructure on the site (Area A in Figure 4-7).

- Containment walls to the top of bedrock surrounding the remaining source soil within the site (Area B).
- Bedrock fracture grouting below the contained area using angled boreholes and pressure grouting to create a sealed “floor” or “bottom” beneath the substation contained area.
- A geomembrane cap over Area B.
- On-site NAPL/groundwater collection for hydraulic control within the contained area with on-site pretreatment and disposal at the POTW.
- On-site bedrock NAPL collection within the contained area above the bottom liner.

The conceptual layout of this alternative is depicted on Figure 4-7.

Size and Configuration

- Excavation of source material and remnant on-site subsurface MGP structures to bedrock, outside of the substation (Area A on Figure 4-7). A total estimated in-place volume of 15,500 cy would be excavated. Excavated soil would be stockpiled and tested; soil which meets criteria would be re-used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled and compacted to existing grade. Temporary excavation support would be required along the excavation limits.
- Approximately 530 linear feet of containment walls to the top of bedrock would be constructed around the active portion of the site (outline of Area B as depicted in Figure 4-7). Walls bordering the excavation areas would be designed for low permeability and excavation support.
- A bottom liner would be installed within the bedrock below the contained area using pressure grouting of bedrock fractures. A conceptual rock grouting configuration is shown on Figure 4-8 and a conceptual rock grout cross section is depicted on Figure 4-9.
- A geomembrane cap overlain with crushed stone would cover the surface of the contained area and be sealed around substation equipment slabs to limit infiltration.

- Hydraulic control (i.e., maintain inward hydraulic gradient toward containment cell) would be maintained on-site via collection of NAPL/groundwater from 6 dual phase (i.e., NAPL and groundwater) extraction wells within Area B. Based upon groundwater modeling calculations included in Appendix B, the extraction wells would be installed in the overburden. Collected liquid would be treated at an on-site pretreatment facility (see Figure 4-4 for conceptual pretreatment system). Conceptually, the pretreatment system is anticipated to operate 8 hours per day, 5 days per week in batch mode at 2 gpm and may include the following components:
    - NAPL collection with on-site storage.
    - An oil/water separator for the separation of groundwater and NAPL, and the settling of suspended solids.
    - An equalization/storage tank to store extracted groundwater over evenings, weekends and other system downtimes.
    - A filtration system (e.g., bag filters, organoclay, sand) for the removal of solids and NAPL not captured by the oil/water separator.
    - An air stripper for the removal of volatile organic contaminants.
    - An aqueous phase carbon adsorption system and/or organophylic clay for the removal of the PAH and other SVOC contaminants.
    - A chemical feed system to prevent iron fouling and scaling of the air stripper and/or adjustment of the water pH as required for discharge.
    - An air treatment system for the removal of vapor phase from the air stripper. The air treatment would consist of either vapor phase carbon adsorption, or thermal treatment such as a catalytic oxidizer.
    - Various storage tanks, pumps, controls, and other appurtenances as required for the efficient operation of the treatment system.
- On-site NAPL in the bedrock above the liner would be collected from 4 new on-site NAPL recovery wells.
- Conveyance of treated water through a gravity sewer main to the local POTW.

- Off-site disposal of collected NAPL.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for NAPL recovery and operation of the groundwater pretreatment facility.
- Construction would require approximately two years.

Spatial Requirements

- On-site and off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Traffic control on Transit Street would be necessary for off-site transportation of excavated soil and during excavation on the western portion of the site.
- Saxton Street may be affected by remediation construction.

Options for Disposal

- Asphalt would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either transported off-site to a thermal desorption facility or an appropriate landfill. Tar would be disposed off-site as a liquid waste.
- Water pretreated on-site would be disposed of at the nearby POTW if acceptable.
- Collected NAPL would be disposed of off-site.

Permit Requirements

- An industrial wastewater discharge permit may be required for discharge to the POTW.
- The discharge from the groundwater treatment air stripper may require a permit.
- NYSDEC approval of the remedial alternative.

Limitations

- NYSEG would need to relocate the Control House and 12 kV switchgear, some overhead electrical lines, and grounding wires during remediation.

- Subsurface electrical conduits along the sidewalk along the north side of the site may require the northern containment wall to be placed in the LaGrange Street, or relocation of electrical conduits may be required.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.7 On-site Alternative 7 – Substation Relocation, On-Site Source Removal

Alternative 7 is a source removal alternative with complete substation relocation to an off-site location. It includes the following remediation elements as well as an SMP:

- Complete substation relocation to an off-site location.
- Excavation of on-site overburden soils and subsurface MGP structures.

The conceptual layout of this alternative is depicted on Figure 4-10.

Size and Configuration

- Following substation relocation, excavation of source material and remnant subsurface structures in the on-site area will be performed (Figure 4-10 - Areas A and B) to the top of bedrock. A total estimated in-place volume of 23,800 cy would be excavated. This volume includes the extent of all overburden within the property boundary. Excavated soil would be stockpiled and tested; soil which meets criteria would be used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled and compacted to existing grade. Temporary excavation support would be required along the excavation limits.

Time for Remediation

- Construction would require approximately one year excluding substation relocation.

Spatial Requirements

- An off-site location would be required for substation relocation.
- On- and off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Traffic control on Transit Street would be necessary for off-site transportation of excavated soil and during excavation on the western portion of the site.
- Saxton Street may be affected by remediation construction.

Options for Disposal

- Asphalt would be recycled or disposed of at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either transported off-site to a thermal desorption facility or an appropriate landfill. Tar would be disposed off-site as a liquid waste.

Permit Requirements

- Substation relocation would require NYSEG to obtain permits and regulatory and local approval.
- NYSDEC approval of the remedial alternative.

Limitations

- On-site remediation would occur once NYSEG relocated the substation. This process would require several years to complete the approval and permitting processes and to design and construct a new substation at an alternate location.
- Groundwater control during excavation may be difficult.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.8 On-site Alternative 8 – Substation Relocation, On-Site ISS

Alternative 8 is a source containment alternative with substation relocation. It includes the following primary remediation elements as well as SMP:

- Complete substation relocation to an off-site location.
- In-situ solidification of all on-site overburden soil.

The conceptual layout of this alternative is depicted on Figure 4-11.

Size and Configuration

- The size and configuration of Alternative 8 components off-site would be the same as Alternative 7.
- Following substation relocation, removal of surface slabs and known subsurface structures would be performed.
- In-situ solidification will be performed on the entire on-site area, Areas A and B shown in Figure 4-10. The estimated in-place volume of soil to be solidified in these areas is 23,800 cy. Subsurface debris and/or structures encountered during solidification will be demolished and either disposed off-site or size-reduced and incorporated into the solidification.
- Depending on the final grading configuration for the site and the amount of swell material generated due to solidification, some solidified material will be removed for off-site treatment/disposal. Alternatively, the site grade could be reduced prior to solidification by removing surface soil to accommodate solidification swell.

Time for Remediation

- Construction would require approximately one year excluding substation relocation.

Spatial Requirements

- An off-site location would be required for substation relocation.
- On- and off-site space would be required for necessary equipment. LaGrange Street may be closed during the majority of construction.
- Saxton Street may be affected by remediation construction.

Options for Disposal

- Asphalt and clean demolition debris would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and if criteria are met either re-used on-site as backfill, or transported off-site to a thermal desorption facility or an appropriate landfill. Tar would be disposed off-site as a liquid waste.
- Excess swell material from ISS would be subject to characterization and either be re-graded on-site if feasible, or disposed of off-site.

Permit Requirements

- Substation relocation would require NYSEG to obtain permits and regulatory and local approval.
- NYSDEC approval of the remedial alternative.

Limitations

- On-site remediation would occur once NYSEG relocated the substation. This process would require several years to complete the approval and permitting processes and to design and construct a new substation at an alternate location.
- Remnant MGP structures would have to be removed in remediation areas prior to implementing ISS.
- ISS creates an increase in the soil volume and off-site disposal may be required.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.9 Off-site Alternative 1 – No Action, Monitoring

Alternative 1 is the no action alternative that includes no active remediation but does include monitoring.

Size and Configuration

- Annual sampling and analysis for VOCs and SVOCs, as well as indicator parameters, (e.g., oxidation-reduction potential, pH, temperature and conductivity) would be performed in 12 select existing groundwater monitoring wells identified on Figure 4-12. The list of parameters and monitoring wells may be modified following data review of monitoring results.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for monitoring.

Spatial Requirements

- There are no spatial requirements for this alternative.

Options for Disposal

- No significant off-site disposal will be required for this alternative.

Permit Requirements

- Work and traffic permits may be required.
- Access agreements will be required for long-term monitoring in off-site areas, and deed notifications documenting off-site contamination may be necessary.

Limitations

- The time frame to continue monitoring is unknown at this time.

Ecological Impacts

- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.10 Off-site Alternative 2 – LaGrange Street Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Excavation

Off-site Alternative 2 is a source containment and partial removal alternative. It includes monitoring and the following off-site remediation elements:

- Excavation and off-site disposal/treatment of contaminated soil from the off-site area within LaGrange Street (Area C in Figure 4-13).
- Grout curtain with 6 bedrock NAPL recovery wells near southern bedrock face in Canal.
- Off-site bedrock NAPL recovery wells.
- Excavation of MGP-impacted sediments.

The conceptual layout of this alternative is depicted on Figure 4-10.

Size and Configuration

- Excavation of identified overburden soil source from the off-site area within LaGrange Street (Area C on Figure 4-13). A total estimated in-place volume of 3,200 cy would be excavated. Excavated soil would be stockpiled and tested; soil which meets criteria would be used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled, compacted, and restored to pre-construction conditions. Disrupted utilities will be restored. LaGrange Street will be re-surfaced to Saxton Street.
- A 200-foot long bedrock grout curtain would be installed downgradient of the site near the southern bedrock face of the Canal as located in Figure 4-13. It would extend to a depth of approximately 75 feet. Six new NAPL recovery wells would be installed on the upgradient and side gradient edges of the curtain into the bedrock.
- Off-site NAPL in the bedrock would be collected in 9 existing downgradient bedrock monitoring wells, 9 new downgradient NAPL recovery wells, and 6 new NAPL recovery wells near the grout curtain and disposed of off-site. (If during excavation of LaGrange Street the two existing monitoring wells are destroyed, two new wells will be constructed at the same locations.)
- Approximately 1,200 cy of impacted sediments would be excavated from within the Canal and disposed of off-site.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for monitoring and NAPL recovery.

- Construction would require less than one year including a winter season for sediment excavation.
- Following on-site source remediation, an assessment would be made of the presence of NAPL seeps. Sediment remediation would begin once NAPL seepage had apparently ceased and would be conducted during one winter season following draining of the Canal when access to the Canal bottom is easier.

Spatial Requirements

- Installation of a grout curtain adjacent to the Canal may disrupt parking lot use for the property owner.
- Off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Excavation of soil from off-site areas would temporarily disrupt operations for the property owner.
- Sediment excavation would require access from a property adjacent to the Canal and will require access agreement(s).

Options for Disposal

- Asphalt and clean demolition debris would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either re-used as backfill, or transported off-site to a thermal desorption facility or an appropriate landfill.
- Collected NAPL would be disposed of off-site.

Permit Requirements

- NYSDEC approval of the remedial alternative.
- Remediation of the Canal sediments will require a work permit from the NYSTA Canal Corporation.
- Access agreements will be required for long-term monitoring in off-site areas, and deed notifications documenting off-site contamination may be necessary.

Limitations

- The time frame to commence sediment remediation and to continue monitoring is unknown at this time; however, sediment remediation would not commence for a period of at least two years following completion of on-site source remediation.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Sediment excavation within the Canal may have a short-term impact on wildlife resources in the Canal; however, remediation would be beneficial over the long-term.
- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.11 Off-site Alternative 3 – Off-Site Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Excavation

Off-site Alternative 3 is a source containment and removal alternative. It includes monitoring and the following off-site remediation elements:

- Excavation and off-site disposal/treatment of contaminated soil from off-site areas within LaGrange Street and portions of the Reid Petroleum property (Areas C, D, E, and F in Figure 4-14).
- Grout curtain with 6 bedrock NAPL recovery wells near southern bedrock face in Canal.
- Off-site bedrock NAPL recovery wells.
- Excavation of MGP-impacted sediments.

The conceptual layout of this alternative is depicted on Figure 4-14.

Size and Configuration

- Excavation of identified overburden soil source areas off-site (Areas C, D, E, F in Figure 4-14). A total estimated in-place volume of 4,835 cy would be excavated. Excavated soil would be stockpiled and tested; soil which meets criteria would be used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled, compacted, and restored to pre-construction conditions.

- A 200-foot long bedrock grout curtain would be installed downgradient of the site near the southern bedrock face of the Canal as located in Figure 4-14. It would extend to a depth of approximately 75 feet. Six new NAPL recovery wells would be installed on the upgradient and side gradient edges of the curtain into the bedrock.
- Off-site NAPL in the bedrock would be collected in 9 existing downgradient bedrock monitoring wells, 9 new downgradient NAPL recovery wells, and 6 new NAPL recovery wells near the grout curtain and disposed of off-site.
- Approximately 1,200 cy of impacted sediments would be excavated from within the Canal and disposed of off-site.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for monitoring and NAPL recovery.
- Construction would require less than one year including a winter season for sediment excavation.
- Following on-site source remediation, an assessment would be made of the presence of NAPL seeps. Sediment remediation would begin once NAPL seepage had apparently ceased and would be conducted during one winter season following draining of the Canal when access to the Canal bottom is easier.

Spatial Requirements

- Installation of a grout curtain adjacent to the Canal may disrupt parking lot use for the property owner.
- Off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Excavation of soil from off-site areas would temporarily disrupt operations for the property owner.

- Sediment excavation would require access from a property adjacent to the Canal and will require access agreement(s).

Options for Disposal

- Asphalt and clean demolition debris would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either re-used on-site as backfill or transported off-site to a thermal desorption facility or an appropriate landfill.
- Collected NAPL would be disposed of off-site.

Permit Requirements

- NYSDEC approval of the remedial alternative.
- Remediation of the Canal sediments will require a work permit from the NYSTA Canal Corporation.
- Access agreements will be required for long-term monitoring in off-site areas, and deed notifications documenting off-site contamination may be necessary.

Limitations

- The time frame to commence sediment excavation and to continue monitoring is unknown at this time; however, sediment remediation would not commence for a period of at least two years following completion of on-site remediation.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Sediment excavation within the Canal may have a short-term impact on wildlife resources in the Canal; however, remediation would be beneficial over the long-term.
- Implementation of this alternative is not anticipated to have any significant impacts on wildlife resources.

4.1.12 Off-site Alternative 4 – LaGrange Street Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Cap

Off-site Alternative 4 is a source containment and partial removal alternative. It includes monitoring and the following off-site remediation elements:

- Excavation and off-site disposal/treatment of contaminated soil from the off-site area within LaGrange Street north of the site (Area C in Figure 4-15).
- Grout curtain with 6 bedrock NAPL recovery wells near southern bedrock face in Canal.
- Off-site bedrock NAPL recovery wells.
- Capping of MGP-impacted sediments.

The conceptual layout of this alternative is depicted on Figure 4-15.

Size and Configuration

- Excavation of identified off-site overburden soil source area within LaGrange Street (Area C in Figure 4-15). A total estimated in-place volume of 3,200 cy would be excavated. Excavated soil would be stockpiled and tested; soil which meets criteria would be used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled, compacted, and restored to pre-construction conditions.
- A 200-foot long bedrock grout curtain would be installed downgradient of the site near the southern bedrock face of the Canal as located in Figure 4-15. It would extend to a depth of approximately 75 feet. Six new NAPL recovery wells would be installed on the upgradient and side gradient edges of the curtain into the bedrock.
- Off-site NAPL in the bedrock would be collected in 9 existing downgradient bedrock monitoring wells, 9 new downgradient NAPL recovery wells, and 6 new NAPL recovery wells near the grout curtain and disposed of off-site.
- An armored cap would be constructed over the MGP-impacted sediment area of the Canal following source remediation. A conceptual detail of the sediment cap is shown on Figure 4-16.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for monitoring and NAPL recovery.
- Construction would require less than one year including a winter season for sediment capping.

Spatial Requirements

- Installation of a grout curtain adjacent to the Canal may disrupt parking lot use for the property owner.
- Off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Excavation of soil from off-site areas would temporarily disrupt operations for nearby property owners.
- Sediment capping would require access from a property adjacent to the Canal and will require access agreement(s).

Options for Disposal

- Asphalt and clean demolition debris would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either re-used on-site as backfill or transported off-site to a thermal desorption facility or an appropriate landfill.
- Collected NAPL would be disposed of off-site.

Permit Requirements

- NYSDEC approval of the remedial alternative.
- A cap within the Canal will require a work permit from the NYSTA Canal Corporation.
- Access agreements will be required for long-term monitoring in off-site areas, and deed notifications documenting off-site contamination may be necessary.

Limitations

- The time frame to continue monitoring is unknown at this time.
- Spatial requirements for construction activities identified above will have impacts on nearby property owners and roadways.

Ecological Impacts

- Construction of a cap within the Canal may have a short-term impact on wildlife resources in the Canal; however, remediation would be beneficial over the long-term.

4.1.13 Off-site Alternative 5 – Off-Site Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Cap

Off-site Alternative 5 is a source containment and removal alternative. It includes monitoring and the following off-site remediation elements:

- Excavation and off-site disposal/treatment of contaminated soil from the off-site areas within LaGrange Street and portions of the Reid Petroleum property (Areas C, D, E, and F in Figure 4-17).
- Grout curtain with 6 bedrock NAPL recovery wells near the southern bedrock face of the Canal.
- Off-site bedrock NAPL recovery wells.
- Capping of MGP-impacted sediments.

The conceptual layout of this alternative is depicted on Figure 4-17.

Size and Configuration

- Excavation of identified overburden soil source areas off-site (Areas C, D, E, F in Figure 4-17). A total estimated in-place volume of 4,835 cy would be excavated. Excavated soil would be stockpiled and tested; soil which meets criteria would be used as on-site backfill. Soil not meeting criteria would be transported off-site for treatment/disposal. Excavated areas would be backfilled, compacted, and restored to pre-construction conditions.

- A 200-foot long bedrock grout curtain would be installed downgradient of the site near the southern bedrock face of the Canal as located in Figure 4-17. It would extend to a depth of approximately 75 feet. Six new NAPL recovery wells would be installed on the upgradient and side gradient edges of the curtain into the bedrock.
- Off-site NAPL in the bedrock would be collected in 9 existing downgradient bedrock monitoring wells, 9 new downgradient NAPL recovery wells, and 6 new NAPL recovery wells near the grout curtain and disposed of off-site.
- An armored cap would be constructed over the MGP-impacted sediment area of the Canal following source remediation. A conceptual detail of the sediment cap is shown on Figure 4-16.

Time for Remediation

- For the purpose of this report, a 30-year period is assumed for monitoring and NAPL recovery.
- Construction would require less than one year including a winter season for sediment capping.

Spatial Requirements

- Installation of a grout curtain adjacent to the Canal may disrupt parking lot use for the property owner.
- Off-site space would be required for necessary equipment. LaGrange Street would be closed during the majority of construction.
- Excavation of soil from off-site areas would temporarily disrupt operations for nearby property owners.
- Sediment capping would require access from a property adjacent to the Canal and will require access agreement(s).

Options for Disposal

- Asphalt and clean demolition debris would be recycled or disposed at an appropriate landfill. Excavated soil would be subject to waste characterization testing and either re-used on-site as backfill or transported off-site to a thermal desorption facility or an appropriate landfill.

- Collected NAPL would be disposed of off-site.

Permit Requirements

- NYSDEC approval of the remedial alternative.
- A cap within the Canal will require a work permit from the NYSTA Canal Corporation.
- Access agreements will be required for long-term monitoring in off-site areas, and deed notifications documenting off-site contamination may be necessary.

Limitations

- The time frame to continue monitoring is unknown at this time.
- Spatial requirements for construction activities will have impacts on nearby property owners and roadways.

Ecological Impacts

- Construction of a cap within the Canal may have a short-term impact on wildlife resources in the Canal; however, remediation would be beneficial over the long-term.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

5.1 Description of Evaluation Criteria

Each of the alternatives is subjected to a detailed evaluation with respect to the criteria outlined in 6 New York State Codes, Rules, and Regulations (NYCRR) Part 375. A description of each of the evaluation criteria is provided below. This evaluation aids in the selection process for remedial actions in New York State.

Overall Protection of Public Health and the Environment

This criterion is an assessment of whether the alternative meets requirements that are protective of human health and the environment. The overall assessment is based on a composite of factors assessed under other evaluation criteria, particularly long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs. This evaluation focuses on how a specific alternative achieves protection over time and how site risks are reduced. The analysis includes how the source of contamination is to be eliminated, reduced, or controlled.

Compliance with Standards, Criteria, and Guidance

This criterion determines whether or not each alternative and the proposed remedial technologies comply with applicable environmental laws and SCGs pertaining to the chemicals detected in contaminated media and the location of the site.

Long-term Effectiveness and Permanence

This criterion addresses the performance of a remedial action in terms of its permanence and the quantity/nature of waste or residuals remaining at the site after implementation. An evaluation is made on the extent and effectiveness of controls required to manage residuals remaining at the site and the operation and maintenance systems necessary for the remedy to remain effective. The factors that are evaluated include permanence of the remedial alternative, magnitude of the remaining risk, adequacy of controls used to manage residual contamination, and the reliability of controls used to manage residual contamination.

Reduction of Toxicity, Mobility or Volume with Treatment

This criterion assesses the remedial alternative's use of technologies that permanently and significantly reduce toxicity, mobility, or volume (TMV) of the contamination as their principal element. Preference is given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

Short-term Effectiveness

This criterion assesses the effects of the alternative during the construction and implementation phase with respect to the effect on human health and the environment. The factors that are assessed include protection of the workers and the community during remedial action, environmental impacts that result from the remedial action, and the time required until the remedial action objectives are achieved.

Implementability

This criterion addresses the technical and administrative feasibility of implementing the alternative and the availability of various services and materials required during implementation. The evaluation includes the feasibility of construction and operation, the reliability of the technology, the ease of undertaking additional remedial action, monitoring considerations, activities needed to coordinate with regulatory agencies, availability of adequate equipment, services and materials, off-site treatment, and storage and disposal services.

Cost

Capital costs and operation, maintenance, and monitoring costs (OM&M) are estimated for each alternative and presented as present worth using a 5% discount rate. Cost estimates for each remedial alternative are presented in Appendix C and summarized on Table 5-1.

Community and State Acceptance

Concerns of the State and the Community will be addressed separately in accordance with the public participation program developed for this site.

Land Use

This criterion addresses the current, intended, and reasonably anticipated future land use of the site and surroundings. Land use will be considered when evaluating the feasibility and applicability of remediation to pre-disposal conditions. The use of the site shall be either unrestricted or restricted. Unrestricted use is a use without imposed restrictions, such as environmental easements, following remediation to Part 375-6 Remedial Program Soil Cleanup Objectives (SCOs) for unrestricted use. Restricted uses include imposed controls and restrictions, such as institutional and engineering controls and environmental easements following remediation to Part 375 SCOs for restricted use such as restricted residential, commercial, or industrial use.

5.2 On-Site Alternative 1 – No Action, SMP

5.2.1 Overall Protection of Public Health and the Environment

This alternative does not comply with SCGs and is not effective in the long-term because source materials are not removed, treated, or contained and NAPL discharge to the Canal would remain. By implementing the restrictions outlined in the SMP, this alternative would provide limited protection to human health and the environment as compared to current conditions.

5.2.2 Compliance with SCGs

Since no remediation is proposed, contamination would remain. This alternative would not meet SCGs for media at the site.

5.2.3 Long-term Effectiveness and Permanence

Contaminant migration and potential exposure to contaminants would continue due to residual contamination. The potential risks to human health caused by contaminated soil and groundwater could be addressed by an SMP with use restrictions, soil excavation protocols and prohibiting groundwater extraction for potable purposes. This alternative is not considered effective or permanent in the long-term at reducing site risks.

5.2.4 Reduction of Toxicity, Mobility and Volume with Treatment

Reduction of the toxicity, mobility, and volume of contaminants would occur slowly through natural processes. No treatment is included which would reduce toxicity, mobility, or volume. Given the nature of coal tar contaminants and the timeframe from initial releases to current conditions, natural processes would be very slow in reducing TMV.

5.2.5 Short-term Effectiveness

As there is no construction associated with this alternative, there would no impact to workers or site users. RAOs would not be met.

5.2.6 Implementability

Deed restrictions are routinely implemented on contaminated sites. An SMP would not be difficult to implement considering the continued future ownership and use of the site by NYSEG. This would not meet RAOs for the site.

5.2.7 Cost

Estimated capital and OM&M costs for the SMP included in on-site Alternative 1 are presented on Table 5-1. The total capital cost is $32,000, annual OM&M costs are $3,000, and the total present worth of on-site Alternative 1 is $79,000.

5.2.8 Land Use

It is not anticipated that the site will be redeveloped for industrial, commercial, or residential use by the current property owner. An active electrical substation currently occupies the property. Transfer of property ownership is not expected at this time nor in the future due to the substation and the property owner's need to maintain the substation indefinitely to reliably serve its local customers. On-site Alternative 1 is consistent with current and anticipated future land use of the property.

5.3 On-Site Alternative 2 – NAPL Migration Barrier

5.3.1 Overall Protection of Public Health and the Environment

This alternative poses few short-term risks during construction of the NAPL migration barrier. It does not comply with SCGs for media at the site. Source materials other than NAPL are not removed, treated, or contained. Monitoring would assess the degree to which this alternative provides protection to human health and the environment.

5.3.2 Compliance with SCGs

Following NAPL recovery at the NAPL migration barrier, the downgradient plume would begin to collapse and contaminant concentrations would be reduced over time. This alternative does not comply with soil or sediment SCGs.

5.3.3 Long-term Effectiveness and Permanence

Groundwater monitoring during long-term NAPL recovery upgradient of the grout curtain would assess the degree to which groundwater conditions have improved over time. This alternative is considered effective and permanent for NAPL recovery in the long-term.

5.3.4 Reduction of Toxicity, Mobility and Volume with Treatment

Placement of the grout curtain and NAPL recovery wells immediately downgradient of the site will significantly reduce overall NAPL mobility. Reduction of toxicity of contaminants in groundwater would occur slowly through natural processes following NAPL recovery.

5.3.5 Short-term Effectiveness

Construction of the NAPL migration barrier will present noise and disruption of daily traffic patterns and short-term risks to workers and the public that could be managed through a combination of controls and community air monitoring. Dust control will be required. Utilities in the area and within LaGrange Street may be temporarily disrupted and would have to be restored. The time for construction is less than 1 year. Following implementation of an SMP, RAOs pertaining to preventing human exposure will be met.

5.3.6 Implementability

Construction of the NAPL migration barrier will disrupt pedestrian and vehicular traffic on LaGrange, Transit and Saxton Streets and nearby roadways and walkways and to nearby property owners and customers to a limited extent. The grout curtain and NAPL recovery wells would be installed on off-site properties requiring some disruption. Construction sequencing will be conducted to minimize impacts to off-site property owners and customers.

5.3.7 Cost

Estimated capital and OM&M costs for on-site Alternative 2 are presented on Table 5-1. The total capital cost is $2,002,000, annual OM&M costs are $34,452, and the total present worth of on-site Alternative 2 is $2,533,000.

5.3.8 Land Use

It is not anticipated that the site will be redeveloped for industrial, commercial, or residential use by the current property owner. An active electrical substation currently occupies the property. Transfer of property ownership is not expected at this time nor in the future due to the substation and the property owner's need to maintain the substation indefinitely to reliably serve its local customers. On-site Alternative 2, which does not include substation relocation, is consistent with current and anticipated future land use of the property.

5.4 On-Site Alternative 3 – Partial On-Site Source Removal and Containment and NAPL Control

5.4.1 Overall Protection of Public Health and the Environment

This alternative poses few but manageable short-term risks during construction to on-site workers and adjacent residents. On-site partial source removal and containment would not fully comply with SCGs but when combined with NAPL collection and control is effective in the long term. By implementing the restrictions outlined in the SMP, NAPL collection and control, and proposed partial source removal and containment, this alternative would provide protection to human health and the environment. Potential risks associated with downgradient groundwater would be effectively managed through restrictions prohibiting groundwater use for potable purposes.

5.4.2 Compliance with SCGs

Since some soil contamination will remain on-site with containment, this alternative will not fully meet SCGs for soil. Once source was removed and NAPL collected and controlled, contaminant concentrations would be reduced over time in downgradient groundwater.

5.4.3 Long-term Effectiveness and Permanence

Potential risks from contaminated media could be addressed through deed restrictions and an SMP with soil excavation protocols and prohibiting groundwater extraction for potable purposes. Long-term maintenance of the on-site cap and NAPL collection system would be necessary. This alternative is considered effective and permanent in the long-term.

5.4.4 Reduction of Toxicity, Mobility and Volume with Treatment

Source removal of soil in the western portion of the site will reduce the volume of contaminants present in soil. The cap will reduce infiltration and containment walls will reduce the mobility of contaminants in soil NAPL collection and control will reduce the toxicity and volume of contaminants in the overburden, and in bedrock groundwater downgradient. This will be further enhanced through natural processes. Downgradient groundwater would improve and potentially meet SCGs over a long time period.

5.4.5 Short-term Effectiveness

Excavation and construction of containment walls, a cap, a grout curtain, interceptor trench and NAPL recovery wells will not negatively impact human health or the environment. They will however, present noise, disruption of daily traffic patterns and short-term risks to on-site workers. Excavation of contaminated soil poses risks to on-site workers and the adjacent public, which will need to be managed through a combination of controls and community air monitoring. Dust control will be required. The time for construction is less than 1 year. Following implementation of the alternative with an SMP, RAOs pertaining to preventing human exposure will be met and those pertaining to source removal will be partially met.

5.4.6 Implementability

This alternative includes partial substation relocation and on-site construction within the active substation and will present difficulties during construction. Difficulties may arise from relocation of the Control House and 12 kV switchgear, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. Construction of containment walls, a grout curtain, an interceptor trench and NAPL recovery wells will disrupt pedestrian and vehicular traffic on LaGrange, Transit, and Saxton Streets, and nearby roadways and walkways.

5.4.7 Cost

Estimated capital and OM&M costs for on-site Alternative 3 are presented on Table 5-1. The total capital cost is $6,918,000, annual OM&M costs are $34,452, and the total present worth of on-site Alternative 3 is $7,449,000.

5.4.8 Land Use

It is not anticipated that the site will be redeveloped for industrial, commercial, or residential use by the current property owner. An active electrical substation currently occupies the property. Transfer of property ownership is not expected at this time nor in the future due to the substation and the property owner’s need to maintain the substation indefinitely to reliably serve its local customers. On-site Alternative 3, which includes partial substation relocation, is consistent with the current and anticipated future land use of the property.

5.5 On-Site Alternative 4 – Partial On-Site Containment and Hydraulic Control without Bottom Liner, Partial On-Site Source Removal

5.5.1 Overall Protection of Public Health and the Environment

This alternative poses short-term risks during construction primarily associated with excavation activities. It complies with soil SCGs in portions of the site. On-site containment would not fully comply with SCGs and may have limited effectiveness in the long-term due to limited control of NAPL migration in bedrock at the site. Risks associated with contaminated groundwater would be effectively managed through groundwater use restrictions. This alternative would be moderately protective of human health and the environment.

5.5.2 Compliance with SCGs

Since soil contamination will partially remain on-site with containment, this alternative will not meet the SCGs for all soil. Once the source was isolated through containment walls and hydraulic control, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time.

5.5.3 Long-term Effectiveness and Permanence

Contaminant migration from soil to groundwater would be significantly reduced with excavation, and containment and NAPL/groundwater extraction. However, hydraulic control at the site may have limited effectiveness over the long-term in controlling NAPL migration through bedrock from the site. Potential risks from contaminated media could be addressed through an SMP with soil excavation protocols and prohibiting groundwater extraction for potable purposes. Long-term NAPL recovery and groundwater monitoring would assess the degree to which groundwater conditions have improved following source containment through containment walls and hydraulic control. This alternative is considered moderately effective and permanent in the long-term.

5.5.4 Reduction of Toxicity, Mobility and Volume with Treatment

Source removal of the tar sumps and through soil excavation in portions of the site will reduce the volume of contaminants present in soil. Containment will reduce infiltration and groundwater inflow and outflow from the site and the mobility of contaminants. Reduction of toxicity and volume of contaminants in groundwater would occur with NAPL/groundwater extraction and treatment, and downgradient slowly through natural processes following source containment.

5.5.5 Short-term Effectiveness

Excavation and construction of containment walls, a cap, a pretreatment facility and groundwater extraction wells will not negatively impact human health or the environment. It will however, present noise and disruption of daily traffic patterns and short-term risks to on-site workers. Excavation of contaminated soil poses risks to on-site workers and the adjacent public, which will need to be managed through a combination of controls and community air monitoring. Dust control will be required. The time for construction is approximately 1 and one half years. Following implementation of the alternative with an SMP, RAOs pertaining to preventing human exposure will be met and those pertaining to source removal will be partially met. RAOs pertaining to removing the source and reducing concentrations of groundwater contamination would be partially met.

5.5.6 Implementability

This alternative does not include full substation relocation. It does include on-site construction in the vicinity of, the active substation and may be difficult to construct. Difficulties may arise from relocation of the Control House and 12 kV switchgear, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. Construction of containment walls and a cap and soil excavation will disrupt pedestrian and vehicular traffic on LaGrange, Transit ,and Saxton Streets, and nearby roadways and walkways. Operation of a groundwater pretreatment facility on-site would be necessary over the long-term. Permission to discharge pre-treated groundwater to the local POTW would need to be obtained through an industrial wastewater discharge permit.

5.5.7 Cost

Estimated capital and OM&M costs for on-site Alternative 4 are presented on Table 5-1. The total capital cost is $8,322,000, annual OM&M costs are $113,312, and the total present worth of on-site Alternative 4 is $10,066,000.

5.5.8 Land Use

It is not anticipated that the site will be redeveloped for industrial, commercial, or residential use by the current property owner. An active electrical substation currently occupies the property. Transfer of property ownership is not expected at this time nor in the future due to the substation and the property owner’s need to maintain the substation indefinitely to reliably serve its local customers. On-site Alternative 4, which includes partial substation relocation, is consistent with the current and anticipated future land use of the property.

5.6 On-Site Alternative 5 – Partial On-Site Containment and Hydraulic Control without Bottom Liner, Partial On-Site ISS

5.6.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with excavation and solidification activities. On-site containment would not fully comply with SCGs and may have limited effectiveness in the long-term due to limited control of NAPL migration in bedrock at the site. Risks associated with contaminated groundwater would be effectively managed through groundwater use restrictions. It complies with soil SCGs in portions of the site. This alternative would be protective of human health and the environment.

5.6.2 Compliance with SCGs

Soil SCGs would be met in off-site soil source areas following excavation. Soil contamination will remain on-site either contained within the ISS area, or contained outside of the ISS area; therefore, this alternative will not meet SCGs for all soil. Once the source was isolated through ISS and hydraulic control, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time.

5.6.3 Long-term Effectiveness and Permanence

Contaminant migration from soil to groundwater and would be significantly reduced with excavation, ISS and containment. However, hydraulic control at the site may have limited effectiveness over the long-term in controlling NAPL migration through bedrock from the site. Potential risks from solidified material and contaminated media could be addressed through an SMP with soil excavation protocols and prohibiting groundwater extraction for potable purposes. Source soil removal is considered to be permanent in the long-term. This alternative is considered moderately effective and permanent in the long-term.

5.6.4 Reduction of Toxicity, Mobility and Volume with Treatment

Source removal of the tar sumps and through soil excavation from portions of the site will reduce the volume of contaminants present in soil. Containment through treatment by ISS will reduce infiltration and groundwater inflow and outflow from the site and the mobility of contaminants. Reduction of toxicity and volume of contaminants in groundwater would occur with groundwater extraction and treatment, and downgradient slowly through natural processes following source containment.

5.6.5 Short-term Effectiveness

Excavation and construction of containment walls, ISS, a cap, a pretreatment facility, and groundwater extraction wells will not negatively impact human health or the environment. It will however, present noise and disruption of daily traffic patterns and short-term risks to on-site workers. Excavation and/or solidification of contaminated soil pose risks to on-site workers and the adjacent public, which will need to be managed through a combination of controls and community air monitoring. Dust control will be required. The time for construction is approximately 1 and one half years. Following implementation of the alternative with an SMP, RAOs pertaining to preventing human exposure will be met. RAOs pertaining to removing the source and reducing concentrations of groundwater contamination would be partially met.

5.6.6 Implementability

This alternative does not include full substation relocation. It does include on-site construction in the vicinity of, the active substation and will be difficult to construct. Difficulties may arise from relocation of the Control House and 12 kV switchgear, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. ISS, which would require pre-excavation of subsurface structures, and soil excavation, will disrupt pedestrian and vehicular traffic on LaGrange, Transit, and Saxton Streets, and nearby roadways and walkways. Operation of a groundwater pretreatment facility on-site would be necessary over the long-term. Permission to discharge pre-treated groundwater to the local POTW would need to be obtained through an industrial wastewater discharge permit.

5.6.7 Cost

Estimated capital and OM&M costs for on-site Alternative 5 are presented on Table 5-1. The total capital cost is $6,617,000, annual OM&M costs are $113,312, and the total present worth of on-site Alternative 5 is $8,361,000.

5.6.8 Land Use

It is not anticipated that the site will be redeveloped for industrial, commercial, or residential use by the current property owner. An active electrical substation currently occupies the property. Transfer of property ownership is not expected at this time nor in the future due to the substation and the property owner's need to maintain the substation indefinitely to reliably serve its local customers. On-site Alternative 5, which includes partial substation relocation, is consistent with the current and anticipated future land use of the property

5.7 On-Site Alternative 6 – Partial On-Site Containment and Hydraulic Control with Bottom Liner, Partial On-Site Source Removal

5.7.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with excavation activities. It complies with soil SCGs in portions of the site. This alternative would be protective of human health and the environment since it fully contains the source material beneath the substation and removes source material off-site. Risks associated with contaminated groundwater would be effectively managed through groundwater use restrictions.

5.7.2 Compliance with SCGs

Since soil contamination will partially remain on-site with containment, this alternative will not meet the SCGs for all soil. Once the source was isolated through containment walls, a bottom liner, and hydraulic control, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time.

5.7.3 Long-term Effectiveness and Permanence

Contaminant migration from soil to groundwater would be significantly reduced with excavation, containment with a bottom liner, and NAPL/groundwater extraction. Potential risks from residual contaminated media could be addressed through deed restrictions requiring an SMP with soil excavation protocols and prohibiting groundwater extraction for potable purposes. This alternative is considered effective and permanent in the long-term.

5.7.4 Reduction of Toxicity, Mobility and Volume with Treatment

Source removal of the tar sumps and through soil excavation in portions of the site will reduce the volume of contaminants present in soil. Containment with a bottom liner will reduce infiltration and significantly reduce groundwater inflow and outflow from the site and the mobility of NAPL and dissolved-phase contaminants. Reduction of toxicity and volume of contaminants in groundwater would occur with NAPL/groundwater extraction and treatment, and downgradient slowly through natural processes following source containment.

5.7.5 Short-term Effectiveness

Excavation and construction of containment walls, a bottom liner, a cap, a pretreatment facility and NAPL/groundwater wells will not negatively impact human health or the environment. It will however, present noise and disruption of daily traffic patterns and short-term risks to on-site workers. Excavation of contaminated soil poses risks to on-site workers and the adjacent public that will need to be managed through a combination of controls and community air monitoring. Dust control will be required. The time for construction is approximately 2 years. Following implementation of the alternative with an SMP, RAOs pertaining to preventing human exposure will be met and those pertaining to source removal will be partially met. RAOs pertaining to removing the source and reducing concentrations of groundwater contamination would be partially met.

5.7.6 Implementability

This alternative does not include full substation relocation. It does include on-site construction beneath, and in the vicinity of, the active substation and could be difficult to construct. Difficulties may arise from relocation of the Control House and 12 kV switchgear, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. Construction of containment walls and a cap and soil excavation will disrupt pedestrian and vehicular traffic on LaGrange, Transit, and Saxton Streets, and nearby roadways and walkways. Operation of a groundwater pretreatment facility on-site would be necessary over the long-term. Permission to discharge pre-treated groundwater to the local POTW would need to be obtained through an industrial wastewater discharge permit.

5.7.7 Cost

Estimated capital and OM&M costs for on-site Alternative 6 are presented on Table 5-1. The total capital cost is $10,776,000, annual OM&M costs are $78,634, and the total present worth of on-site Alternative 6 is $11,986,000.

5.7.8 Land Use

It is not anticipated that the site will be redeveloped for industrial, commercial, or residential use by the current property owner. An active electrical substation currently occupies the property. Transfer of property ownership is not expected at this time nor in the future due to the substation and the property owner’s need to maintain the substation indefinitely to reliably serve its local customers. On-site Alternative 6, which includes partial substation relocation, is consistent with the current and anticipated future land use of the property.

5.8 On-Site Alternative 7 – Substation Relocation, On-Site Source Removal

5.8.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with excavation and off-site transport of contaminated soil. Risks associated with contaminated groundwater would be effectively managed through groundwater use restrictions. It complies with SCGs, and is effective in the long-term. This alternative is protective of human health and the environment.

5.8.2 Compliance with SCGs

Soil SCGs would be met in soil on-site following excavation. The on-site NAPL source in overburden would be removed with the soil source material excavation. Once the source was removed, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time.

5.8.3 Long-term Effectiveness and Permanence

Contaminant migration from soil to groundwater would be significantly reduced following source removal of contaminated on-site soil in the overburden. This alternative is considered effective and permanent in the long-term.

5.8.4 Reduction of Toxicity, Mobility and Volume with Treatment

Soil source excavation in the overburden will remove the volume of contaminants present in soil on-site. Reduction of toxicity of contaminants in groundwater would occur slowly through natural processes following source removal.

5.8.5 Short-term Effectiveness

Soil source removal will present noise and disruption of daily traffic patterns and short-term risks to on-site workers. Excavation of contaminated soil poses risks to on-site workers and the adjacent public that could be managed through a combination of controls and community air monitoring. Dust control will be required. The high truck traffic volume for excavation and backfill will impact traffic in the local area. The time for construction is approximately 1 year. Following implementation of the alternative, RAOs pertaining to preventing human exposure and source removal will be met. RAOs pertaining to removing the source and reducing concentrations of groundwater contamination would be met.

5.8.6 Implementability

This alternative includes substation relocation that would require regulatory approval and could prove to be a substantial challenge in locating and permitting a suitable property, and constructing new underground transmission conduits during relocation. NYSEG will undertake measures to provide reliable service during remediation. Soil excavation will disrupt pedestrian and vehicular traffic on LaGrange, Transit, and Saxton Streets, and nearby roadways and walkways. Excavation of off-site soil will impact the property owner and customers.

5.8.7 Cost

Estimated capital and OM&M costs for on-site Alternative 7 are presented on Table 5-1. The total capital cost is $22,329,000, annual OM&M costs are $3,000, and the total present worth of on-site Alternative 7 is $22,376,000.

5.8.8 Land Use

On-site Alternative 7, which includes substation relocation and excavation of source material over contaminated areas of the site, may allow unrestricted future use of the site.

5.9 On-Site Alternative 8 – Substation Relocation, On-Site ISS

5.9.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with solidification and excavation of contaminated soil. Risks associated with contaminated groundwater would be effectively managed through groundwater use restrictions. It complies with soil SCGs in portions of the site. This alternative would be protective of human health and the environment.

5.9.2 Compliance with SCGs

Soil contamination will remain on-site contained within the ISS area; therefore, this alternative will not meet the soil SCGs. Once the source was removed and/or contained, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time.

5.9.3 Long-term Effectiveness and Permanence

Contaminant migration from soil to groundwater would be significantly reduced with excavation, ISS and containment, but limited migration could continue due to residual contamination. Potential risks from solidified material and contaminated media could be addressed through an SMP with soil excavation protocols and prohibiting groundwater extraction for potable purposes. This alternative is considered effective and permanent in the long-term.

5.9.4 Reduction of Toxicity, Mobility and Volume with Treatment

Containment through treatment by ISS will reduce infiltration and groundwater inflow and outflow from the site and the mobility of contaminants. Reduction of toxicity and volume of contaminants in groundwater would occur slowly through natural processes following source containment and NAPL recovery downgradient. Solidification of overburden NAPL at the site, and the resulting permeability reduction in overburden soil at the site will significantly reduce overall NAPL mobility.

5.9.5 Short-term Effectiveness

Excavation and solidification of contaminated soil pose risks to on-site workers and the adjacent public, which could be managed through a combination of vapor controls and community air monitoring. Noise and disruption of daily traffic patterns will occur. Excavation of contaminated soil poses risks to on-site workers and the adjacent public, which will need to be managed through a combination of controls and air monitoring. Dust control will be required. The time for construction is approximately 1 year. Following implementation of the alternative, RAOs pertaining to preventing human exposure will be met. RAOs pertaining to reducing concentrations of groundwater contamination would be met.

5.9.6 Implementability

This alternative includes substation relocation that would require regulatory approval and could prove to be a substantial challenge in locating and permitting a suitable property, and constructing new underground transmission conduits. NYSEG will undertake measures to provide reliable service during remediation. ISS, which would require pre-excavation of subsurface structures, and soil excavation, will disrupt pedestrian and vehicular traffic on LaGrange, Transit and Saxton Streets, and nearby roadways and walkways.

5.9.7 Cost

Estimated capital and OM&M costs for on-site Alternative 8 are presented on Table 5-1. The total capital cost is $20,905,000, annual OM&M costs are $3,000, and the total present worth of on-site Alternative 8 is $20,952,000.

5.9.8 Land Use

On-site Alternative 8 includes substation relocation, but following ISS, the SMP would have to be followed with restrictions on future site use.

5.10 Off-Site Alternative 1 – No Action, Monitoring

5.10.1 Overall Protection of Public Health and the Environment

Although this alternative poses few short-term risks during monitoring, it does not comply with SCGs, and is not effective in the long-term because contaminated media are not removed, treated, or contained and NAPL discharge to the Canal would remain.

5.10.2 Compliance with SCGs

Since no remediation is proposed, contamination would remain. This alternative would not meet SCGs for off-site media at the site.

5.10.3 Long-term Effectiveness and Permanence

Contaminant migration and potential exposure to contaminants would continue due to residual contamination. The potential risks to human health caused by contaminated soil and groundwater could be addressed by an SMP with use restrictions, soil excavation protocols and prohibiting groundwater extraction for potable purposes. Implementing deed restrictions and other ICs/ECs on off-site properties can be difficult. This alternative is not considered effective or permanent in the long-term at reducing site risks.

5.10.4 Reduction of Toxicity, Mobility and Volume with Treatment

Reduction of the toxicity, mobility, and volume of contaminants would occur slowly through natural processes. No treatment is included which would reduce toxicity, mobility, or volume. Given the nature of coal tar contaminants and the timeframe from initial releases to current conditions, natural processes would be very slow in reducing TMV.

5.10.5 Short-term Effectiveness

As there is no construction associated with this alternative, there would be no impact to workers or site users. RAOs would not be met.

5.10.6 Implementability

Monitoring is routinely implemented on contaminated sites. Monitoring would require access agreements for long-term monitoring with other property owners. This would not meet RAOs for the site.

5.10.7 Cost

Estimated capital and OM&M costs for sampling and analysis of monitoring wells included in off-site Alternative 1 are presented on Table 5-1. The total capital cost is $0, annual OM&M costs are $13,500, and the total present worth of off-site Alternative 1 is $208,000.

5.10.8 Land Use

Off-site Alternative 1 does not include off-site remediation. The SMP would have to be followed with restrictions on future off-site activities and use.

5.11 Off-Site Alternative 2 – LaGrange Street Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Excavation

5.11.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with excavation and off-site transportation of contaminated soil and sediments. Risks at the Canal would be addressed by eliminating the NAPL seeps and removing MGP-impacted sediment. This alternative complies with sediment SCGs and some off-site soil SCGs and is effective in the long-term. This alternative is protective of human health and the environment.

5.11.2 Compliance with SCGs

Soil SCGs would be met in soil within LaGrange Street. Following NAPL recovery in downgradient groundwater, the downgradient plume would begin to collapse and contaminant concentrations would be reduced over time. Removal of site-impacted sediments through sediment excavation would meet sediment SCGs.

5.11.3 Long-term Effectiveness and Permanence

Contaminant migration would be significantly reduced with off-site soil excavation, the grout curtain, NAPL recovery and sediment excavation. Sediment removal and source soil excavation is considered to be permanent in the long-term. Long-term NAPL recovery and groundwater monitoring would assess the degree to which groundwater conditions have improved following source removal. This alternative is considered effective and permanent in the long-term.

5.11.4 Reduction of Toxicity, Mobility and Volume with Treatment

Overburden soil source excavation within LaGrange Street will remove the volume of contaminants present in soil. Placement of the grout curtain and NAPL recovery wells adjacent to the Canal will significantly reduce overall NAPL mobility by collecting it and eliminating seeps into the Canal. Reduction of toxicity of contaminants in groundwater would occur slowly through natural processes following soil removal and NAPL recovery downgradient. Sediment excavation will reduce the volume of contaminants in the Canal.

5.11.5 Short-term Effectiveness

Off-site soil excavation will present noise and disruption of daily traffic patterns and short-term risks to workers and the adjacent public that could be managed through a combination of controls, and community air monitoring. Dust control will be required. Utilities within LaGrange Street would be temporarily disrupted and would have to be restored. Sediment excavation within the Canal will negatively affect the Canal environment in the short-term; however, it will be beneficial to wildlife over the long-term. The time for construction is less than 1 year. RAOs will be met for sediments following remediation and in groundwater in the long-term.

5.11.6 Implementability

Soil excavation will disrupt pedestrian and vehicular traffic on LaGrange Street and nearby roadways and walkways and to nearby property owners and customers to a limited extent. The grout curtain and NAPL recovery wells would be installed on off-site properties requiring some disruption of those properties. Construction sequencing will be conducted to minimize impacts to off-site properties owners and customers. Sediment excavation in the Canal would require access and coordination with State and local agencies requiring some disruption of these properties.

5.11.7 Cost

Estimated capital and OM&M costs for Off-site Alternative 2 are presented on Table 5-1. The total capital cost is $2,940,000, annual OM&M costs are $39,524, and the total present worth of off-site Alternative 2 is $3,549,000.

5.11.8 Land Use

Off-site Alternative 2 includes excavation within LaGrange Street. The SMP would have to be followed with restrictions on future off-site activities and use within the Reid Petroleum property.

5.12 Off-Site Alternative 3 – Off-Site Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Excavation

5.12.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with excavation and off-site transportation of contaminated soil and sediments. Risks at the Canal would be addressed by eliminating the NAPL seeps and removing MGP-impacted sediment. This alternative complies with sediment SCGs and off-site soil SCGs and is effective in the long-term. This alternative is protective of human health and the environment.

5.12.2 Compliance with SCGs

Soil SCGs would be met for off-site soil. Following NAPL recovery in downgradient groundwater, the downgradient plume would begin to collapse and contaminant concentrations would be reduced over time. Removal of site-impacted sediments through sediment excavation would meet sediment SCGs.

5.12.3 Long-term Effectiveness and Permanence

Contaminant migration would be significantly reduced with off-site soil excavation, the grout curtain, NAPL recovery and sediment excavation. Sediment removal and source soil excavation is considered to be permanent in the long-term. Long-term NAPL recovery and groundwater monitoring would assess the degree to which groundwater conditions have improved following source removal. This alternative is considered effective and permanent in the long-term.

5.12.4 Reduction of Toxicity, Mobility and Volume with Treatment

Overburden off-site soil source excavation will remove the volume of contaminants present in soil. Placement of the grout curtain and NAPL recovery wells adjacent to the Canal will significantly reduce overall NAPL mobility by collecting it and eliminating seeps into the Canal. Reduction of toxicity of contaminants in groundwater would occur slowly through natural processes following soil removal and NAPL recovery downgradient. Sediment excavation will reduce the volume of contaminants in the Canal.

5.12.5 Short-term Effectiveness

Off-site soil excavation will present noise and disruption of daily traffic patterns and short-term risks to workers and the adjacent public that could be managed through a combination of controls, and community air monitoring. Excavation of off-site soil will impact nearby property owners and customers. Dust control will be required. Utilities within LaGrange Street would be temporarily disrupted and would have to be restored. Sediment excavation within the Canal will negatively affect the Canal environment in the short-term; however, it will be beneficial to wildlife over the long-term. The time for construction is less than 1 year. RAOs will be met for sediments following remediation and in groundwater in the long-term.

5.12.6 Implementability

Soil excavation will disrupt pedestrian and vehicular traffic on LaGrange Street and nearby roadways and walkways and to nearby property owners and customers. The grout curtain and NAPL recovery wells would be installed on off-site properties requiring some disruption of those properties. Construction sequencing will be conducted to minimize impacts to off-site properties owners and customers. Sediment excavation in the Canal would require access and coordination with State and local agencies requiring some disruption of these properties.

5.12.7 Cost

Estimated capital and OM&M costs for off-site Alternative 3 are presented on Table 5-1. The total capital cost is $3,226,000, annual OM&M costs are $39,524, and the total present worth of off-site Alternative 3 is $3,835,000.

5.12.8 Land Use

Off-site Alternative 3 includes off-site excavation of impacted soil. The SMP would include minimal restrictions on future off-site activities within the Reid Petroleum property.

5.13 Off-Site Alternative 4 – LaGrange Street Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Cap

This alternative poses some short-term risks during construction primarily associated with excavation and off-site transportation of contaminated soil and construction of the sediment cap. Risks at the Canal would be addressed by eliminating the NAPL seeps and capping MGP-impacted sediment. This alternative complies with some off-site soil SCGs and is effective in the long-term. This alternative is protective of human health and the environment.

5.13.1 Compliance with SCGs

Soil SCGs would be met in soil within LaGrange Street. Following NAPL recovery in downgradient groundwater, the downgradient plume would begin to collapse and contaminant concentrations would be reduced over time. Sediment SCGs would not be met with a sediment cap.

5.13.2 Long-term Effectiveness and Permanence

Contaminant migration would be significantly reduced with off-site soil excavation, the grout curtain, NAPL recovery and a sediment cap. Source soil excavation is considered to be permanent in the long-term. Long-term NAPL recovery and groundwater monitoring would assess the degree to which groundwater conditions have improved following source removal. This alternative is considered effective and permanent in the long-term.

5.13.3 Reduction of Toxicity, Mobility and Volume with Treatment

Overburden soil source excavation within LaGrange Street will remove the volume of contaminants present in soil. Placement of the grout curtain and NAPL recovery wells adjacent to the Canal will significantly reduce overall NAPL mobility by collecting it and eliminating seeps into the Canal. Reduction of toxicity of contaminants in groundwater would occur slowly through natural processes following soil removal and NAPL recovery downgradient. A sediment cap will reduce the mobility of contaminants in the Canal.

5.13.4 Short-term Effectiveness

Off-site soil excavation will present noise and disruption of daily traffic patterns and short-term risks to workers and the adjacent public that could be managed through a combination of controls, and community air monitoring. Dust control will be required. Utilities within LaGrange Street would be temporarily disrupted and would have to be restored. Construction of a sediment cap within the Canal will negatively affect the Canal environment in the short-term; however, it will be beneficial to wildlife over the long-term. The time for construction is less than 1 year. RAOs will be met for sediments following remediation and in groundwater in the long-term.

5.13.5 Implementability

Soil excavation will disrupt pedestrian and vehicular traffic on LaGrange Street and nearby roadways and walkways and to nearby property owners and customers to a limited extent. The grout curtain and NAPL recovery wells would be installed on off-site properties requiring some disruption of those properties. Construction sequencing will be conducted to minimize impacts to off-site properties owners and customers. Construction of a sediment cap in the Canal would require access and coordination with State and local agencies requiring some disruption of these properties.

5.13.6 Cost

Estimated capital and OM&M costs for Off-site Alternative 4 are presented on Table 5-1. The total capital cost is $3,585,000, annual OM&M costs are $39,524, and the total present worth of off-site Alternative 4 is $4,194,000.

5.13.7 Land Use

Off-site Alternative 4 includes excavation within LaGrange Street. The SMP would have to be followed with restrictions on future off-site activities and use within the Reid Petroleum property.

5.14 Off-Site Alternative 5 – Off-Site Excavation, Downgradient NAPL Recovery and Grout Curtain, Sediment Cap

5.14.1 Overall Protection of Public Health and the Environment

This alternative poses some short-term risks during construction primarily associated with excavation and off-site transportation of contaminated soil and construction of the sediment cap. Risks at the Canal would be addressed by eliminating the NAPL seeps and capping MGP-impacted sediment. This alternative complies with sediment SCGs and off-site soil SCGs and is effective in the long-term. This alternative is protective of human health and the environment

5.14.2 Compliance with SCGs

Soil SCGs would be met for off-site soil. Following NAPL recovery in downgradient groundwater, the downgradient plume would begin to collapse and contaminant concentrations would be reduced over time. Sediment SCGs would not be met with a sediment cap.

5.14.3 Long-term Effectiveness and Permanence

Contaminant migration would be significantly reduced with off-site soil excavation, the grout curtain, NAPL recovery and a sediment cap. Source soil excavation is considered to be permanent in the long-term. Long-term NAPL recovery and groundwater monitoring would assess the degree to which groundwater conditions have improved following source removal. This alternative is considered effective and permanent in the long-term.

5.14.4 Reduction of Toxicity, Mobility and Volume with Treatment

Overburden off-site soil source excavation will remove the volume of contaminants present in soil. Placement of the grout curtain and NAPL recovery wells adjacent to the Canal will significantly reduce overall NAPL mobility by collecting it and eliminating seeps into the Canal. Reduction of toxicity of contaminants in groundwater would occur slowly through natural processes following soil removal and NAPL recovery downgradient. Construction of a sediment cap will reduce the mobility of contaminants in the Canal.

5.14.5 Short-term Effectiveness

Off-site soil excavation will present noise and disruption of daily traffic patterns and short-term risks to workers and the adjacent public that could be managed through a combination of controls, and community air monitoring. Excavation of off-site soil will impact nearby property owners and customers. Dust control will be required. Utilities within LaGrange Street would be temporarily disrupted and would have to be restored. Construction of a sediment cap within the Canal will negatively affect the Canal environment in the short-term; however, it will be beneficial to wildlife over the long-term. The time for construction is less than 1 year. RAOs will be met for sediments following remediation and in groundwater in the long-term.

5.14.6 Implementability

Soil excavation will disrupt pedestrian and vehicular traffic on LaGrange Street and nearby roadways and walkways and to nearby property owners and customers. The grout curtain and NAPL recovery wells would be installed on off-site properties requiring some disruption of those properties. Construction sequencing will be conducted to minimize impacts to off-site properties owners and customers. Construction of a sediment cap in the Canal would require access and coordination with State and local agencies requiring some disruption of these properties.

5.14.7 Cost

Estimated capital and OM&M costs for Off-site Alternative 5 are presented on Table 5-1. The total capital cost is $3,872,000, annual OM&M costs are $39,524, and the total present worth of off-site Alternative 5 is $4,481,000.

5.14.8 Land Use

Off-site Alternative 5 includes off-site excavation of impacted soil. The SMP would include minimal restrictions on future off-site activities within the Reid Petroleum property.

5.15 Comparative Analysis of Alternatives

The comparative analysis of alternatives using the 6NYCRR Part 375 evaluation criteria for on-site and off-site alternatives is summarized on Table 5-2. A more detailed comparison discussion is provided below.

5.15.1 Overall Protection of Public Health and the Environment for On-Site Alternatives

On-site Alternative 1 followed by on-site Alternatives 2 and 3 poses the lowest level of short-term risks during construction. All alternatives except on-site Alternatives 1 and 2 comply with soil SCGs in portions of the site. On-site Alternative 7 complies with soil SCGs over the entire site; on-site Alternatives 4 and 6 comply with soil SCGs over a large portion of the site. On-site Alternative 3 complies with soil SCGs in the western portion of the site. All on-site alternatives would be protective of human health and the environment. On-site Alternative 7, followed by on-site Alternative 8, both with full substation relocation, provide the highest level of protection.

5.15.2 Compliance with SCGs for On-Site Alternatives

Soil SCGs on-site would be met with on-site Alternative 7 since it includes full source excavation. Remaining alternatives vary in the degree to which soil SCGs are met. On-site Alternatives 4 and 6 meet soil SCGs on a larger scale than on-site Alternatives 5 and 8 that treat, but do not remove, the source. On-site Alternative 3 complies with soil SCGs in the western portion of the site. On-site Alternative 2 does not meet on-site soil SCGs. NAPL/groundwater extraction would continue until SCGs were met, or to the extent practicable, for on-site

Alternatives 4 through 6. NAPL extraction would continue for on-site Alternatives 2 and 3 until no NAPL was recovered or until SCGs in groundwater were met. Once the source was cut off with containment walls, and/or NAPL and/or groundwater was extracted, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time for all alternatives except on-site Alternative 1.

5.15.3 Long-term Effectiveness and Permanence for On-Site Alternatives

Contaminant migration from soil to groundwater would be significantly reduced with excavation, ISS, and containment, but limited migration could continue due to residual contamination. On-site Alternative 7 provides the highest level of long-term effectiveness and permanence followed by on-site Alternatives 8, 6, 4, 5, 3, 2, and 1. Potential risks from residuals (solidified material and contaminated media) would have to be addressed through a Site Management Plan with soil excavation protocols and prohibiting groundwater extraction for potable purposes. On-site Alternative 7, which includes on-site NAPL removal within the overburden (excavated with on-site soil), would reduce NAPL source to the greatest extent. On-site Alternative 6, which includes a bottom liner and on-site NAPL recovery, would reduce migration from the NAPL source to the next greatest extent. On-site Alternative 3 collects NAPL and controls soil contaminants and NAPL migration in the overburden and bedrock. On-site Alternatives 5 and 8 would immobilize on-site NAPL within the overburden and eliminate overburden infiltration through the ISS process. On-site Alternatives 4, and 5, which include on-site dual-phase NAPL/groundwater extraction, would be similarly effective in the long-term for NAPL removal in overburden, but would not address NAPL in bedrock beneath the site. On-site Alternative 2 addresses NAPL migration in both overburden and bedrock, but does not address contamination on-site.

5.15.4 Reduction of Toxicity, Mobility and Volume with Treatment for On-Site Alternatives

Source removal through on-site soil excavation will reduce the volume of contaminants present in soil for on-site Alternatives 3 though 7. On-site Alternative 7 would reduce the volume of contaminants to the greatest extent through excavation. Containment, through either a cap and containment walls, a bottom liner, or ISS will reduce infiltration and groundwater inflow and outflow from the site and the mobility of contaminants for on-site Alternatives 2 through 8. On-site Alternative 6, which includes a bottom liner and NAPL/groundwater extraction, and on-site Alternatives 4 through 6, which include dual-phase extraction (all of which include subsequent pretreatment of collected groundwater and NAPL disposal), would reduce toxicity, mobility and volume to a greater extent than other alternatives. On-site Alternative 3 includes NAPL collection and migration control to reduce NAPL volume and mobility. Reduction of toxicity and volume of contaminants in groundwater would occur slowly through natural processes following source removal, containment or treatment, and NAPL recovery.

5.15.5 Short-term Effectiveness for On-Site Alternatives

Remediation including excavation and construction of containment walls, ISS, a cap, and NAPL recovery wells will not negatively impact human health or the environment as long as controls and a community air monitoring program are effectively implemented. It will however, present noise and disruption of daily traffic patterns and short-term risks to on-site workers. Dust control will be required. The time for construction ranges approximately less than 1 year to 2 years with on-site Alternative 2 requiring a shorter construction period than remaining on-site alternatives. Implementation of an SMP will be necessary to meet RAOs for all alternatives except on-site Alternative 7. RAOs pertaining to human exposure would be met in the shortest time period for on-site Alternative 2, on-site Alternatives 7 and 8 (excluding substation relocation time), on-site Alternative 3 (providing partial source removal and containment and NAPL control), on-site Alternatives 4 and 5 (containment and source removal), followed by on-site Alternative 6 (full containment and source removal).

5.15.6 Implementability for On-Site Alternatives

On-site Alternatives 2 through 6 do not include full substation relocation. They would present difficulties to implement while the substation remains active, and would require careful coordination of construction equipment, construction procedures, and sequencing, as well as coordination with NYSEG substation operations personnel. Difficulties may arise from relocation of the Control House and 12 kV switchgear for on-site Alternatives 3, 4, 5, and 6, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. Substation relocation included in on-site Alternatives 7 and 8 would require regulatory approval and could prove to be a substantial challenge in locating and permitting a suitable property, and constructing new underground transmission conduits. All alternatives except on-site Alternative 1 include varying degrees of soil excavation that will disrupt pedestrian and vehicular traffic on LaGrange, Transit, and Saxton Streets, and nearby roadways and walkways. The time for construction for on-site Alternatives 2 through 8 is between 1 to 2 years. Implementation of an SMP will be necessary to partially meet RAOs for all alternatives..

5.15.7 Cost for On-Site Alternatives

A review of costs for each alternative indicates that on-site Alternatives 7 and 8 have the highest capital costs followed in descending order by on-site Alternatives 6, 4, 3, 5, 2 and 1. On-site Alternatives 4 and 5 have the highest annual OM&M cost, followed by on-site Alternative 6 on-site Alternatives 2 and 3, and on-site Alternatives 1, 7 and 8. All alternatives include 30 years of annual reporting of site conditions. On-site alternatives 4, 5, and 6 include 30 years of NAPL/groundwater extraction and on-site pretreatment; on-site Alternatives 2 through 6 include 30 years of on-site NAPL extraction.

In ascending order, the alternative which presents the lowest total present worth is on-site Alternative 1 followed by on-site Alternatives 2, 3, 5, 4, 6, 8, and 7 which has the highest total present worth.

5.15.8 Land Use

On-site Alternative 7, which includes substation relocation and excavation of source material over contaminated areas of the site, is the only alternative that may allow unrestricted future use of the site.

5.15.9 Overall Protection of Public Health and the Environment for Off-Site Alternatives

Off-site Alternative 1 poses the lowest level of short-term risks since it does not include construction, followed by off-site Alternatives 2 and 4 that include less soil excavation than off-site Alternatives 3 and 5. All off-site alternatives except Alternative 1 comply with soil SCGs in portions of the site; off-site Alternatives 3 and 5 comply with all off-site soil SCGs. Sediment SCGs are met for off-site Alternatives 2 and 3. Off-site Alternatives 2 through 5 would be protective of human health and the environment. Off-site Alternative 3, followed by off-site Alternative 2, provides the highest level of protection.

5.15.10 Compliance with SCGs for Off-Site Alternatives

Soil SCGs would be met in off-site soil source areas for off-site Alternatives 3 and 5, and partially met for off-site Alternatives 2 and 4. Removal of site-impacted sediments through sediment excavation would meet sediment SCGs for off-site Alternatives 2 and 3. Once the source soil was excavated, and downgradient NAPL extracted, the downgradient plume would begin to collapse and contaminant concentrations would be reduced in downgradient groundwater over time for all alternatives except off-site Alternative 1.

5.15.11 Long-term Effectiveness and Permanence for Off-Site Alternatives

Contaminant migration from soil to groundwater and sediments would be significantly reduced with excavation, a sediment cap, and containment, but limited migration could continue due to residual contamination. Off-site Alternative 3 provides the highest level of long-term effectiveness and permanence followed by off-site Alternatives 2, 5 and 4. Long-term NAPL recovery and groundwater monitoring would assess the degree to which groundwater conditions have improved following remediation. Off-site alternatives include a grout curtain and downgradient NAPL recovery wells and would be similarly effective in the long-term for NAPL removal in bedrock. Sediment removal, included in off-site Alternatives 2 and 3, is considered to be permanent in the long-term as opposed to a sediment cap included in off-site Alternatives 4 and 5.

5.15.12 Reduction of Toxicity, Mobility and Volume with Treatment for Off-Site Alternatives

Source removal through off-site soil excavation will reduce the volume of contaminants present in soil for off-site Alternatives 2 though 5. Off-site Alternatives 3 and 4 would reduce the volume of contaminants to the greatest extent through excavation. Placement of the grout curtain and NAPL recovery wells adjacent to the Canal in all alternatives except Alternative 1 will significantly reduce overall NAPL mobility by collecting it and eliminating seeps into the Canal. Reduction of toxicity and volume of contaminants in groundwater would occur slowly through natural processes following source removal, and NAPL recovery downgradient. Sediment excavation included in off-site Alternatives 2 and 3 will reduce the volume of contaminants. Sediment capping included in off-site Alternatives 4 and 5 will reduce the mobility of contaminants in sediments.

5.15.13 Short-term Effectiveness for Off-Site Alternatives

Remediation including excavation, a grout curtain, a sediment cap, and NAPL recovery wells will not negatively impact human health or the environment as long as controls and a community air monitoring program are effectively implemented. It will however, present noise and disruption of daily traffic patterns and short-term risks to on-site workers. Dust control will be required. Off-site Alternatives 3 and 5 would require a longer time period for construction. Sediment capping or excavation will negatively affect the Canal environment in the short-term; however, it will be beneficial to wildlife over the long-term. The time for construction is approximately 1 year. RAOs would be met in the shortest time period for off-site Alternative 2 followed by off-site Alternative 3, off-site Alternative 4 (providing reduced mobility), and off-site Alternative 5.

5.15.14 Implementability for Off-Site Alternatives

All alternatives except off-site Alternative 1 include varying degrees of soil excavation that will disrupt pedestrian and vehicular traffic on Transit and LaGrange Streets, and nearby roadways and walkways. Excavation of off-site soil will impact the property owner and customers and will require construction sequencing to minimize impacts to off-site property owners and customers. Off-site Alternatives 3 and 5 will potentially affect property owners and customers to a greater extent. The grout curtain and NAPL recovery wells for all alternatives, except off-site Alternative 1, would be installed on off-site properties and require access agreements. Sediment excavation or a sediment cap in the Canal would require coordination with State and local agencies. The time for construction for off-site Alternatives 2 through 5 is approximately 1 year with sediment remediation proposed during the winter construction season.

5.15.15 Cost for Off-Site Alternatives

A review of costs for each alternative indicates that off-site Alternative 5 has the highest capital cost followed in descending order by off-site Alternatives 4, 3, 2, and 1. All off-site alternatives have similar annual OM&M costs except off-site Alternative 1. All off-site alternatives include 30 years of monitoring

In ascending order, the alternative which presents the lowest total present worth is off-site Alternative 1 followed by off-site Alternatives 2, 3, 4 and off-site Alternative 5 which has the highest total present worth.

5.15.16 Land Use

Off-site Alternatives 2 and 4 includes excavation within LaGrange Street. The SMP would have to be followed with restrictions on future off-site activities and use within the Reid Petroleum property. Off-site Alternatives 3 and 5 include off-site excavation of all impacted soil. The SMP would include minimal restrictions on future off-site activities within the Reid Petroleum property.

5.16 Screening of On-Site Alternatives

On-site Alternatives 4 and 5 and on-site Alternatives 7 and 8 are similar to each other with regard to the extent of on-site soil remediation. On-site Alternatives 4 and 5 include partial containment with hydraulic control, relocation of substation infrastructure from the western portion of the site and source excavation/treatment of 65% of potentially impacted soil. On-site Alternatives 7 and 8 include full substation relocation prior to remediation of 100% of potentially impacted soil. On-site Alternatives 3, 4 and 7 include excavation of source material; on-site Alternatives 5 and 8 include ISS of source material following excavation/demolition of MGP structures within the treatment area. While RAOs would be met for all these alternatives, on-site Alternatives 3, 5 and 8 result in the larger amount of residual material on-site and do not meet SCGs. Since on-site Alternatives 3, 4 and 7 would provide the greater level of protection to human health and the environment, meet SCGs to a greater extent, and are more permanent and effective, they are preferred over on-site Alternatives 5 and 8.

Hydraulic control and NAPL recovery within the site containment area are included in on-site Alternatives 4 and 6. Hydraulic control without a bottom liner is included in on-site Alternative 4 requiring a larger overburden groundwater extraction and pretreatment system. On-site Alternative 6, which includes a bottom liner, reduces the size of the hydraulic control system and includes bedrock NAPL recovery above the bottom liner. It is unknown whether an effective bottom liner can be installed below the active substation due to the difficulties in angled drilling through fractured bedrock. Further, a reduction in capital and OM&M costs for the pretreatment facilities as compared to the capital cost of installing the bottom liner are not realized when comparing the total present worth of the alternatives as shown on Table 5-1. On-site Alternative 4 is therefore preferred over on-site Alternative 6.

5.17 Screening of Off-Site Alternatives

When screening off-site alternatives, sediment excavation is considered more protective of human health and the environment, more effective and permanent in the long-term, and meets sediment SCGs, when compared to a sediment cap. Sediment excavation and capping are similar in implementability and short-term impacts. They both will meet RAOs. Sediment capping may be disturbed during future Canal dredging for navigation purposes. Off-site alternatives with sediment excavation (off-site Alternatives 2 and 3) are preferred over off-site alternatives with sediment capping (off-site Alternatives 4 and 5).

The difference between off-site Alternative 2 and off-site Alternative 3 is the volume of off-site soil subject to remediation. Off-site Alternative 2 includes remediation within LaGrange Street (excavation of 3,200 cy of which 458 cy is tar-impacted). Off-site Alternative 3 includes remediation within LaGrange Street and the Reid Petroleum property (excavation of 4,835 cy of which 611 cy is tar-impacted). While both off-site Alternatives 2 and 3 meets RAOs and would be protective of human health and the environment, off-site Alternative 2 is more implementable, and provides fewer impacts to off-site property owners and customers. Residual tar contaminated soil with off-site Alternative 2 would be an extremely small volume estimated at approximately 153 cy. Residual contaminated soil would generally be near the overburden/bedrock interface and not present a completed human health exposure pathway except during future excavation activities to the overburden/bedrock interface within identified contamination areas. If, in the future, excavation within the Reid Petroleum property were to be conducted within the identified contamination areas, NYSEG would implement an SMP, which includes managing potential exposure to residual contaminated soil, including procedures for soil characterization, handling, disposal, and health and safety of workers and the community.

5.18 Development of Site-Wide Alternatives

As discussed in Section 5.16, on-site Alternative 1, which is the No Action alternative, on-site Alternative 2 (containment alternatives), on-site Alternative 3 (partial source removal and containment), on-site Alternative 4 (partial source removal), and on-site Alternative 7 (full source removal) are preferred and will be carried forward and developed into the site-wide alternatives.

As discussed in Section 5.17, off-site Alternative 1, which is the No Action alternative, and off-site Alternative 2, which includes soil excavation within LaGrange Street and sediment excavation within the Canal, are preferred and will be carried forward and developed into the site-wide alternatives.

The five site-wide alternatives are:

- Site-wide Alternative 1 – No Action, SMP, Monitoring
- Site-wide Alternative 2 – NAPL Migration Barrier, Downgradient Grout Curtain and NAPL Recovery Wells, LaGrange Street Excavation, Sediment Excavation
- Site-wide Alternative 3 – Partial Source Removal and Containment with NAPL Control, Downgradient Grout Curtain and NAPL Recovery Wells, LaGrange Street Excavation, Sediment Excavation
- Site-wide Alternative 4 – Partial Containment with Hydraulic Control, Partial Source Removal, Downgradient Grout Curtain and NAPL Recovery Wells, LaGrange Street Excavation, Sediment Excavation
- Site-wide Alternative 5 – Substation Relocation, Source Removal, Downgradient Grout Curtain and NAPL Recovery Wells, LaGrange Street Excavation, Sediment Excavation.

Table 5-3 presents a summary of the site-wide remedial alternative cost estimates.

6.0 RECOMMENDED REMEDIAL ALTERNATIVE

On-site and off-site alternatives were developed and evaluated for remediation at the Transit Street Former MGP site. The evaluation of alternatives was conducted using remedial action objectives identified for cleanup levels to provide source and exposure pathway elimination or attain SCGs. Remediation areas and volumes were calculated for the cleanup levels identified for the site. Costs were developed for on-site and off-site alternatives. Preferred remedial alternatives for on-site and off-site were combined into five site-wide alternatives. Selection of a recommended remedy for the site as a whole will therefore include both on-site and off-site alternatives. This combination remediation strategy is protective of human health and the environment and considers the cost to implement each site-wide alternative.

6.1 Basis for Recommendation

Site-wide Alternative 1 was rejected because it does not provide additional protection to human health and the environment over existing conditions, does not meet SCGs, and does not satisfy RAOs for soil, sediments or NAPL/groundwater except through site management controls and restrictions.

All remaining site-wide alternatives include the common elements of a Site Management Plan with monitoring, removal of the on-site tar sumps and their contents, excavation of soil from portions of the site and LaGrange Street, downgradient NAPL recovery wells, a grout curtain with NAPL recovery wells near the Canal, and sediment excavation in the Canal area of MGP-impacted sediments. Site-wide Alternatives 2 though 5 will meet RAOs through implementation of the SMP and either source containment and/or removal. Once the source is contained and/or removed, contaminant levels in downgradient groundwater will be reduced over time, especially when combined with off-site remediation which includes a grout curtain and NAPL recovery in downgradient recovery wells as well as natural processes. On-site dual-phase NAPL/groundwater extraction with on-site pretreatment for site-wide Alternative 4 will improve groundwater quality in the overburden and bedrock in a shorter time frame as compared to other alternatives.

Site-wide Alternatives 4 and 5 differ in their approach to remediating on-site soil. Site-wide Alternative 4 includes partial source removal on-site and excavation within LaGrange Street. The western portion of the substation (Control House and 12 kV switchgear) would be relocated prior to remedial construction. Site-wide Alternative 5 includes full substation relocation, which would take several years to complete the siting, regulatory approval and permitting processes, and design and construction phases. Once substation relocation is complete, remediation of the entire on-site area may occur including excavation of all overburden soil and MGP structures within the NYSEG property and within LaGrange Street. NAPL at the overburden/bedrock interface would also be removed through the excavation process and from the downgradient NAPL recovery wells. Site-wide Alternative 5 provides the greatest level of source removal of all alternatives and results in no on-site residual in overburden materials. RAOs and SCGs for soil on-site and within LaGrange Street would be met. Of the remedial alternatives developed for the site, site-wide Alternative 5 would be the most permanent and effective and require the lowest level of OM&M (other than No Action) in the long-term. However, it also presents the highest total cost, implementability issues, and short-term impacts to workers and the community.

Site-wide Alternatives 2 through 4 present varying degrees of on-site soil, NAPL and groundwater containment and removal. They all require maintenance and monitoring to maintain their long-term permanence and effectiveness. Site-wide Alternatives 2 and 3 include a NAPL migration barrier and Alternative 3 includes excavation of source material from the western portion of the site and partial containment of the on-site source area. These alternatives would be implementable in a shorter construction time frame. Site-wide Alternative 4 includes partial excavation of on-site source material (soil and former MGP structures) to the greatest extent with containment of the residual through containment walls, NAPL recovery and dual-phase NAPL/groundwater extraction. Without substation relocation, site-wide Alternatives 2 through 4 present construction difficulties with regard to worker health and safety, and maintaining the substation in active use which would require careful construction scheduling and sequencing. Difficulties may arise from relocation of the Control House and 12 kV switchgear for site-wide Alternatives 3 and 4, according to NYSEG, as the electrical devices for relay or control of the substation are sensitive to vibrations. Excessive vibration may cause unintended power interruptions that would be unacceptable to NYSEG and its customers. Site-wide Alternatives 3 and 4 include capping the contained area with a geomembrane to limit infiltration. Of site-wide Alternatives 2 through 4, site-wide Alternatives 2 and 3 would be the most implementable in the shortest time period but would result in the greatest amount of on-site residual.

NAPL migration control is included with site-wide Alternatives 2 and 3 with the installation of a grout curtains, NAPL interceptor trench and NAPL recovery wells. Site-wide Alternative 3 includes partial on-site containment with a site cap to limit infiltration and containment walls on the west, south and east sides of the site to contain NAPL and soil. NAPL migration in the overburden and bedrock would be controlled with the interceptor trench, recovery wells and the grout curtain. Site-wide Alternatives 3, 4 and 5 would remove NAPL from the overburden within the excavation areas as well as from the NAPL recovery wells.

RAOs would be met for site-wide Alternatives 2 through 5 following remediation and implementation of the SMP. All alternatives except site-wide Alternative 5 would result in on-site residual requiring an SMP is to address residual material. The SMP would also address residual material in adjacent areas and within the Reid Petroleum property. Soil SCGs would be partially met for site-wide Alternative 4 , which presents less residual contamination both on-site and off-site Site-wide Alternative 5 presents the least amount of off-site residual.

Hydraulic control within the site containment area and downgradient NAPL recovery is included in site-wide Alternative 4. On-site long-term operation and maintenance of the NAPL/groundwater extraction and pretreatment systems would be necessary. Long-term monitoring of downgradient groundwater would also be necessary.

Based on the evaluation, site-wide Alternative 3, which includes: an SMP, relocation of the Control House and 12 kV switchgear, containment of a portion of the on-site area with containment walls on the west, south and east sides, a geomembrane cap, removal of the on-site tar sumps and their contents, grout curtain and NAPL recovery wells adjacent to the Canal excavation of impacted soil on the western side of the substation and within LaGrange Street, a NAPL interceptor trench immediately downgradient of the site to the overburden/bedrock interface and NAPL recovery wells in the bedrock is the recommended remedy for the site. Excavation of potentially impacted soil within LaGrange Street could continue during construction of the NAPL migration barrier. If these construction activities were properly coordinated, it would present fewer short-term impacts to off-site property owners, customers and the community. Site-wide Alternative 3 includes technologies that are protective of human health and the environment, contains residual contaminated soil, provides NAPL collection and migration control, and is effective and permanent in the long-term. Along with the Site Management Plan and downgradient NAPL extraction wells, the grout curtains, and sediment excavation. site-wide Alternative 3 is readily implementable and addresses the human health exposure pathways and meets RAOs with fewer short-term impacts than the majority of on-site alternatives. Careful remediation planning will be needed to avoid disruption in substation operation.

6.2 Recommended Remedy Components

The components of the Recommended Remedy (i.e., site-wide Alternative 3) are shown on Figure 6-1 and include the following:

- A Site Management Plan would include institutional controls and engineering controls to: manage potential exposure to residual contaminated soil by construction and utility workers on-site and in adjacent areas, including procedures for soil characterization, handling, disposal, and health and safety of workers and the community, as well as disposal/reuse in accordance with applicable NYSDEC regulations and procedures; and maintain use restrictions regarding site development and groundwater use. The SMP would include provisions related to residual material on the NYSEG property, and adjacent area including along Transit Street, on the Reid Petroleum property, and within LaGrange and Transit Streets.

- Relocation of the Control House and 12 kV switchgear from the western portion of the site to the eastern portion of the site.

- Tar from the tar sumps (approximately 14 cy) will be disposed or treated off-site at a thermal desorption facility.

- Excavation and removal of approximately 3,960 cy of source material from the western side of the substation. Approximately 3,210 cy would be to the overburden/bedrock interface in the northwestern portion, and approximately 750 cy would be to an estimated tar-impacted depth of approximately 7 feet in the southwestern portion.

- A geomembrane cap overlain with crushed stone would cover the surface of the contained area to limit infiltration. Care will be taken to seal the cap around substation equipment slabs.

- Approximately 450 linear feet of partially-penetrating containment walls would be constructed and keyed into the bedrock surface around the site (Areas A, B) on the west, south and east as shown in Figure 4-3. Walls would not extend to the ground surface, but would be constructed to a height approximately half the saturated thickness of the overburden. Containment walls would provide low permeability and contain soil contaminants and NAPL present at the overburden/bedrock interface. Wall construction materials and techniques will be assessed during design.
- Approximately 400 linear feet of vertical interceptor (gravel) trench would be constructed from approximately the overburden/bedrock interface within LaGrange Street. Sumps and approximately 4 NAPL recovery wells (or a collection pipe with recovery risers) would be installed within the lined trench to collect NAPL over a 30-year period.
- Approximately 400 linear feet of grout curtain in the bedrock would be constructed on the downgradient side of the interceptor trench. It would extend from 1 to 2 feet above the overburden/bedrock interface to an approximate depth of 75 feet to eliminate migration in the more permeable bedrock zones overlying the relatively impervious lower Rochester Shale. Ten new NAPL recovery wells would be installed on the upgradient side and endpoints of the curtain into the bedrock to collect NAPL over a 30-year period.
- Identified areas of off-site soil source material within LaGrange Street (approximately 3,200 cy) will be excavated. Excavated soil will be subject to stockpiling, waste characterization testing and either transported off-site to a thermal desorption facility or an appropriate landfill or re-used as backfill material. Excavated asphalt and clean demolition debris would be recycled or disposed at an appropriate landfill. Excavated areas would be backfilled, compacted, and restored to pre-construction conditions. It is estimated that at a minimum, approximately half (1,600 cy) of excavated soil within LaGrange Street may be re-used as backfill material. Disrupted utilities will be restored. LaGrange Street will be re-surfaced to Saxton Street.
- Bedrock grouting will require further evaluation and pilot testing to refine techniques, materials, monitoring, and implementability.

- NAPL recovery in off-site downgradient wells (new recovery wells will include unscreened collection sumps) will initially be performed manually to determine recovery rates in existing monitoring wells and new NAPL recovery wells. If any of the selected existing wells are rendered unusable during remediation, they will be replaced as new NAPL recovery wells. Once sustained recovery rates are established, consideration will be given to automate recovery with dedicated pumps on timed pumping cycles, and/or enhanced recovery methods as described in Section 3. As shown on Figure 4-13, NAPL will be collected from 9 existing monitoring wells, 9 new downgradient NAPL recovery wells located both east and west of the Transit Street Bridge, and 6 new NAPL recovery wells near the grout curtain to collect NAPL.

- The location of the grout curtain adjacent to the Canal shown on Figure 6-1 will be refined and placed with a sufficient protective offset from the Main Interceptor Tunnel. The number and location of NAPL recovery wells associated with this grout curtain may be refined based on observed grout takes during grout wall construction (i.e., zones or locations with higher grout takes indicate higher fluid transmissivity). The preliminary estimate includes 6 NAPL recovery wells adjacent to and upgradient of the grout curtain. A detail of proposed remediation in this area is shown on Figure 6-2. The grout wall will be placed as close to the Canal face as possible so that during construction, the fractures can be grouted until grout bleeds through the Canal face, encapsulating or displacing remaining NAPL in fractures between the grout wall and the Canal face. During the Design Phase, factors such as Canal rock face stability, Interceptor Tunnel location, the presence of utility lines, and anticipated horizontal grout penetration will be factored into the grout wall and NAPL recovery well locations. The number of NAPL recovery wells necessary behind the wall will be evaluated based on initial recoveries to determine if additional recovery wells would be beneficial. Depending on how close to the Canal face the grout wall is placed, there is the potential for residual NAPL to remain in fractures between the grout wall and the Canal face. The remaining volume of NAPL would likely be at *de minimus* levels, since larger fractures that would contain more NAPL would also allow grout penetration to a further distance than in the smaller fractures. Since the grout wall will eliminate the NAPL migration pathway, long term NAPL flow to the Canal will be cut off. It is expected that within a few years of seasonally cycling the Canal water level up and down, the remaining residual NAPL will be flushed from the fractures.

- Sediment remediation will not commence until such time in the future when on-site remediation is complete, and observations indicate that NAPL seeps from the Canal face have ceased. A sediment delineation program will be conducted prior to sediment remediation as discussed in Section 6.3. Sediment remediation will include:
  1. Obtaining access both from above (for transportation equipment) and within the Canal (for excavation equipment) during the winter months when the Canal has been drained.
  2. Sediment excavation of approximately 1,200 cy in the area identified.
  3. Potential dewatering and/or drying/moisture conditioning of excavated sediment prior to transportation off-site to a thermal desorption facility or an appropriate landfill (may require construction of a sediment management containment area).
  4. Following sediment removal, excavated areas are proposed to be left as-is (i.e., not backfilled).
- Annual sampling and analysis for VOCs and SVOCs, in addition to indicator parameters (e.g., oxidation-reduction potential, pH, temperature and conductivity) would be performed in 12 select existing groundwater monitoring wells shown on Figure 6-1. The list of parameters and monitoring wells may be modified following data review of monitoring results.
- An annual report and Five-Year Review will evaluate OM&M activities and recommend any necessary changes to the remediation and/or OM&M program over the long-term.

The total capital cost of the recommended alternative is $9,857,000, annual OM&M costs are $74,000, and the total present worth is $10,995,000.

6.3 Additional Investigations

Additional investigation and/or evaluation will be necessary to design the Recommended Remedy and will include, at a minimum, the following:

- Site topographic and site features survey.
- Structural evaluation of site retaining walls.
- Utility survey within and adjacent to remediation areas.
- Geotechnical borings in the overburden for excavation stability analysis and containment wall technology evaluation.
- Pilot demonstration of bedrock fracture grouting in vertical and angled orientations in order to develop design information regarding grout types, grout compatibility with site contaminants, grout hole spacing, grout take, means and methods, and barrier continuity in order to develop site-specific design and cost information for full-scale implementation.
- A sediment delineation program will be conducted prior to sediment remediation. In order to determine excavation endpoints. Sediment excavation will, at a minimum, include the defined area adjacent to the seeps that exhibits visible indicators of coal tar (i.e., NAPL and/or petroleum-like sheens on the sediments), as the sediment chemistry forensics indicated multiple sources of PAHs throughout the Canal. Additional sampling and analysis for MGP-impacted sediment is proposed between SED-16 where MGP impacts were noted, and SED-05 approximately 800 feet upstream where no impacts were noted.

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TABLES

TABLE 1-1
POTENTIALLY APPLICABLE STANDARDS, CRITERIA AND GUIDANCE

Division/ Agency	Title	Standard or Guidance	Requirements
DAR/ NYSDEC	Air Guide 1 – Guidelines for the Control of Toxic Ambient Air Contaminants	G	▪ Control of toxic air contaminants ▪ Screening analysis for ambient air impacts ▪ Toxicity classifications ▪ Ambient standards – short-term/annual
DAR/ NYSDEC	6 NYCRR Part 200 (200.6) – General Provisions	S	▪ Ambient standards - Prohibits contravention of Ambient Air Quality Standards or causes of air pollution
DAR/ NYSDEC	6 NYCRR Part 201 - Permits & Certificates	S	▪ Ambient standards - Prohibits construction/operation without a permit/certificate
DAR/ NYSDEC	6 NYCRR Part 211 (211.1) – General Prohibitions	S	▪ Ambient standards -Prohibits emissions which are injurious to human, plant, or animal life, or causes a nuisance
DAR/ NYSDEC	6 NYCRR Part 212 – General Process Emission Sources	S	▪ Establishes control requirements
DAR/ NYSDEC	6 NYCRR Part 257 – Air Quality Standards	S	▪ Applicable air quality standards
DER/ NYSDEC	TAGM HWR-89-4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites	G	▪ Dust suppression during Interim Remedial Measures/Remedial Actions
DER/ NYSDEC	TAGM HWR-92-4030 Selection of Remedial Actions at Inactive Hazardous Waste Sites	G	▪ Remedy selection criteria/evaluations
DER/ NYSDEC	TAGM HWR-92-4042 Interim Remedial Measures	G	▪ Define and track Interim Remedial Measures (IRMs)
DER/ NYSDEC	TAGM 4061 – Management of Coal Tar Waste and Coal Tar Contaminated Sediment From Former Manufactured Gas Plants (MGPs)	G	▪ Coal tar waste and coal tar contaminated soils and sediment that exhibit the toxicity characteristic for Benzene (D018) may be conditionally exempt from 6 NYCRR Parts 370 – 374 and 376 when they are destined for permanent thermal treatment

TABLE 1-1 (Continued)

Division/ Agency	Title	Standard or Guidance	Requirements
DER/ NYSDEC	6 NYCRR Part 375 – Inactive Hazardous Waste Disposal Site Remediation Program	S	▪ Remedial program requirements ▪ Private party programs; state funded programs; state assistance to municipalities
DFW/ NYSDEC	Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA)	G	▪ Habitat assessments ▪ Contaminant impact assessments ▪ Ecological effects of remedies ▪ Remedial requirements ▪ Monitoring ▪ Checklist
DOW/ NYSDEC	Analytical Services Protocols (ASP)	G	▪ Analytical procedures
DOW/ NYSDEC	TOGS 1.1.2 – Groundwater Effluent Limitations	G	▪ Guidance for developing effluent limitations
DOW/ NYSDEC	TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values	G	▪ Compilation of ambient water quality standards and guidance values
DOW/ NYSDEC	TOGS 1.2.1 – Industrial SPDES Permit Drafting Strategy for Surface Waters	G	▪ Guidance for developing effluent and monitoring limits for point source releases to surface water
DOW/ NYSDEC	TOGS 1.3.8 – New Discharges to Publicly Owned Treatment Works	G	▪ Limits on new or changed discharges to POTWs; strict requirements regarding bioaccumulative and persistent substances; plus other considerations
DOW/ NYSDEC	6 NYCRR Part 702-15(a), (b), (c), (d) & (e)	S	▪ Empowers NYSDEC to apply and enforce guidance where there is no promulgated standard
DOW/ NYSDEC	6 NYCRR Part 700-705 – NYSDEC Water Quality Regulations for Surface Waters and Groundwater	S	▪ 700 – Definitions, Samples and Tests; ▪ 701 – Classifications for Surface Waters and Groundwaters; ▪ 702 – Derivation and Use of Standards and Guidance Values; ▪ 703 – Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards

TABLE 1-1 (Continued)

Division/ Agency	Title	Standard or Guidance	Requirements
DOW/ NYSDEC	6 NYCRR Part 750-757 – Implementation of NPDES Program in NYS	S	▪ Regulations regarding the SPDES program
DSHM/ NYSDEC	6 NYCRR Part 364 – Waste Transporter Permits	S	▪ Regulates collection, transport, and delivery of regulated waste
DSHM/ NYSDEC	6 NYCRR Part 360 – Solid Waste Management Facilities	S	▪ Solid waste management facility requirements; landfill closures; construction & demolition (C&D) landfill requirements; used oil; medical waste; etc.
DSHM/ NYSDEC	6 NYCRR Part 370 – Hazardous Waste Management System: General	S	▪ Definitions and terms and general standards applicable to Parts 370-374 and 376
DSHM/ NYSDEC	6 NYCRR Part 371 – Identification and Listing of Hazardous Wastes	S	▪ Hazardous waste determinations
DSHM/ NYSDEC	6 NYCRR Part 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities	S	▪ Manifest system and record keeping; certain management standards
DSHM/ NYSDEC	6 NYCRR Part 376 – Land Disposal Restrictions	S	▪ Identifies hazardous waste restricted from land disposal
DSHM/ NYSDEC	6 NYCRR Subpart 373-1 – Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements	S	▪ Hazardous waste permitting requirements; includes substantive requirements
DSHM/ NYSDEC	6 NYCRR Subpart 373-2 – Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	S	▪ Hazardous waste management standards such as contingency plans; releases from SWMUs; closure/post closure; container management; tank management; surface impoundments; waste piles; landfills; incinerators; etc.
DSHM/ NYSDEC	6 NYCRR subpart 373-3 – Interim Status Standards for Owners and Operators of Hazardous Waste Facilities	S	▪ Similar to 373-2

TABLE 1-1 (Continued)

Division/ Agency	Title	Standard or Guidance	Requirements
OSHA/ PESH	29 CFR Part 1910.120; Hazardous Waste Operations and Emergency Response	S	▪ Health and safety
USEPA	40 CFR Part 261 – Hazardous Waste Management System; Definition of Solid Waste; Toxicity Characteristic; Final Rule; Response to Court Order Vacating Regulatory Provisions	S	▪ TCLP may not be used for determining whether MGP waste is hazardous under RCRA

TABLE 1-2
New York State Barge Canal - 2007 Additional Sediment Sampling Program
NYSEG - Transit Street, Lockport, New York

Sediment Sample Location ID	Depth of Sediment Sample Collected	Description	MiniRae 2000 PID (ppm)	MGP or Other Undifferentiated Petroleum Indicators (Y/N)
07-SED-01	0'-2'	Brown Silt, trace gravel.	Non-detect	No
	2'-4'	Gray-Black Clayey Silt.	Non-detect	Yes, undifferentiated petroleum odor
	4'-5'	Black Clayey Silt, trace sand.	Non-detect	Yes, slight undifferentiated petroleum odor
07-SED-02	0'-2'	Gray-Brown Clayey Silt.	Non-detect	No
	2'-4'	Dark Gray-Black Clayey Silt, trace sand, trace organics.	Non-detect	Yes, undifferentiated petroleum odor, stronger odor at 4'.
07-SED-03	0'-2'	Gray-Brown Clayey Silt, trace sand.	Non-detect	No
	2'-4'	Dark Gray-Black Clayey Silt.	Non-detect	Yes, undifferentiated petroleum odor
	4'-5'	Dark Gray-Black Clayey Silt.	Non-detect	Yes, undifferentiated petroleum odor
07-SED-04	0'-2'	Gray-Brown Clayey Silt, trace sand.	Non-detect	Yes, slight undifferentiated petroleum odor
	2'-3'	Dary Gray Clayey Silt, trace sand.	Non-detect	Yes slight undifferentiated petroleum odor
07-SED-05	0'-2'	Brown Clayey Silt, trace sand.	Non-detect	Yes, undifferentiated petroleum odor
	2'-3'	Dary Gray Clayey Silt, trace sand.	Non-detect	Yes, undifferentiated petroleum odor
07-SED-06	0'-2'	Brown Clayey Silt, trace sand.	Non-detect	No
	2'-3'	Brown Clayey Silt, organics, trace gravel.	Non-detect	No

Note: All locations were advanced using a hand driven Macrocore sampler until refusal.

TABLE 1-2
New York State Barge Canal - 2007 Additional Sediment Sampling Program
NYSEG - Transit Street, Lockport, New York

Sediment Sample Location ID	Depth of Sediment Sample Collected	Description	MiniRae 2000 PID (ppm)	MGP or Other Undifferentiated Petroleum Indicators (Y/N)
07-SED-07	0'-2'	Brown Clayey Silt, trace sand.	Non-detect	No
	2'-4'	Brown to Gray-Brown Clayey Silt, trace sand.	Non-detect	Yes, slight undifferentiated petroleum odor
	4'-6'	Dary Gray Clayey Silt, trace sand.	Non-detect	Yes, slight undifferentiated petroleum odor
07-SED-08	0'-2'	Brown Clayey Silt.	Non-detect	No
	2'-4'	Brown Clayey Silt.	Non-detect	No
	4'-5'	Brown-Gray Clayey Silt, trace gravel, trace wood.	Non-detect	No
07-SED-09	0'-2'	Brown Clayey Silt.	Non-detect	No
	2'-4'	Dark Gray-Black Clayey Silt, some gravel.	Non-detect	Yes, moderate undifferentiated petroleum odor and sheen
07-SED-10	0'-2'	Brown Clayey Silt.	Non-detect	No
	2'-4'	Gray Brown Clayey Silt.	Non-detect	No
	4'-5'	Dark Gray-Black Clayey Silt and Gravel.	Non-detect	Yes, slight sheen and moderate undifferentiated petroleum odor

Note: All locations were advanced using a hand driven Macrocore sampler until refusal.

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-01	07-SED-01	07-SED-02	07-SED-02	07-SED-02
Sample ID		07-SED-01-0-2	07-SED-01-4-5	07-SED-02-0-2	07-SED-02-2-4	07-SED-02-2-4-DUP
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		0.0-2.0	4.0-5.0	0.0-2.0	2.0-4.0	2.0-4.0
Date Sampled		12/13/07	12/13/07	12/13/07	12/13/07	12/13/07
Parameter	**Units**					Field Duplicate (0-1)
Volatile Organic Compounds						
Benzene	UG/KG	27 U	33 U	21 U	35 U	33 U
Ethylbenzene	UG/KG	27 U	33 U	21 U	35 U	33 U
Toluene	UG/KG	27 U	33 U	21 U	35 U	33 U
Xylene (total)	UG/KG	82 U	98 U	62 U	100 U	98 U
Total BTEX	UG/KG	ND	ND	ND	ND	ND
Semivolatile Organic Compounds						
2-Methylnaphthalene	UG/KG	140 U	270 U	120 U	260 U	260 U
Acenaphthene	UG/KG	140 U	270 U	120 U	260 U	260 U
Acenaphthylene	UG/KG	140 U	110 J	27 J	120 J	79 J
Anthracene	UG/KG	140 U	88 J	120 U	160 J	92 J
Benzo(a)anthracene	UG/KG	120 J	350	170	780	490
Benzo(a)pyrene	UG/KG	94 J	460	160	710	430
Benzo(b)fluoranthene	UG/KG	170 J	850 J	230 J	1,000 J	690 J
Benzo(g,h,i)perylene	UG/KG	130 J	430	170	600	430
Benzo(k)fluoranthene	UG/KG	140 U	270 U	120 U	260 U	260 U
Chrysene	UG/KG	83 J	390	110 J	530	320
Dibenz(a,h)anthracene	UG/KG	36 J	160 J	44 J	150 J	98 J
Dibenzofuran	UG/KG	140 U	270 U	120 U	260 U	260 U
Fluoranthene	UG/KG	180	480	180	1,200	770
Fluorene	UG/KG	140 U	270 U	120 U	64 J	260 U
Indeno(1,2,3-cd)pyrene	UG/KG	91 J	370	140	480	360
Naphthalene	UG/KG	140 U	270 U	120 U	260 U	260 U
Phenanthrene	UG/KG	100 J	260 J	71 J	500	220 J

Flags assigned during chemistry validation are shown.

U - Not detected above the reported quantitation limit.
J - The reported concentration is an estimated value.
R - Rejected, the data is unusable.
ND - Not detected (used for total analyte groups only).

Detection Limits shown are PQL

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-01	07-SED-01	07-SED-02	07-SED-02	07-SED-02
Sample ID		07-SED-01-0-2	07-SED-01-4-5	07-SED-02-0-2	07-SED-02-2-4	07-SED-02-2-4-DUP
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		0.0-2.0	4.0-5.0	0.0-2.0	2.0-4.0	2.0-4.0
Date Sampled		12/13/07	12/13/07	12/13/07	12/13/07	12/13/07
Parameter	Units					Field Duplicate (0-1)
Semivolatile Organic Compounds						
Pyrene	UG/KG	130 J	400	150	820	560
Total Carcinogenic PAHs	UG/KG	594	2,580	854	3,650	2,388
Total Non-Carcinogenic PAHs	UG/KG	540	1,768	598	3,464	2,151
Total Polycyclic Aromatic Hydrocarbons	UG/KG	1,134	4,348	1,452	7,114	4,539
Miscellaneous Parameters						
Total Cyanide	MG/KG	1.6 U	3.1	1.4 U	1.3 U	1.3 U
Phenolics, Total Recoverable	MG/KG	R	R	R	R	R
Total Organic Carbon (TOC)	MG/KG	45,900	43,400	45,800	46,500	40,400

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TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-03	07-SED-03	07-SED-04	07-SED-04	07-SED-05
Sample ID		07-SED-03-2-4	07-SED-03-4-5	07-SED-04-0-2	07-SED-04-2-3	07-SED-05-0-2
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		2.0-4.0	4.0-5.0	0.0-2.0	2.0-3.0	0.0-2.0
Date Sampled		12/13/07	12/13/07	12/13/07	12/13/07	12/13/07
Parameter	Units					
Volatile Organic Compounds						
Benzene	UG/KG	27 U	25 U	26 U	29 U	20 U
Ethylbenzene	UG/KG	27 U	25 U	26 U	29 U	20 U
Toluene	UG/KG	27 U	25 U	26 U	29 U	20 U
Xylene (total)	UG/KG	81 U	75 U	78 U	88 U	59 U
Total BTEX	UG/KG	ND	ND	ND	ND	ND
Semivolatile Organic Compounds						
2-Methylnaphthalene	UG/KG	280 U	130 U	260 U	140 U	250 U
Acenaphthene	UG/KG	280 U	85 J	260 U	140 U	250 U
Acenaphthylene	UG/KG	100 J	110 J	52 J	40 J	250 U
Anthracene	UG/KG	98 J	78 J	78 J	36 J	63 J
Benzo(a)anthracene	UG/KG	410	420	400	180	290
Benzo(a)pyrene	UG/KG	340	350	300	160	250
Benzo(b)fluoranthene	UG/KG	590 J	480 J	510 J	270 J	440 J
Benzo(g,h,i)perylene	UG/KG	370	290	300	170	270
Benzo(k)fluoranthene	UG/KG	280 U	130 U	260 U	140 U	250 U
Chrysene	UG/KG	290	280	280	130 J	320
Dibenz(a,h)anthracene	UG/KG	120 J	92 J	90 J	66 J	70 J
Dibenzofuran	UG/KG	280 U	130 U	260 U	140 U	250 U
Fluoranthene	UG/KG	650	450	730	250	480
Fluorene	UG/KG	280 U	62 J	68 J	32 J	250 U
Indeno(1,2,3-cd)pyrene	UG/KG	270 J	220	280	140	210 J
Naphthalene	UG/KG	280 U	26 J	260 U	140 U	250 U
Phenanthrene	UG/KG	300	180	280	150	220 J

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TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-03	07-SED-03	07-SED-04	07-SED-04	07-SED-05
Sample ID		07-SED-03-2-4	07-SED-03-4-5	07-SED-04-0-2	07-SED-04-2-3	07-SED-05-0-2
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		2.0-4.0	4.0-5.0	0.0-2.0	2.0-3.0	0.0-2.0
Date Sampled		12/13/07	12/13/07	12/13/07	12/13/07	12/13/07
Parameter	Units					
Semivolatile Organic Compounds						
Pyrene	UG/KG	470	380	480	210	380
Total Carcinogenic PAHs	UG/KG	2,020	1,842	1,860	946	1,580
Total Non-Carcinogenic PAHs	UG/KG	1,988	1,661	1,988	888	1,413
Total Polycyclic Aromatic Hydrocarbons	UG/KG	4,008	3,503	3,848	1,834	2,993
Miscellaneous Parameters						
Total Cyanide	MG/KG	1.5 U	1.5	1.5 U	1.4 U	1.7
Phenolics, Total Recoverable	MG/KG	R	R	R	R	R
Total Organic Carbon (TOC)	MG/KG	46,700	43,800	52,600	57,600	42,900

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TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-05	07-SED-06	07-SED-06	07-SED-07	07-SED-07
Sample ID		07-SED-05-2-3	07-SED-06-0-2	07-SED-06-2-3	07-SED-07-2-4	07-SED-07-4-6
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		2.0-3.0	0.0-2.0	2.0-3.0	2.0-4.0	4.0-6.0
Date Sampled		12/13/07	12/14/07	12/14/07	12/14/07	12/14/07
Parameter	Units					
Volatile Organic Compounds						
Benzene	UG/KG	25 U	22 U	26 U	42 U	37 U
Ethylbenzene	UG/KG	25 U	22 U	26 U	42 U	37 U
Toluene	UG/KG	25 U	22 U	26 U	42 U	37 U
Xylene (total)	UG/KG	76 U	66 U	78 U	130 U	110 U
Total BTEX	UG/KG	ND	ND	ND	ND	ND
Semivolatile Organic Compounds						
2-Methylnaphthalene	UG/KG	230 U	110 U	23 J	52 J	140 U
Acenaphthene	UG/KG	53 J	110 U	100 U	150	140 U
Acenaphthylene	UG/KG	130 J	140	190	42 J	140 U
Anthracene	UG/KG	200 J	94 J	130	140 J	140 U
Benzo(a)anthracene	UG/KG	840	460	760	210	110 J
Benzo(a)pyrene	UG/KG	790	560	880	160	75 J
Benzo(b)fluoranthene	UG/KG	1,200 J	680 J	1,100 J	180	130 J
Benzo(g,h,i)perylene	UG/KG	670	540	780	140 J	90 J
Benzo(k)fluoranthene	UG/KG	230 U	110 U	100 U	120 J	140 U
Chrysene	UG/KG	600	300	480	140 J	70 J
Dibenz(a,h)anthracene	UG/KG	210 J	160	240	150 U	140 U
Dibenzofuran	UG/KG	230 U	110 U	100 U	78 J	140 U
Fluoranthene	UG/KG	1,400	490	800	400	130 J
Fluorene	UG/KG	88 J	110 U	52 J	200	140 U
Indeno(1,2,3-cd)pyrene	UG/KG	560	440	650	120 J	73 J
Naphthalene	UG/KG	230 U	110 U	100 U	150 U	140 U
Phenanthrene	UG/KG	700	130	270	770	71 J

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Detection Limits shown are PQL

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-05	07-SED-06	07-SED-06	07-SED-07	07-SED-07
Sample ID		07-SED-05-2-3	07-SED-06-0-2	07-SED-06-2-3	07-SED-07-2-4	07-SED-07-4-6
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		2.0-3.0	0.0-2.0	2.0-3.0	2.0-4.0	4.0-6.0
Date Sampled		12/13/07	12/14/07	12/14/07	12/14/07	12/14/07
Parameter	Units					
Semivolatile Organic Compounds						
Pyrene	UG/KG	940	380	600	280	100 J
Total Carcinogenic PAHs	UG/KG	4,200	2,600	4,110	930	458
Total Non-Carcinogenic PAHs	UG/KG	4,181	1,774	2,845	2,174	391
Total Polycyclic Aromatic Hydrocarbons	UG/KG	8,381	4,374	6,955	3,104	849
Miscellaneous Parameters						
Total Cyanide	MG/KG	2.3	0.76	0.92	3.0	1.1
Phenolics, Total Recoverable	MG/KG	14.2 J	R	R	R	R
Total Organic Carbon (TOC)	MG/KG	42,100	38,000	56,300	46,500	48,300

Flags assigned during chemistry validation are shown.

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J - The reported concentration is an estimated value.
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ND - Not detected (used for total analyte groups only).

Detection Limits shown are PQL

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-08	07-SED-08	07-SED-09	07-SED-09	07-SED-10
Sample ID		07-SED-08-2-4	07-SED-08-4-5	07-SED-09-0-2	07-SED-09-2-4	07-SED-10-2-4
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		2.0-4.0	4.0-5.0	0.0-2.0	2.0-4.0	2.0-4.0
Date Sampled		12/14/07	12/14/07	12/14/07	12/14/07	12/14/07
Parameter	Units					
Volatile Organic Compounds						
Benzene	UG/KG	40 U	21 U	41 U	38 U	36 U
Ethylbenzene	UG/KG	40 U	5 J	41 U	38 U	36 U
Toluene	UG/KG	40 U	21 U	41 U	38 U	36 U
Xylene (total)	UG/KG	120 U	18 J	120 U	110 U	110 U
Total BTEX	UG/KG	ND	23	ND	ND	ND
Semivolatile Organic Compounds						
2-Methylnaphthalene	UG/KG	160 U	130 U	160 U	120 U	130 U
Acenaphthene	UG/KG	160 U	130 U	160 U	120	130 U
Acenaphthylene	UG/KG	160 U	130 U	160 U	120 U	130 U
Anthracene	UG/KG	160 U	32 J	63 J	120	32 J
Benzo(a)anthracene	UG/KG	160	150	330	330	190
Benzo(a)pyrene	UG/KG	190	160	410	240	170
Benzo(b)fluoranthene	UG/KG	370 J	280 J	820 J	370 J	280 J
Benzo(g,h,i)perylene	UG/KG	270	190	560	230	180
Benzo(k)fluoranthene	UG/KG	160 U	130 U	160 U	120 U	130 U
Chrysene	UG/KG	230	190	480	230	140
Dibenz(a,h)anthracene	UG/KG	65 J	52 J	120 J	52 J	53 J
Dibenzofuran	UG/KG	160 U	130 U	160 U	120 U	130 U
Fluoranthene	UG/KG	360	350	930	730	340
Fluorene	UG/KG	160 U	130 U	160 U	88 J	130 U
Indeno(1,2,3-cd)pyrene	UG/KG	210	140	440	190	160
Naphthalene	UG/KG	160 U	130 U	160 U	50 J	130 U
Phenanthrene	UG/KG	130 J	120 J	330	340	140

Flags assigned during chemistry validation are shown.

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Detection Limits shown are PQL

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-08	07-SED-08	07-SED-09	07-SED-09	07-SED-10
Sample ID		07-SED-08-2-4	07-SED-08-4-5	07-SED-09-0-2	07-SED-09-2-4	07-SED-10-2-4
Matrix		Sediment	Sediment	Sediment	Sediment	Sediment
Depth Interval (ft)		2.0-4.0	4.0-5.0	0.0-2.0	2.0-4.0	2.0-4.0
Date Sampled		12/14/07	12/14/07	12/14/07	12/14/07	12/14/07
Parameter	Units					
Semivolatile Organic Compounds						
Pyrene	UG/KG	250	220	570	540	240
Total Carcinogenic PAHs	UG/KG	1,225	972	2,600	1,412	993
Total Non-Carcinogenic PAHs	UG/KG	1,010	912	2,453	2,218	932
Total Polycyclic Aromatic Hydrocarbons	UG/KG	2,235	1,884	5,053	3,630	1,925
Miscellaneous Parameters						
Total Cyanide	MG/KG	1.3 U	1.0 U	1.6 U	0.92 U	1.3 U
Phenolics, Total Recoverable	MG/KG	R	R	R	R	R
Total Organic Carbon (TOC)	MG/KG	42,200	105,000	37,000	57,800	39,700

Flags assigned during chemistry validation are shown.

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J - The reported concentration is an estimated value.
R - Rejected, the data is unusable.
ND - Not detected (used for total analyte groups only).

Detection Limits shown are PQL

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-10
Sample ID		07-SED-10-4-5
Matrix		Sediment
Depth Interval (ft)		4.0-5.0
Date Sampled		12/14/07
Parameter	Units	
Volatile Organic Compounds		
Benzene	UG/KG	36 U
Ethylbenzene	UG/KG	36 U
Toluene	UG/KG	36 U
Xylene (total)	UG/KG	110 U
Total BTEX	UG/KG	ND
Semivolatile Organic Compounds		
2-Methylnaphthalene	UG/KG	120
Acenaphthene	UG/KG	110 U
Acenaphthylene	UG/KG	110 U
Anthracene	UG/KG	110 U
Benzo(a)anthracene	UG/KG	320
Benzo(a)pyrene	UG/KG	160
Benzo(b)fluoranthene	UG/KG	240 J
Benzo(g,h,i)perylene	UG/KG	170
Benzo(k)fluoranthene	UG/KG	110 U
Chrysene	UG/KG	300
Dibenz(a,h)anthracene	UG/KG	110 U
Dibenzofuran	UG/KG	110 U
Fluoranthene	UG/KG	360
Fluorene	UG/KG	110 U
Indeno(1,2,3-cd)pyrene	UG/KG	120
Naphthalene	UG/KG	150
Phenanthrene	UG/KG	450

Flags assigned during chemistry validation are shown.

U - Not detected above the reported quantitation limit.
J - The reported concentration is an estimated value.
R - Rejected, the data is unusable.
ND - Not detected (used for total analyte groups only).

Detection Limits shown are PQL

TABLE 1-3
SUMMARY OF 2007 SEDIMENT SAMPLE ANALYTICAL RESULTS
FORMER TRANSIT STREET MGP SITE - LOCKPORT, NY
NEW YORK STATE ELECTRIC AND GAS

Location ID		07-SED-10
Sample ID		07-SED-10-4-5
Matrix		Sediment
Depth Interval (ft)		4.0-5.0
Date Sampled		12/14/07
Parameter	Units	
Semivolatile Organic Compounds		
Pyrene	UG/KG	600
Total Carcinogenic PAHs	UG/KG	1,140
Total Non-Carcinogenic PAHs	UG/KG	1,850
Total Polycyclic Aromatic Hydrocarbons	UG/KG	2,990
Miscellaneous Parameters		
Total Cyanide	MG/KG	1.1 U
Phenolics, Total Recoverable	MG/KG	R
Total Organic Carbon (TOC)	MG/KG	59,600

Flags assigned during chemistry validation are shown.

U - Not detected above the reported quantitation limit.
J - The reported concentration is an estimated value.
R - Rejected, the data is unusable.
ND - Not detected (used for total analyte groups only).

Detection Limits shown are PQL

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[LOGDATE] >= #12/13/2007# AND [MATRIX] = 'SE

TABLE 3-1
SUMMARY OF REMEDIAL TECHNOLOGY SCREENING
Page 1 of 3

General Response Actions	Remedial Technologies for Soil	Description	Screening Comments
No Action	Site Management Plan	SMP would include IC/EC to manage residual contamination.	Retained for site use.
Containment	Capping	Geomembrane Cap to limit infiltration.	Retained for site use.
	Vertical Barriers	Vertical barriers installed to the top of bedrock (e.g., sheet piling, soil cement wall, jet grouting)	Retained for site use as appropriate.
	Horizontal Barrier	Pressure grouted bottom liner within bedrock	Retained for site use.
Source Removal	Excavation and Off-site Disposal/Treatment	Excavate contaminated soil and transport off-site for disposal/treatment.	Retained for site use.
	On-site Ex-situ Treatment	Excavate contaminated soil and sediments and treat on-site.	Not retained for site use.
In-situ Treatment	Biological Treatment	Microorganisms, oxygen, and/or nutrients added to subsurface to reduce the toxicity of contaminants in soil.	Not retained for site use.
	Chemical/Physical Treatment	Chemical Oxidation (ISCO) – oxidants are injected into the subsurface to destroy contaminants and convert them to non-toxic compounds.	Not retained for site use.
	Solidification	ISS - Using excavator buckets or other injection/mixing technology, contaminated soil is mixed in-situ with binders isolating and immobilizing contaminants.	Retained for site use.
	Thermal Treatment	Various processes to increase temperatures of soil; off-gases are collected and treated. Groundwater control may be needed to retain heat during treatment and to maintain control of contaminant migration.	Not retained for site use.

TABLE 3-1 (Continued)
SUMMARY OF REMEDIAL TECHNOLOGY SCREENING
Page 2 of 3

General Response Actions	Remedial Technologies for NAPL/Groundwater	Description	Screening Comments
No Action	Site Management Plan with Monitoring	SMP would include IC/EC to manage residual contamination. Monitoring would indicate the degree naturally-occurring processes reduce contamination levels.	Retained for site use.
Containment	Grout Curtain	A jet-grouted curtain may be installed downgradient of site either within LaGrange St. or near the seep face. NAPL recovery wells would be located upgradient and at the edges.	Grout curtains will be retained.
	NAPL Migration Barrier	Grout curtain with a permeable trench immediately upgradient and NAPL recovery wells	Retained for use in LaGrange St.
	Containment walls	Containment walls (full and partially-penetrating) installed to the top of bedrock (e.g., sheet piling, soil cement wall, jet grouting)	Retained for site use as appropriate.
	Horizontal Barriers	Pressure grouted bottom liner within bedrock	Retained for site use.
	Groundwater Extraction Wells	Extraction wells or well points to collect groundwater.	Retained for site use.
Source Removal	Passive NAPL Recovery Wells	Hand bailing of selected existing monitoring wells and new NAPL recovery wells	Retained for site use.
	Enhanced NAPL Recovery Wells	Dual-Phase Extraction – collects groundwater and NAPL	Retained for site use.
		Surfactant – Enhanced NAPL Recovery – Surfactants injected into subsurface to increase NAPL solubility and mobility.	Not retained for site use.
		Thermal-enhanced NAPL Recovery – Heat added to subsurface to decrease viscosity and increase NAPL mobility.	Not retained for site use.
Treatment	In-situ Groundwater Treatment	Relief Gate – Passive subsurface treatment (activated carbon) gate in vertical barrier.	Not retained for site use.
	Groundwater Treatment On-site	On-site water treatment facility; discharge to groundwater.	Not retained for site use.
	Groundwater Pretreatment On-site	On-site water pretreatment with full treatment at POTW	Retained for site use.

TABLE 3-1 (Continued)
SUMMARY OF REMEDIAL TECHNOLOGY SCREENING
Page 3 of 3

General Response Actions	Remedial Technologies for Canal Sediments	Description	Screening Comments
Containment	Sediment Cap	Armor cap – Cap to eliminate exposure pathways posed by impacted sediments.	Retained for site use.
Source Removal	Excavation and Off-site Disposal/Treatment	Excavate impacted sediments in Canal and dispose/treat off-site.	Retained for site use.

TABLE 4-1
SUMMARY OF REMEDIAL ALTERNATIVE COMPONENTS

	On-Site Alternative 1	On-Site Alternative 2	On-Site Alternative 3	On-Site Alternative 4	On-Site Alternative 5	On-Site Alternative 6	On-Site Alternative 7	On-Site Alternative 8
Location/Media Addressed	**No Action**	**NAPL Migration Barrier**	**Partial Source Removal and Containment with NAPL Control**	**Partial Containment with Hydraulic Control; Partial Source Control**	**Partial Containment with Hydraulic Control; Partial ISS**	**Partial Containment, Hydraulic Control; Partial Source Removal; Bottom Liner**	**Substation Relocation; Source Removal**	**Substation Relocation; ISS**
Objective	No active remediation, maintains exposure controls through SMP	Collection and control alternative for NAPL	Containment alternative for source material with partial substation relocation. NAPL collection and control	Removes source material to greatest extent with partial substation relocation	Treats source material to the greatest extent with partial substation relocation	Removes source to greatest extent with partial substation relocation. Added NAPL collection and control	Removes source material to the greatest extent with substation relocation	Treats source material to the greatest extent with substation relocation
Substation	No Relocation	No Relocation	Partial Relocation	Partial Relocation	Partial Relocation	Partial Relocation	Relocation	Relocation
Soil On-site	SMP	SMP	Partial source removal; containment walls around substation, SMP	Excavation outside substation, containment walls around substation, SMP	Solidification outside substation, SMP	Excavation outside substation, horizontal and vertical barriers around substation, SMP	Source removal, SMP	In-situ solidification, SMP
NAPL On-Site	SMP	NAPL collection and containment immediately downgradient of on-site area	NAPL collection and containment immediately downgradient of on-site area	NAPL recovery and dual-phase extraction within containment	NAPL recovery and dual-phase extraction within containment	Bottom liner, NAPL recovery and dual-phase extraction within containment	Removed with soil source material	In-situ solidification
Groundwater On-Site	SMP	SMP	Cap reduces infiltration	Dual-phase recovery within containment	Dual-phase recovery within containment	Dual-phase recovery within containment	None except during dewatering for excavation	None

TABLE 4-1
SUMMARY OF REMEDIAL ALTERNATIVE COMPONENTS (Continued)

	Off-Site Alternative 1	Off-Site Alternative 2	Off-Site Alternative 3	Off-Site Alternative 4	Off-Site Alternative 5
Location/Media Addressed	**No Action**	**LaGrange St. and Sediment Excavation**	**Off-Site Soil and Sediment Excavation**	**LaGrange St. Excavation and Sediment Cap**	**Off-Site Excavation and Sediment Cap**
Objective	No active remediation, maintains exposure controls through SMP	Soil and sediment excavation	Soil and sediment excavation	Soil and sediment excavation	Soil and sediment excavation
Soil Off-Site	No Action	Excavation with minimal residual	Excavation with no residual	Excavation with minimal residual	Excavation with no residual
Groundwater Off-Site	MNA	MNA	MNA	MNA	MNA
Downgradient NAPL	MNA	NAPL Recovery	NAPL Recovery	NAPL Recovery	NAPL Recovery
Canal NAPL Seeps	MNA	Grout curtain w/NAPL recovery	Grout curtain w/NAPL recovery	Grout curtain w/NAPL recovery	Grout curtain w/NAPL recovery
Canal Sediments	No Action	Excavation	Excavation	Cap	Cap

TABLE 5-1

SUMMARY OF REMEDIAL ALTERNATIVE COST ESTIMATES - ON-SITE

	Alternative 1 No Action	Alternative 2 NAPL Migration Barrier	Alternative 3 Partial Substation Relocation, Source Removal and Containment with NAPL Control	Alternative 4 Partial Containment with Hydraulic Control; Partial Source Removal	Alternative 5 Partial Containment with Hydraulic Control; Partial ISS	Alternative 6 Partial Containment with Hydraulic Control; Partial Source Removal; Bottom Liner	Alternative 7 Substation Relocation; Source Removal	Alternative 8 Substation Relocation; ISS
Capital Costs								
Site Management Plan	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Construction Support Facilities		$404,000	$404,000	$404,000	$404,000	$404,000	$404,000	$404,000
Sump/Contents Removal and Disposal		$62,308	$62,308	$62,308	$62,308	$62,308	$62,308	$62,308
Substation Relocation							$11,500,000	$11,500,000
Control House and 12 kV switchgear (western portion) Relocation			$1,750,000	$1,750,000	$1,750,000	$1,750,000		
Geomembrane Cap			$162,490	$65,800	$65,800	$65,800		
Soil Excavation (On-site) and Disposal			$824,450	$1,606,250		$1,606,250	$2,326,625	
ISS					$1,151,250			$1,414,000
Containment Walls (On-site)			$414,000	$914,250	$276,000	$914,250		
Bottom Liner						$1,896,000		
On-site Dual-phase Extraction Wells				$334,890	$334,890	$68,710		
On-site (4) NAPL Extraction Wells				$22,600	$22,600	$22,600		
On-site Ground Water Pretreatment with Off-site Treatment				$154,300	$154,300	$97,400		
NAPL Migration Barrier (grout curtain, interceptor trench, (14) NAPL recovery wells)		$796,766	$796,766					
Subtotal Capital Costs	**$20,000**	**$1,283,074**	**$4,434,014**	**$5,334,398**	**$4,241,148**	**$6,907,318**	**$14,312,933**	**$13,400,308**
Contractor Overhead and Profit 20%	$4,000	$256,615	$886,803	$1,066,880	$848,230	$1,381,464	$2,862,587	$2,680,062
Subtotal Capital Costs	**$24,000**	**$1,539,689**	**$5,320,817**	**$6,401,278**	**$5,089,378**	**$8,288,782**	**$17,175,520**	**$16,080,370**
Design Contingency 30%	$7,200	$461,907	$1,596,245	$1,920,383	$1,526,813	$2,486,635	$5,152,656	$4,824,111
Total Capital Costs	**$32,000**	**$2,002,000**	**$6,918,000**	**$8,322,000**	**$6,617,000**	**$10,776,000**	**$22,329,000**	**$20,905,000**

TABLE 5-1

SUMMARY OF REMEDIAL ALTERNATIVE COST ESTIMATES - ON-SITE

	Alternative 1 No Action	**Alternative 2 NAPL Migration Barrier**	**Alternative 3 Partial Substation Relocation, Source Removal and Containment with NAPL Control**	**Alternative 4 Partial Containment with Hydraulic Control; Partial Source Removal**	**Alternative 5 Partial Containment with Hydraulic Control; Partial ISS**	**Alternative 6 Partial Containment with Hydraulic Control; Partial Source Removal; Bottom Liner**	**Alternative 7 Substation Relocation; Source Removal**	**Alternative 8 Substation Relocation; ISS**
Annual Report	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Years of Reporting	30	30	30	30	30	30	30	30
Present Worth Reporting Costs	**$47,000**	**$47,000**	**$47,000**	**$47,000**	**$47,000**	**$47,000**	**$47,000**	**$47,000**
Annual Operation (NAPL Recovery)		$31,452	$31,452	$10,656	$10,656	$10,656		
Years of Operation		30	30	30	30	30		
Present Worth Operating Costs		**$484,000**	**$484,000**	**$164,000**	**$164,000**	**$164,000**		
Annual Operation (Dual Phase NAPL/Groundwater Treatment)				$99,656	$99,656	$64,978		
Years of Operation				30	30	30		
Present Worth Operating Costs				**$1,533,000**	**$1,533,000**	**$999,000**		
Present Worth OM&M	**$47,000**	**$531,000**	**$531,000**	**$1,744,000**	**$1,744,000**	**$1,210,000**	**$47,000**	**$47,000**
Total Present Worth	**$79,000**	**$2,533,000**	**$7,449,000**	**$10,066,000**	**$8,361,000**	**$11,986,000**	**$22,376,000**	**$20,952,000**

Note Present Worth uses 5% Discount Rate

TABLE 5-1

SUMMARY OF REMEDIAL ALTERNATIVE COST ESTIMATES - OFF-SITE

	Alternative 1 No Action	Alternative 2 LaGrange St. and Sediment Excavation	Alternative 3 Off-Site Soil and Sediment Excavation	Alternative 4 LaGrange St. Excavation and Sediment Cap	Alternative 5 Off-Site Soil Excavation and Sediment Cap
Capital Costs					
Grout Curtain Off-site		$708,140	$708,140	$708,140	$708,140
Downgradient (15 new) NAPL Recovery Well		$92,900	$92,900	$92,900	$92,900
Sediment Cap				$926,964	$926,964
Sediment Excavation		$513,237	$513,237		
Soil Excavation		$569,790	$753,430	$569,790	$753,430
Subtotal Capital Costs		**$1,884,067**	**$2,067,707**	**$2,297,794**	**$2,481,434**
Contractor Overhead and Profit 20%		$376,813	$413,541	$459,559	$496,287
Subtotal Capital Costs		**$2,260,881**	**$2,481,249**	**$2,757,352**	**$2,977,720**
Design Contingency 30%		$678,264	$744,375	$827,206	$893,316
Total Capital Costs	**$0**	**$2,940,000**	**$3,226,000**	**$3,585,000**	**$3,872,000**

	Alternative 1 No Action	Alternative 2 LaGrange St. and Sediment Excavation	Alternative 3 Off-Site Soil and Sediment Excavation	Alternative 4 LaGrange St. Excavation and Sediment Cap	Alternative 5 Off-Site Soil Excavation and Sediment Cap
Annual Monitoring	$13,500	$13,500	$13,500	$13,500	$13,500
Years of Monitoring	30	30	30	30	30
Present Worth Monitoring Costs	**$208,000**	**$208,000**	**$208,000**	**$208,000**	**$208,000**
Annual Operation (15 new recovery + 9 existing monitoring wells for NAPL Recovery)		$26,024	$26,024	$26,024	$26,024
Years of Operation		30	30	30	30
Present Worth Operating Costs		**$401,000**	**$401,000**	**$401,000**	**$401,000**
Present Worth OM&M	**$208,000**	**$609,000**	**$609,000**	**$609,000**	**$609,000**
Total Present Worth	**$208,000**	**$3,549,000**	**$3,835,000**	**$4,194,000**	**$4,481,000**

Note Present Worth uses 5% Discount Rate

TABLE 5-2

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Evaluation Criteria	On-Site Alternative 1 No Action	On-Site Alternative 2 NAPL Migration Barrier	On-Site Alternative 3 Partial Source Removal and Containment with NAPL Control	On-Site Alternative 4 Partial Containment with Hydraulic Control; Partial Source Control	On-Site Alternative 5 Partial Containment with Hydraulic Control; Partial ISS	On-Site Alternative 6 Partial Containment with Hydraulic Control; Partial Source Removal; Bottom Liner	On-Site Alternative 7 Substation Relocation; Source Removal	On-Site Alternative 8 Substation Relocation; ISS
Overall Protection of Human Health and the Environment	Limited protection through SMP.	Limited protection through SMP and NAPL migration barrier.	Protection through partial source removal and containment NAPL collection and migration barrier, and SMP.	Provides high level of protection to human health and the environment.	Off-site protection; provides on-site protection through removal and ISS.	Provides high level of protection to human health and the environment.	Provides highest level of protection to human health and the environment.	Off-site protection; provides on-site protection through ISS.
Compliance with SCGs	SCGs would not be met.	SCGs would not be met.	Some on-site soil SCGs not met. Downgradient groundwater contaminant concentrations reduced over time.	Some on-site soil SCGs met. On-site groundwater extracted until SCGs are met. Downgradient groundwater contaminant concentrations reduced over time.	On-site groundwater extracted until SCGs are met. Downgradient groundwater contaminant concentrations reduced over time.	Some on-site soil SCGs met. On-site groundwater extracted until SCGs are met. Downgradient groundwater contaminant concentrations reduced over time.	On-site soil SCGs met. Downgradient groundwater contaminant concentrations reduced over time.	Downgradient groundwater contaminant concentrations reduced over time.
Long-term Effectiveness and Permanence	Not effective or permanent. SMP addresses potential risks.	Effective, permanent for NAPL. SMP addresses potential risks.	Effective and permanent through source removal and containment and control and SMP.	Effective and permanent through source removal in soil.	Effective and permanent through ISS.	Effective and permanent through source removal in soil.	Effective and permanent through source removal in soil.	SMP necessary to maintain effectiveness.
Reduction of Toxicity (T), Mobility (M), and Volume (V) with Treatment	Reduction of TMV would occur slowly through natural processes.	Reduction of T would occur slowly through natural processes.	Reduction of V and M with source removal and NAPL collection and control.	Containment reduces mobility hydraulic con-trol. Reduction of TV in over-burden with gw extraction. V reduced with soil removal.	Mobility reduced with ISS and hydraulic control. Reduction of TV in over-burden with groundwater extraction. V reduced with soil removal.	Mobility reduced containment and hydraulic control. Reduction of TV in overburden with groundwater extraction. V reduced with soil removal.	Volume of on-site soil removed. Reduction of T in overburden with groundwater extraction.	Mobility reduced through ISS. Volume reduced with soil removal.

TABLE 5-2 (Continued)

Evaluation Criteria	On-Site Alternative 1 No Action	On-Site Alternative 2 NAPL Migration Barrier	On-Site Alternative 3 Partial Source Removal & Containment with Hydraulic Control	On-Site Alternative 4 Partial Containment with Hydraulic Control; Partial Source Control	On-Site Alternative 5 Partial Containment with Hydraulic Control; Partial ISS	On-Site Alternative 6 Partial Containment with Hydraulic Control; Partial Source Removal; Bottom Liner	On-Site Alternative 7 Substation Relocation; Source Removal	On-Site Alternative 8 Substation Relocation; ISS
Short-term Effectiveness	Minimal short-term impacts since no construction would be performed. RAOs would not be met.	Minimal short-term impacts since limited construction would be performed. RAOs would be partially met.	RAOs met with removal and containment and SMP. Fewer short-term impacts from construction.	RAOs met with removal, containment and SMP.	RAOs met with containment, ISS and SMP.	RAOs met in a shorter time due to full containment.	RAOs met in the shortest time. Extensive soil removal will impact community.	RAOs met with ISS and SMP.
Implementability	Deed restrictions could be implemented.	Limited disruptions to community during construction	Partial substation relocation. Difficult to implement with active substation.	Partial substation relocation. Difficult to implement with active substation.	Partial substation relocation. ISS may be more difficult to implement than excavation due to limited working area. Difficult to implement with active substation.	Partial substation relocation. Difficult to implement with active substation. Grout bottom liner may be difficult to construct.	Substation relocation presents fewer difficulties for on-site construction. However, substation relocation is difficult to implement.	ISS may be more difficult to implement than excava-tion since subsurface obstructions are unknown. Substation relocation presents fewer difficulties for construction but is difficult to implement.
Total Present Worth	$79,000	$2,533,000	$7,449,000	$10,066,000	$8,361,000	$11,986,000	$22,376,000	$20,952,000

TABLE 5-2 (Continued)

Evaluation Criteria	Off-Site Alternative 1 No Action	Off-Site Alternative 2 LaGrange St. and Sediment Excavation	Off-Site Alternative 3 Off-Site Soil and Sediment Excavation	Off-Site Alternative 4 LaGrange St. Excavation and Sediment Cap	Off-Site Alternative 5 Off-Site Soil Excavation and Sediment Cap
Overall Protection of Human Health and the Environment	Not effective.	Protection and risks addressed through excavation and recovery.	Protection and risks addressed through excavation and recovery.	Protection and risks addressed through excavation, capping and recovery.	Protection and risks addressed through excavation, capping and recovery.
Compliance with SCGs	Does not meet SCGs.	Some soil SCGs met. Sediment SCGs met. Plume will collapse over time.	Soil SCGs met. Sediment SCGs met. Plume will collapse over time.	Some soil SCGs met. Sediment SCGs not met. Plume will collapse over time.	Soil SCGs met. Sediment SCGs not met. Plume will collapse over time.
Long-term Effectiveness and Permanence	Contaminant migration would continue. Potential risks addressed through SMP.	Excavation of soil and sediments and NAPL recovery permanent and effective.	Excavation of soil and sediments and NAPL recovery permanent and effective.	Excavation of soil and NAPL recovery permanent and effective.	Excavation of soil and NAPL recovery permanent and effective.
Reduction of Toxicity, Mobility and Volume with Treatment	Reduction of TMV occurs slowly through natural processes.	Excavation/removal reduces soil and sediment V. M reduced for NAPL. Reduction of T in groundwater over time.	Excavation/removal reduces soil and sediment V. M reduced for NAPL. Reduction of T in groundwater over time.	Excavation/removal reduces V for soil. M reduced for NAPL. Reduction of T in groundwater slowly over time.	Excavation/removal reduces V for soil. M reduced for NAPL. Reduction of T in groundwater slowly over time.
Short-term Effectiveness	No construc-tion.	Off-site disruptions to traffic and community. Short-term impact on Canal. RAOs met for soil & sediments and for groundwater over long-term.	Greater off-site disruptions to traffic and community. Short-term impact on Canal. RAOs met for soil and sediments and for groundwater over long-term.	Off-site disruptions to traffic and community. Short-term impact on Canal. RAOs met for soil and sediments and for groundwater over long-term.	Greater off-site disruptions to traffic and community. Short-term impact on Canal. RAOs met for soil and sediments and for groundwater over long-term.
Implementability	Monitoring is easy to implement.	All technologies implementable with off-site disruptions. Canal remediation requires access and coordination with agencies.	All technologies implementable with off-site disruptions. Canal remediation requires access and coordination with agencies.	All technologies implementable with off-site disruptions. Canal remediation requires access and coordination with agencies.	All technologies implementable with off-site disruptions. Canal remediation requires access and coordination with agencies.
Total Present Worth	$208,000	$3,549,000	$3,835,000	$4,194,000	$4,481,000

TABLE 5-3

SUMMARY OF SITE-WIDE REMEDIAL ALTERNATIVE COST ESTIMATES

Capital Costs	Alternative 1 No Action	Alternative 2 NAPL Migration Barrier	Alternative 3 Partial Source Removal and Containment with NAPL Control	Alternative 4 Partial Containment with Hydraulic Control; Partial Source Removal	Alternative 5 Substation Relocation; Source Removal
Site Management Plan	$20,000	$20,000	$20,000	$20,000	$20,000
Construction Support Facilities		$404,000	$404,000	$404,000	$404,000
Sump/Contents Removal and Disposal		$62,308	$62,308	$62,308	$62,308
Substation Relocation					$11,500,000
Control House and 12 kV switchgear (western portion) Relocation			$1,750,000	$1,750,000	
Geomembrane Cap			$162,490	$65,800	
Soil Excavation (On-site) and Disposal			$824,450	$1,606,250	$2,326,625
Containment Walls (On-site)			$414,000	$914,250	
On-site Dual-phase Extraction Wells				$334,890	
On-site (4) NAPL Extraction Wells				$22,600	
On-site Ground Water Pretreatment with Off-site Treatment				$154,300	
NAPL Migration Barrier (grout curtain, interceptor trench, (14) NAPL recovery wells)		$796,766	$796,766		
Grout Curtain Off-site		$708,140	$708,140	$708,140	$708,140
Downgradient (15 new) NAPL Recovery Well		$92,900	$92,900	$92,900	$92,900
Sediment Excavation		$513,237	$513,237	$513,237	$513,237
Off-site Soil Excavation		$569,790	$569,790	$569,790	$569,790
Subtotal Capital Costs	**$20,000**	**$3,167,141**	**$6,318,081**	**$7,218,466**	**$16,197,001**
Contractor Overhead and Profit 20%	$4,000	$633,428	$1,263,616	$1,443,693	$3,239,400
Subtotal Capital Costs	**$24,000**	**$3,800,569**	**$7,581,697**	**$8,662,159**	**$19,436,401**
Design Contingency 30%	$7,200	$1,140,171	$2,274,509	$2,598,648	$5,830,920
Total Capital Costs	**$32,000**	**$4,941,000**	**$9,857,000**	**$11,261,000**	**$25,268,000**

OM&M Costs	Alternative 1 No Action	Alternative 2 NAPL Migration Barrier	Alternative 3 Partial Containment with NAPL Control	Alternative 4 Partial Containment with Hydraulic Control; Partial Source Removal	Alternative 5 Substation Relocation; Source Removal
Annual Monitoring	$13,500	$13,500	$13,500	$13,500	$13,500
Annual Reportin	$3,000	$3,000	$3,000	$3,000	$3,000
Present Worth Monitoring Costs	**$254,000**	**$254,000**	**$254,000**	**$254,000**	**$254,000**
Annual On-site NAPL Recovery		$31,452	$31,452	$10,656	
Annual Downgradient NAPL Recovery (24)		$26,024	$26,024	$26,024	$26,024
Present Worth Operating Costs		**$884,000**	**$884,000**	**$564,000**	**$401,000**
Annual Operation (Dual Phase NAPL/Groundwater Treatment)				$99,656	
Years of Operation				30	
Present Worth Operating Costs				**$1,533,000**	
Present Worth OM&M	**$254,000**	**$1,138,000**	**$1,138,000**	**$2,351,000**	**$655,000**
Total Present Worth	**$286,000**	**$6,079,000**	**$10,995,000**	**$13,612,000**	**$25,923,000**

Note Present Worth uses 5% Discount Rate