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National Grid

Feasibility Study Report

North Albany Former Manufactured Gas Plant Site

January 2016

ARCADIS

Certification

I, Terry W. Young, P.E. certify that I am currently a NYS registered professional engineer and that this *Feasibility Study Report* was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation *Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010).

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Feasibility Study Report

North Albany Former Manufactured Gas Plant Site

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Executive Summary

Introduction

This *Feasibility Study Report* (FS Report) presents an evaluation of remedial alternatives to address environmental impacts identified at the National Grid North Albany Former Manufactured Gas Plant (MGP) site (the site) located at 1125 Broadway in Albany, New York. This FS Report has been prepared by Arcadis of New York, Inc. (Arcadis) on behalf of National Grid and has been prepared in accordance with an Administrative Order on Consent (Consent Order Index No. D0-0001-92101) entered into between National Grid and the New York State Department of Environmental Conservation (NYSDEC). This FS Report has been revised to address NYSDEC comments provided during a November 19, 2015 meeting between National Grid, NYSDEC, and Arcadis.

Purpose

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

- Appropriate for site-specific conditions
- Protective of human health and the environment
- Consistent with relevant NYSDEC regulations and guidance, the National Contingency Plan (NCP), and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The overall objective of this FS Report is to recommend an appropriate remedial alternative that achieves the remedial action objectives (RAOs) established for the site.

Background

The former MGP site is located at the National Grid North Albany Service Center in Albany, New York. Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site is bordered by Interstate I-90 to the north, Bridge Street to the south, a Canadian Pacific (CP) Railroad right-of-way to the east and Broadway to the west. The Hudson River is located approximately 0.5 miles east of the site.

The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas. The site is an active utility service center that functions as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State.

For the purpose of this FS Report the North Albany former MGP site consists of the following areas:

- Former MGP Area (FMA) – consists of the main service center building (Building #2) and the paved area immediately north and east of Building #2. Former MGP operations were primarily located in the paved area. Building #2 is included in the FMA due to the potential presence of impacts beneath the eastern portion of the building, as described later in this report.

- Hazardous Waste Storage Tank Area (HWSTA) – consists of the aboveground storage tank area immediately south of Building #2.

- Yard Storage Area (YSA) – consists of the equipment storage area located south of Building #2.

- Off-Site/Downgradient Area (OSDA) – consists of the area east of the National Grid property to approximately 200 feet east of Erie Boulevard.

Industrial usage of the property has included the MGP facility, which operated from the 1870s through the 1940s, and electric/gas utility support services, which began in connection with the MGP operation and continues to the present. The southern portion of the property has also been used for ice storage and distribution, lumber planing and milling, and petroleum distribution operations. During the period of industrial usage of the site (e.g., 1870s to present), the property has been bordered to the west by Broadway and to the east by a railroad right-of-way (currently owned by CP Rail). Historical site usage to the east and south of the property includes transportation facilities (railway and streetcar), lumber planing and milling, chemical manufacturing, and rendering.

The former MPG operated at the site from the 1870s through the 1940s and initially used the coal-carbonization process, switched to the water-gas process during the 1890s and subsequently switched to the carbureted water-gas process prior to 1908. MGP structures were demolished after the facility ceased operations, with the final MGP-related buildings removed during the early 1990s.

National Grid began operation of a regional hazardous waste storage facility (the North Albany Treatment, Storage and Disposal Facility [TSDF]) on the property during the 1980s.

The NYSDEC issued a final 6NYCRR Part 373 Hazardous Waste Management Permit for the North Albany TSDF on January 6, 1995. As part of the Hazardous Waste Management Permit, National Grid was required to implement a Resource Conservation and Recovery Act (RCRA) Corrective Action program to address releases of hazardous waste and/or hazardous constituents from solid waste management units (SWMUs) at the facility. Spills and releases associated with hazardous waste storage areas at the facility were addressed through TSDF closure activities that were implemented in 2000. Following implementation of the TSDF closure activities, the NYSDEC agreed that remaining environmental concerns at the site would be addressed under the MGP Consent Order. National Grid has also implemented two interim remedial measures (IRMs) to address specific issues at the site, including a storm sewer cleaning IRM that was conducted in 1999 and an IRM to address spills and releases from utility operations in the YSA south of Building #2.

Nature and Extent of Impacts

Numerous investigation activities, monitoring events, and remedial technology studies have been conducted to delineate the nature and extent of impacts at the site. Summaries of these activities and the associated results can be found in the following reports and submittals to the NYSDEC:

- *Preliminary Site Assessment/Interim Remedial Measure Study Report* (Foster Wheeler, 1995)
- *MGP/RCRA Investigation Report* (BBL, 1997)
- Periodic groundwater and non-aqueous phase liquid (NAPL) monitoring letter reports (various dates from 1997 through 2008)
- Pre-design soil investigation letter report, dated May 29, 2001
- High-Temperature Superconductive Cable Installation Subsurface Soil Sampling Letter, dated December 21, 2004
- *Pilot-Scale Treatability Testing Summary Report (*Arcadis, 2007)

Constituents of concern (COCs) and materials of concern (MOCs) are related to both MGP- and non-MGP-related operations conducted at the site and primarily consist of the following:

- The presence of MGP-related materials consisting of coal tar (i.e., dense, non-aqueous phase liquid [DNAPL]) and tar-saturated wood chips (i.e., potentially purifier waste materials), as well as soil and groundwater containing polynuclear aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylenes (BTEX), and cyanide associated with the former MGP operations conducted in the northern portion of the site.

- Light, non-aqueous phase liquid (LNAPL), PAHs and BTEX in soil and groundwater related to former on-site petroleum storage (underground and aboveground storage tanks) and dispensing.

The following measures were used to delineate the nature and extent of impacts in environmental media:

- Visual characterization of soil samples to identify MGP- and/or petroleum-related impacts based on the presence of odors, staining, sheens, and NAPL.

- Comparison of total BTEX and total PAH concentrations in soil to the soil screening levels of 10 ppm and 500 ppm (respectively) as presented in the NYSDEC Division of Hazardous Waste Remediation document entitled "Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels" HWR 94-4046 (TAGM 4046). In December 2006, the NYSDEC's Environmental Remediation Program (6 NYCRR Part 375) replaced TAGM 4046. The objectives of both programs are consistent, but 6 NYCRR Part 375 also considers land use in establishing soil cleanup objectives (SCOs).

- Comparison of COCs in groundwater to the NYSDEC document entitled "Division of Water Technical and Operation Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (TOGS 1.1.1), reissued June 1998 and addended April 2000 and June 2004.

- Monitoring for the presence of NAPL in the existing monitoring well network.

The foreseeable future use of this site is continued use as an industrial site, namely as a service center (in the FMA and HWSTA) and a railroad and roadway (in the OSDA). There are no current or likely future users of site-related groundwater and there are no known drinking water supply wells within a one-half mile radius of the North Albany Service Center. Residents and commercial establishments in the vicinity of the North Albany Service Center obtain municipal drinking water from the City of Albany.

Remedial Action Objectives

RAOs are medium-specific goals that, if met, would be protective of human health and the environment for the environmental concerns identified at the site. Potential remedial alternatives were evaluated relative to their ability to meet the RAOs and be protective of human health and the environment. The RAOs for the site, in consideration of COCs and MOCs, exposure pathways, and receptors, are presented in the following table.

RAOs for Soil COCs: BTEX and PAHs MOCs: NAPL, Tar Saturated Soil (TSS), and Purifier Waste
RAOs for Public Health Protection 1) Prevent ingestion and direct contact with subsurface soil containing MGP- and/or non-MGP-related materials in soil. 2) Prevent inhalation of or exposure to MPG- and/or non-MPG-related constituents volatilizing from COCs and/or MOCs in soil. *RAOs for Environmental Protection* 3) Prevent migration of MGP- and/or non-MGP-related MOCs that could result in exceedances(s) of NYSDEC groundwater quality standards and guidance values.
RAOs for Groundwater COCs: BTEX and PAHs MOCs: NAPL
RAOs for Public Health Protection 1) Prevent ingestion of groundwater with dissolved-phase COC concentrations exceeding NYSDEC groundwater quality standards and guidance values. 2) Prevent contact with, or inhalation of volatiles from groundwater containing MGP- and/or non-MGP-related COCs at concentrations exceeding NYSDEC groundwater quality standards and guidance values.

RAOs for Environmental Protection

3) Restore groundwater quality to pre-disposal/pre-release conditions, to the extent practicable.

4) Remove the source of groundwater impacts.

Based on the reconnaissance, sampling, and the YSA IRM performed during the site activities, there are no complete exposure pathways to surface soil at the site and an RAO is not needed.

Remedial Technology Screening and Development of Remedial Alternatives

General response actions (GRAs) were identified to address impacted site media. GRAs are medium-specific and describe actions that will satisfy the RAOs, and may include various actions such as treatment, containment, institutional controls, excavation, or any combination of such actions. Potentially applicable technologies and technology process options associated with each of the GRAs underwent preliminary and secondary screening to retain the technologies that would most-effectively achieve the RAOs identified for the site.

The preliminary screening was performed to reduce the number of potentially applicable technologies and technology processes based on technical implementability. This screening was based on several considerations, including: successful full-scale demonstrations of the technology; compatibility of the technology with the specific media, location, and constituent distribution; time-frame to acquire necessary permits; and area required for setup/operation relative to available space at the site. A number of potentially applicable technologies and technology processes were retained through the preliminary screening. To further reduce the technology processes to be assembled into remedial alternatives, a secondary screening of the processes was conducted. The objective of the secondary screening was to choose, when possible, one representative remedial technology process for each remedial technology category to simplify the subsequent development and evaluation of the remedial alternatives.

Based on the nature and extent of impacts and the remedial technologies and associated technology processes retained through the preliminary and secondary screening, none of the retained remedial technologies alone have the ability to meet the RAOs established for the site. Therefore, individual technologies (and associated technology processes) have been combined into remedial alternatives to meet the RAOs and address the MGP- and non-MGP-related environmental concerns at the site.

Based on the nature and extent of impacts in the HWSTA and the TSDF closure activities that have been completed at the site, passive NAPL recovery is the only retained technology applicable for addressing impacts in this area of the site. Therefore, potential remedial alternatives for the HWSTA are not evaluated separately in this Feasibility Study. Monitoring and passive recovery of LNAPL in the HWSTA is included as a component of each FMA alternative.

The potential remedial alternatives for the FMA consist of the following:

- Alternative FMA-1 – No Further Action
- Alternative FMA-2 – Limited Soil Removal, Capping, Passive NAPL Collection via Wells and Barrier Wall, and Institutional Controls
- Alternative FMA-3 – Limited Soil Removal, Capping, Passive NAPL Collection via Wells and Barrier Walls, and Institutional Controls
- Alternative FMA-4 – ISS, Capping, Passive NAPL Collection via Wells and Barrier Walls, and Institutional Controls
- Alternative FMA-5 – Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

The potential remedial alternatives for the OSDA consist of the following:

- Alternative OSDA-1 – No Further Action
- Alternative OSDA-2 – Passive NAPL Recovery, Groundwater Monitoring, and Institutional Controls
- Alternative OSDA-3 – Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

Detailed Evaluation of Alternatives

Following the development of the remedial alternatives, a detailed description of each alternative was prepared and each alternative was evaluated with respect to the following criteria presented in the NYDSEC DER-10 *Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010) and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a):

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

These evaluation criteria encompass statutory requirements and include other gauges such as overall feasibility.

Comparative Analysis of Alternatives

Following the detailed evaluation of each alternative, a comparative analysis of the alternatives was completed using the eight evaluation criteria. The comparative analysis identified the advantages and disadvantages of each alternative relative to each other and with respect to the eight evaluation criteria. The results of the comparative analysis were used as a basis for recommending the preferred site-wide remedy for achieving the RAOs established for the site.

Preferred Site-Wide Remedy

Based on the comparative analysis of the remedial alternatives for addressing environmental impacts in the FMA and OSDA, the combination of Alternatives FMA-4 and OSDA-2 is the preferred site-wide remedial alternative. The combination of these alternatives would cost-effectively achieve the best balance of the evaluation criteria. The preferred site-wide remedy represents a permanent reduction in the toxicity, mobility, and volume of impacted site media and reduces the potential for exposure to impacted material that would remain at the site.

The primary components of the preferred site-wide remedy consist of the following:

- Removing approximately 12,600 CY of surface material and shallow subsurface soil during pre-ISS excavation activities.

- Treating approximately 36,200 CY of subsurface saturated and unsaturated soil containing significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm.

- Excavating approximately 17,400 cubic yards (CY) of highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated wood chips located east and northeast of Building #2.

- Placing clean imported fill material within the excavation area east and northeast of Building #2.

- Constructing (i.e., excavating and installing materials for) passive NAPL barrier walls in the northwest corner of the North Albany Service Center and along the hydraulically downgradient portion of the FMA to facilitate NAPL collection and recovery and prevent further migration of NAPL beyond the FMA. If the Genesee Street substation is de-energized or relocated in the future, National Grid would re-evaluate potential alternatives for addressing NAPL and impacted soil in this area.

- Removing approximately 6,600 CY of surface material (i.e., asphalt and gravel subbase at locations not subject to ISS treatment or excavation) to facilitate installation of a new asphalt cap.

- Constructing a new asphalt cap in the FMA to prevent potential future exposures to remaining impacted media.

- Treating (via low temperature thermal desorption [LTTD]) and disposing of approximately 8,700 CY of material (50% of material excavated from the area east and northeast of Building #2) that is assumed to be characteristically hazardous for benzene.

- Disposing approximately 21,200 tons of surface material and other debris as a non-hazardous waste at a construction and demolition (C&D) landfill.

- Disposing approximately 20,600 CY of material excavated from the area east and northeast of Building #2, as well as material excavated to facilitate ISS treatment and installation of the containment barrier wall and passive NAPL barrier wall as a non-hazardous waste at a solid waste landfill.

- Installing new NAPL recovery wells in the FMA and the HWSTA to facilitate collection and passive recovery of LNAPL and DNAPL, as well as new "sentinel" NAPL monitoring wells west of Broadway.

- Installing up to eight new NAPL recovery wells in the OSDA to facilitate collection and passive recovery of DNAPL.

- Conducting quarterly NAPL monitoring in the FMA and OSDA to passively recover LNAPL and DNAPL that may accumulate in new and existing NAPL recovery wells.

- Conducting annual groundwater monitoring in the OSDA to evaluate the dissolved-phase concentrations of COCs in OSDA groundwater.

- Conducting annual inspections of the asphalt cap (to identify cracks, deterioration, etc.) and implementing repairs to the cap, as necessary.

- Establishing institutional controls for the FMA and OSDA to prohibit use of groundwater and limit the future development and use of these areas.

The total estimated cost associated with implementation of the preferred site-wide remedy is summarized in the following table.

Alternative	Estimated Capital Cost	Estimated Present Worth of O&M Cost	Total Estimated Cost
FMA-4	$22,700,000	$900,000	$23,600,000
OSDA-2	$100,000	$850,000	$950,000
		Total Estimated Present Worth Cost	***$24,550,000***

Acronyms and Abbreviations

AMSL	above mean sea level
BFS	blast furnace slag
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylene
CAMP	Community Air Monitoring Plan
CB	cement-bentonite
C&D	construction and demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	cubic-feet
CFR	Code of Federal Regulations
CMS	Corrective Measure Study
COC	constituent of concern
cP	centipoise
CY	cubic-yard
DER	NYSDEC Division of Environmental Remediation
DNAPL	dense non-aqueous phase liquid
ECL	Environmental Conservation Law
ELUR	environmental land use restriction
FEMA	Federal Emergency Management Agency
FMA	former MGP area
FPS	free product sampler
FS	Feasibility Study
GRA	general response action
GPR	ground penetrating radar
GRS	gas regulator station
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HTS	high-temperature superconductive
HWSTA	hazardous waste storage tank area

IRM	interim remedial measure
ISCO	in-situ chemical oxidation
ISS	in-situ solidification
LDR	Land Disposal Restriction
LNAPL	light non-aqueous phase liquid
LTTD	low-temperature thermal desorption
MGP	manufactured gas plant
MOC	material of concern
MNA	monitored natural attenuation
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NMPC	Niagara Mohawk Power Corporation
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
O&M	operation and maintenance
ORC	oxygen-releasing compound
OSDA	off-site/downgradient area
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
POTW	publicly-owned treatment works
PPE	personal protective equipment
ppm	parts per million
PRAP	Proposed Remedial Action Plan
PSA	Preliminary Site Assessment
QA/QC	quality assurance/quality control
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RFI	RCRA Facility Investigation

RQD	rock quality designation
SCG	standards, criteria and guidelines
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SVE	soil vapor extraction
SVI	soil vapor intrusion
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
SWPPP	Stormwater Pollution Prevent Plan
TAGM	Technical and Administrative Guidance Memorandum
TSDF	Treatment, Storage, Disposal Facility
TCLP	toxicity characteristic leaching procedure
TOGS	Technical and Operational Guidance Series
TSS	tar-saturated soil
UCS	unconfined compressive strength
USACE	United States Army Corp of Engineers
USAF	United States Air Force
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UTS	Universal Treatment Standards
VOC	volatile organic compound
YSA	yard storage area

1. Introduction

1.1 General

This *Feasibility Study Report* (Draft FS Report) presents an evaluation of remedial alternatives to address environmental impacts identified at the National Grid North Albany Former Manufactured Gas Plant (MGP) site (the site) located at 1125 Broadway in Albany, New York. This FS Report has been prepared by Arcadis U.S. Inc. (Arcadis) on behalf of National Grid and has been prepared in accordance with an Administrative Order on Consent (Consent Order Index No. D0-0001-92101) entered into between National Grid and the New York State Department of Environmental Conservation (NYSDEC).

A Draft FS Report (BBL, 2001) for the site was originally prepared by Arcadis (formerly Blasland, Bouck & Lee, Inc. [BBL]) and submitted to the NYSDEC in October 2001. Since that time, several site- and non-site related activities have resulted in the need to revise the 2001 Draft FS Report. These activities include the results of an on-site chemical oxidation pilot test (which was included as a major component of the recommended remedy in the 2001 Draft FS Report) and changes in NYSDEC regulations and presumptive remedies for addressing MGP sites.

New remedial alternatives for the site were presented in the *Draft Feasibility Study Report* (Draft FS Report) prepared by Arcadis (December, 2009). The NYSDEC provided verbal comments on the Draft FS Report during an April 2012 conference call with National Grid and Arcadis. The NYSDEC subsequently submitted an April 30, 2012 email to National Grid which indicated that the alternatives presented in the Draft FS Report were not acceptable to the NYSDEC and requested that National Grid develop and evaluate additional remedial alternatives to address MGP-related residual materials at the site. In response to the April 30, 2012 e-mail, National Grid agreed to propose revised remedial alternatives for the former MGP area (FMA) at the site in a June 26, 2012 letter to the NYSDEC.

In support of developing revised remedial alternatives, NYSDEC, National Grid, and Arcadis met in Albany, New York on November 29, 2012. The objectives of this meeting were to summarize site characterization information; review the rationale used to develop the remedial alternatives presented in the Draft FS Report; and discuss NYSDEC comments/concerns regarding the proposed remedial alternatives. Based on discussions during the meeting, National Grid developed the proposed revised FMA remedial alternatives as presented in a March 6, 2013 memorandum submitted to NYSDEC (included as Appendix A). A revised draft FS Report was submitted to NYSDEC on July 31, 2013.

On October 16, 2015, NYSDEC provided National Grid with a draft *Proposed Remedial Action Plan* (PRAP) for review. A meeting between National Grid, NYSDEC, and Arcadis was held November 19, 2015 to review and discuss the feasibility of select remedial components to be implemented at the site. This FS Report has been revised to address NYSDEC comments provided during the November 19, 2015 meeting, including identification of Alternative FMA-4 as part of the preferred site-wide remedy.

1.2 Regulatory Framework

This FS Report has been prepared to evaluate remedial alternatives to address environmental impacts at the site in a manner consistent with the Order on Consent and with the following documents:

- United States Environmental Protection Agency (USEPA) guidance document titled, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), Interim Final (USEPA, 1988a).

- Applicable provisions of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) regulations contained in Title 40 of the Code of Federal Regulations (CFR) Part 300.

- Applicable provisions of the New York State Environmental Conservation Law (ECL) and associated regulations, including Title 6 of the New York Code of Rules and Regulations (NYCRR) Part 375-6 (6NYCRR Part 375-6).

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

1.3 Purpose

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

- Appropriate for site-specific conditions

- Protective of human health and the environment

- Consistent with relevant sections of NYSDEC guidance, the NCP, and CERCLA

The overall objective of this FS Report is to recommend an appropriate remedial alternative that achieves the remedial action objectives (RAOs) established for the site.

1.4 Report Organization

This FS Report is organized as follows:

Section	Purpose
Section 1 – Introduction	Provides background information relevant to the development of remedial alternatives evaluated in this FS Report.
Section 2 – Standards, Criteria, and Guidelines	Identifies standards, criteria, and guidelines (SCGs) that govern the development and selection of remedial alternatives.
Section 3 – Remedial Action Objectives	Develops site-specific RAOs that are protective of human health and the environment.
Section 4 – Technology Screening and Development of Remedial Alternatives	Presents the results of a screening process to identify potentially applicable remedial technologies and develops remedial alternatives that have the potential to meet the RAOs.
Section 5 – Detailed Evaluation of Remedial Alternatives	Presents a detailed description and analysis of each potential remedial alternative using the evaluation criteria presented in the referenced feasibility study guidance documents.
Section 6 – Comparative Analysis of Alternatives	Presents a comparative analysis of each remedial alternative using the evaluation criteria.
Section 7 – Preferred Site-Wide Remedy	Identifies the preferred site-wide remedy for addressing the environmental concerns at the site.
Section 8 – References	Provides a list of references utilized to prepare this FS Report.

1.5 Background Information

This subsection summarizes site background information relevant to the development of the remedial alternatives evaluated in this FS Report, including site location and physical setting, site history and operation, and a summary of previous investigations.

1.5.1 Site Location and Physical Setting

The former MGP site is located at the National Grid North Albany Service Center in Albany, New York (see Figure 1-1). Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site is bordered by Interstate I-90 to the north, Bridge Street to the south, a Canadian Pacific (CP) Railroad right-of-way to the east, and Broadway to the west. The Hudson River is located approximately 0.5 miles east of the site.

For the purpose of this FS Report the North Albany former MGP site consists of the following areas, as depicted on Figure 1-2:

- Former MGP Area (FMA) – consists of the paved area immediately north and east of Building #2 where the former MGP operations were located.

- Hazardous Waste Storage Tank Area (HWSTA) – consists of the aboveground storage tank area immediately south of Building #2.

- Yard Storage Area (YSA) – consists of the equipment storage area located south of Building #2.

- Off-Site/Downgradient Area (OSDA) – consists of the area east of the National Grid property to approximately 200 feet east of Erie Boulevard.

The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid’s operations in Eastern New York State. The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas. A detailed site plan is presented as Figure 1-2. Current Buildings and primary site features at the facility include:

- The Versaire Building (Building #1) is a warehouse and crew headquarters building.

- Building #2 is the main office building at the site and consists of a three-story structure containing offices, meeting rooms, storage areas, and maintenance shops.

- Buildings #2-3 and #2-4 currently serve as storage sheds and were constructed as part of a lumber planing business formerly located in the southeastern section of the property.

- The Vehicle Maintenance Building is located in the northeastern section of the property.

- An electrical equipment and waste storage building (i.e., the Transformer Building) is located to the south of Building #2.

- An aboveground storage tank facility, consisting of three waste oil storage tanks (one of which was previously utilized to store polychlorinated biphenyl- [PCB-] contaminated waste oil containing PCB concentrations ranging between 50 and 499 parts per million [ppm]) and a virgin oil storage tank, is located south of Building #2 in the area immediately outside the Transformer Shop.

- A control building that was utilized in conjunction with the testing of a high-temperature superconductive (HTS) cable. Since the completion of the cable testing, use of the building has been taken over by National Grid.

- Two sheds in the northeast corner of the property that contain equipment used to support cellular phone communications. The sheds are owned and operated by Verizon Corporation.

- A pole barn/equipment storage pad (enclosed on three sides) is located south of Transformer Building (near the east side of the building).

- A partially paved/partially gravel-covered storage yard (the yard storage area) extends across the southern section of the site. The yard storage area is used to store miscellaneous items, including various electrical equipment, cable spools, steel framing, and wood poles.

- Paved areas at the site include the areas north and east of Building #2, the area west of the yard storage area, and portions of the yard storage area. Paved areas at the site are used for parking, equipment storage, and site access.

- A guardhouse located at the main facility entrance near the northwestern corner of Building #2.

- Two aboveground fuel pump islands (one diesel and one gasoline) are located northeast of Building #2.

- A railroad spur owned and operated by CP Rail enters and crosses the southeastern portion of the property. This railroad spur is used to transport chemical products to industrial properties south of the site.

A natural gas regulator station (GRS) and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. As shown on Figure 1-3, numerous subsurface gas and electric lines associated with the GRS and substation (respectively) enter the property from the west (i.e., from Broadway). The gas regulator station includes numerous subsurface valves and loops associated with the gas distribution equipment. In addition, several subsurface utilities are present, including: underground electric utilities, sewer lines, water lines, and natural gas supply lines and two natural gas mains (one 12-inch gas main and one 16-inch gas main) throughout the FMA; telephone lines located along the western portion of FMA; fiber optic transmission lines in the northern portion of the FMA; and telecommunication/microwave tower communication lines located in the eastern portion of the FMA.. The approximate locations of known utilities are shown on Figure 1-3.

1.5.2 Site History and Operation

This subsection presents a discussion of historical site use at the North Albany Service Center property. The discussion of historical activities at the property is based on a review of the following information:

- The document entitled "Initial Submittal, North Albany (Broadway Ave.) MGP Site," (NMPC, 1994)

- Sanborn Insurance Maps of Albany, New York dated 1892, 1908, and 1935 (prepared by the Sanborn-Perris Company Limited and the Sanborn Map Company)

- New York State Library Archives Department files relating to the construction, operation, and abandonment of the Erie Canal

- City of Albany assessment records dated 1927 and 1932

- Aerial photographs obtained from the City of Albany and the New York State Department of Transportation (NYSDOT)

- NYSDOT records relating to the construction of Interstate 787

General information relating to the historical usage of the site and surrounding properties is presented below, followed by a detailed discussion of former MGP operations at the site.

1.5.2.1 Historical Site Use

Prior to 1872, the property was part of the Steven Van Rensselear estate and was primarily used for farmland and residential purposes. Industrial usage of the property has included the MGP facility, which operated from the 1870s through the 1940s, and electric/gas utility support services, which began in connection with the MGP operation and continues to the present. The southern portion of the property has also been used for ice storage and distribution, lumber planing and milling, and petroleum distribution operations. During the period of industrial usage of the site (e.g., 1870s to present), the property has been bordered to the west by Broadway and to the east by a railroad right-of-way (currently owned by CP Rail). Historical site usage to the east and south of the property includes transportation facilities (railway and streetcar), lumber planing and milling, chemical manufacturing, and rendering.

The Erie Canal was formerly located east of the railroad right-of-way (currently owned by CP Rail) at the current location of Erie Boulevard (as shown on Figure 1-2). The canal (which predates the railroad) was constructed during the 1820s and varied from approximately 7 to 13 feet in depth. The sides of the canal consisted of stone or brick embankments, which were approximately 2.5 feet thick. Former barge slips located on the east side of the canal provided access to various lumber yards and milling operations in an area referred to as the Albany Lumber District. The portion of the Erie Canal in the vicinity of the site was abandoned during the 1920s and was filled during the late 1920s and early 1930s. Several utilities (i.e., water supply, sanitary sewer, and storm sewer lines) were constructed within the former canal bed before the backfilled canal was paved.

A branch of the Hudson River known as the Little River (approximately 1,000 feet east of the property) was previously located immediately east of the Lumber District. The Little River was separated from the main channel of the Hudson River by Patroon's Island. The Little River was filled during construction of Interstate 787 in the mid-1960s (the Interstate was constructed over the former location of the Little River, and Patroon's Island was incorporated into a recreation area that extends along the west bank of the Hudson River).

1.5.2.2 Historical MGP Operations

The former MPG operated at the site from the 1870s through the 1940s and initially used the coal-carbonization process, switched to the water-gas process during the 1890s and subsequently switched to the carbureted water-gas process prior to 1908. Figure 1-4 indicates the approximate location of historical MGP structures in 1892, 1908, and 1935. MGP structures were demolished after the facility ceased operations, with the final MGP-related buildings removed during the early 1990s. Based on conditions encountered in test pits and soil borings completed in the general vicinity of the former MGP structures (i.e., tar pits, tar tanks, oil tanks, gas holders, etc.), potential foundations (i.e., concrete slabs) were identified near the following structures:

- The former relief gas holder located in the northwest corner of the site near the current Genesee Street Substation (soil borings SB-110 and SB-148).
- The 2,000,000 cubic foot (CF) gas holder located in the western portion of the site (soil boring SB-139 and test pit TP-4).
- The former Oil Tanks located immediately north of Building #2 (soil boring SB-144).

The locations of these borings are shown on Figure 1-4.

1.5.2.3 Hazardous Waste Disposal Facility Operations

National Grid began operation of a regional hazardous waste storage facility (the North Albany Treatment, Storage and Disposal Facility [TSDF]) on the property during the 1980s. The NYSDEC issued a final 6NYCRR Part 373 Hazardous Waste Management Permit for the North Albany TSDF on January 6, 1995. As part of the Hazardous Waste Management Permit, National Grid was required to implement a Resource Conservation and Recovery Act (RCRA) Corrective Action program to address releases of hazardous waste and/or hazardous constituents from solid waste management units (SWMUs) at the facility.

As defined in Permit Module III of the Hazardous Waste Management Permit for the North Albany TSDF, releases of hazardous wastes and/or hazardous constituents identified at the site were categorized into the following three groups of SWMUs:

- Category I SWMUs included areas that were impacted by only MGP-related wastes and residual materials. The FMA was the only Category I SWMU identified at the site.

- Category II SWMUs included areas where MGP-related wastes and residuals were co-mingled with other facility-related environmental concerns. Category II SWMUs consisted of several underground and above ground storage tanks that were formerly located in the FMA and the site storm sewer system.

- Category III SWMUs included areas where only facility-related environmental concerns were identified that were not related to the former MGP operations at the site. Category III SWMUs included several former hazardous waste storage areas associated with the TSDF, the yard storage area, and an isolated area of light non-aqueous phase liquid (LNAPL) identified at monitoring well MW-10.

Select SWMUs identified at the site have already been addressed by remedial measures, as described in following subsections.

1.5.3 Summary of Previous Investigations and Remedial Measures

This subsection presents an overview of previous investigations and remedial activities that have been implemented to evaluate and/or address environmental conditions at the North Albany Service Center (including information used to develop the RAOs presented in this FS Report).

1.5.3.1 PSA/IRM Study

The Preliminary Site Assessment/Interim Remedial Measures (PSA/IRM) Study was conducted by Foster Wheeler during 1994 and consisted of collecting two surface soil samples; collecting subsurface soil samples from 37 soil borings and 8 test pits; installing, developing, slug testing, and sampling 14 groundwater monitoring wells; and collecting debris samples from two storm sewer catch basins/manholes in the former MGP area. The results of the PSA/IRM Study are presented in the PSA/IRM Study Report (Foster Wheeler, 1995).

1.5.3.2 MGP/RCRA Investigation

A comprehensive site-wide investigation (the MGP/RCRA Investigation) was conducted at the site pursuant to the following:

- An Order on Consent (Consent Order; Index #A4-0473-0000) between National Grid and the NYSDEC which required National Grid to conduct a site investigation and remediation program to evaluate potential issues associated with the former MGP and develop appropriate remedial measures.

- Module III – Corrective Action (Permit Module III) of the 6NYCRR Part 373 Hazardous Waste Management Permit (NYSDEC Permit No. 4-0101-00114/00004-0) for the North Albany TSDF. Permit Module III required National Grid to conduct a RCRA Facility Investigation (RFI) and Corrective Measure Study (CMS) to evaluate potential impacts from the SWMUs identified at the site.

The MGP/RCRA Investigation was conducted by BBL during 1996 and 1997. The MGP/RCRA Investigation activities consisted of collecting and analyzing surface soil samples from 20 locations in the yard storage area and the area south of the TSDF; collecting and analyzing subsurface soil samples from 50 soil borings and 14 test pits; installing, developing, conducting hydraulic conductivity testing, and collecting and analyzing groundwater samples from 16 on-site and off-site groundwater monitoring wells; and completing a detailed reconnaissance of subsurface drainage structures at the site (including collecting and analyzing debris samples from 10 subsurface structures). The results of the MGP/RCRA Investigation are presented in the MGP/RCRA Investigation Report (BBL, 1997).

1.5.3.3 Groundwater Investigation and NAPL Monitoring Activities

Additional groundwater investigation activities were conducted by BBL during July and August 1998, July 1999, and from October through December 2000 to address data gaps suggested by the results of the MGP/RCRA Investigation. Periodic groundwater and NAPL monitoring activities have also been conducted to assess potential changes in site conditions. These groundwater and NAPL monitoring activities include:

- *July and August 1998* – Groundwater investigation activities consisted of installing three additional groundwater monitoring wells within Erie Boulevard to evaluate the potential hydraulic influence of fill material associated with the former Erie Canal on the distribution of LNAPLs and dissolved-phase constituents in groundwater in the area hydraulically downgradient from the FMA. In August 1998, fluid level measurements were obtained from the new monitoring wells and from each existing on-site/off-site monitoring well and groundwater samples were collected from monitoring wells where NAPL was not present. In addition, two samples of dense non-aqueous phase liquid (DNAPL) were collected for laboratory analysis. The results of the groundwater investigation activities conducted during July and August 1998 were summarized in a January 19, 1999 letter from NMPC to the NYSDEC.

- *July 1999* – Groundwater investigation activities consisted of obtaining fluid level measurements from each existing on-site/off-site monitoring well and collecting groundwater samples from monitoring wells where NAPL was not encountered. The results of the groundwater investigation activities conducted during July 1999 were summarized in an April 10, 2000 letter from NMPC to the NYSDEC.

- *October through December 2000* – Additional groundwater investigation activities consisted of installing six additional groundwater monitoring wells (at three monitoring well cluster locations in the FMA), abandoning/replacing off-site monitoring well MW-21S (which had been damaged), obtaining a site-wide round of fluid level measurements from each new and existing monitoring well, and collecting groundwater samples from wells where NAPL was not encountered. The additional groundwater investigation activities also included the collection of groundwater samples from select groundwater monitoring wells for laboratory analysis for natural attenuation indicator parameters (including alkalinity, ammonia, total Kjeldahl nitrogen, iron, manganese, sulfate, sulfide, carbon dioxide, methane, and orthophosphate). The results of the groundwater investigation activities conducted from October through December 2000 were presented in a May 29, 2001 letter from NMPC to the NYSDEC.

- *July 1998 through June 2013* – NAPL monitoring/recovery activities were conducted on a monthly basis during the period between July 1998 and July 2000 and have been ongoing on a quarterly basis since November 2000. The quarterly NAPL monitoring activities were implemented to achieve the following objectives:

  - Provide data to monitor the presence, thickness, and recharge rate of NAPL within select on-site monitoring wells.

  - Obtain sufficient data to evaluate requirements for the continued monitoring of NAPL at the site.

  The NAPL monitoring/recovery activities consist of periodically measuring fluid levels in select monitoring wells at the site where LNAPL and DNAPL have been encountered, and removing NAPL to the extent practicable. Where encountered, attempts were made to recover NAPL. Field personnel use disposable bottom-loading polypropylene bailers and/or peristaltic pumps to recover LNAPL and a free product sampler (FPS) attached to the bottom of a disposable polypropylene bailer and a peristaltic pump to recover DNAPL. NAPL removed from the wells as part of the monitoring/recovery activities is placed in an on-site accumulation/storage container prior to off-site disposal. Significant amounts of DNAPL have not been recovered using either manual bailing techniques or a peristaltic pump due to the viscosity and density of the DNAPL.

The results of the NAPL monitoring/recovery activities conducted during the period between July 1998 and July 1999 are summarized in the April 10, 2000 letter from NMPC to the NYSDEC. Results for the quarterly NAPL monitoring/recovery activities are summarized in annual Groundwater Monitoring and NAPL Monitoring/Recovery letters submitted to NYSDEC by National Grid.

- *October 2001 through December 2012* – Periodic groundwater monitoring activities were completed in October 2001, November 2002, June 2005, and on an annual basis during December from 2006 through 2012. The objectives of the periodic groundwater monitoring activities included:

    - Obtaining groundwater elevation data from monitoring wells/piezometers to evaluate groundwater flow direction and velocity, and compare the results with groundwater flow conditions encountered during previous monitoring events.

    - Obtaining groundwater analytical data to confirm the results of previous sampling events and compare the results to the Glass GA groundwater standards and guidance values presented in the NYSDEC document entitled "Division of Water Technical and Operation Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (TOGS 1.1.1), reissued June 1998 and addended April 2000 and June 2004.

    - Assessing potential changes in the concentrations of chemical constituents in groundwater samples collected from downgradient monitoring wells relative to concentrations observed during previous groundwater monitoring events.

  Prior to collecting groundwater samples, static fluid level measurements were obtained from on-site and off-site monitoring wells. Groundwater samples were then collected from accessible monitoring wells that did not contain NAPL. Groundwater sampling was completed using low-flow sampling techniques and samples are submitted for laboratory analysis for benzene, toluene, ethylbenzene, and xylene (BTEX) compounds, polycyclic aromatic hydrocarbons (PAHs), RCRA metals, cyanide. Select groundwater samples were previously submitted for laboratory analysis for PCBs. Results for the periodic groundwater sampling activities are summarized in associated annual Groundwater Monitoring and NAPL Monitoring/Recovery letters submitted to NYSDEC by National Grid.

Results of the groundwater and NAPL monitoring activities have been incorporated into the nature and extent of impacts discussed in Section 1.6.3.

1.5.3.4 Pre-Design Soil Investigation

The pre-design soil investigation activities were conducted by BBL between October and December 2000 and consisted of completing 15 soil borings and collecting subsurface soil samples to further evaluate the extent of MGP-related impacts in the FMA north of Building #2. The results of the pre-design soil investigation activities were summarized in the May 29, 2001 letter from NMPC to the NYSDEC.

1.5.3.5 TSDF Closure Activities

The North Albany hazardous waste TSDF was closed in accordance with an NYSDEC-approved *Closure Work Plan* (BBL, 2000a). TSDF closure activities were conducted during 2000 to address each of the hazardous waste storage areas that were identified as Category III SWMUs. The TSDF closure activities were documented in the *TSDF Closure Certification Report* (BBL, 2000c) and generally consisted of the following:

- Removal of PCB-impacted concrete and soil from the Transformer Shop Hazardous Waste Storage Tank Area
- Restoring the concrete and soil removal areas in the Transformer Shop
- Cleaning PCB transfer equipment within the Transformer Shop
- Cleaning the PCB-impacted oil storage tank system
- Cleaning the Truck Loading/Unloading Pad for the Outdoor Tank facility
- Cleaning the Flammables Storage Cabinet and the Corrosives Storage Cabinet
- Removing PCB-impacted concrete from the Versaire Hazardous Waste Storage Shed
- Cleaning the Versaire Hazardous Waste Storage Shed
- Restoring the concrete removal areas in the Versaire Hazardous Waste Storage Shed
- Applying chemically-resistant floor coating system in the Versaire Hazardous Waste Storage Shed
- Cleaning PCB transfer equipment within the Versaire Hazardous Waste Storage Shed

Based on the results of the TSDF closure activities, the NYSDEC granted final closure of the North Albany Service Center TSDF and agreed that remaining environmental issues at the site (including the Category I and Category II SWMUs identified by the MGP/RCRA Investigation) would be addressed under the existing MGP Consent Order between National Grid and the NYSDEC (i.e., there are no post-closure corrective action requirements for the North Albany Service Center Category III SWMUs). The *TSDF Closure Certification Report* was approved by the NYSDEC in a January 10, 2001 letter to National Grid.

1.5.3.6 Storm Sewer Cleaning IRM

Storm sewer cleaning IRM activities were conducted in December 1999 and consisted of removing and collecting accumulated debris from drainage structures and piping associated with the storm sewer system at the site. Accumulated debris were removed by hydroflushing the drainage structures and piping. The resulting wastewater and debris was collected using a vacuum truck for off-site transportation and disposal. The storm sewer IRM activities were documented in the *Interim Remedial Measure Summary Report – Storm Sewer Cleaning Activities* (BBL, 2000b).

1.5.3.7 HTS Cable Installation Subsurface Soil Sampling

Subsurface soil sampling activities were conducted on October 26, 2004 to evaluate subsurface conditions along the path of a HTS underground cable that was subsequently installed in the northern portion of the North Albany Service Center property. A total of 10 subsurface soil samples were collected from eight soil borings and submitted for laboratory analysis. The results of the soil sampling activities were presented in a December 21, 2004 letter to NYSDEC from National Grid (then Niagara Mohawk, a National Grid Company) (Niagara Mohawk, 2004).

1.5.3.8 Chemical Oxidation Treatability Studies

Based on the findings of the 2001 Draft FS Report, in-situ chemical oxidation was identified as a potentially applicable technology process for treating site-related impacts. National Grid conducted a bench-scale treatability study during 2002 and 2003 to evaluate the feasibility of using chemical oxidation for treating site-related impacts including BTEX, PAHs, and coal tar residuals. The findings of the bench-scale treatability study activities indicated that in-situ treatment using ozone may potentially be utilized to treat MGP-related constituents in saturated soil. The bench-scale findings are summarized in the *Chemical Oxidation Bench-Scale Treatability Study Summary Report* (BBL, 2003).

A pilot-scale test was subsequently conducted from late 2005 through early 2006 to achieve the following objectives:

- Assess the potential effectiveness of in-situ chemical oxidation using ozone in reducing the levels of MGP-related constituents in on-site environmental media (including PAHs and BTEX in soil and groundwater and NAPL in subsurface material).

- Evaluate the potential of using in-situ chemical oxidation to treat site-related impacts under actual site conditions.

- Implement testing activities in a manner that protects the safety of personnel operating and monitoring the testing application and National Grid personnel at the site.

- Obtain information to support design and implementation of a subsequent larger scale chemical oxidation system, if appropriate.

Pilot-scale testing was performed in two areas of the FMA (identified as Test Area #1 and Test Area #2) located immediately west of the Vehicle Maintenance Building and adjacent to the southwestern perimeter of the Genesee Street Substation. As summarized in the *Pilot-Scale Treatability Testing Summary Report* (Arcadis, 2007a), pilot testing actives consisted of the following:

- Conducting baseline sampling to confirm soil and groundwater conditions.

- Installing ozone injection points, soil vapor extraction wells, and vapor monitoring cluster points.

- Conducting in-situ performance testing and radius of influence testing to evaluate the pneumatics of gaseous injection/extraction.

- Completing pilot-scale testing injection of oxygen/ozone mixture and extracting off-gas.

- Performing in-situ monitoring of soil vapor and groundwater prior to, during and following pilot-scale testing, including the collection and laboratory analysis of soil and groundwater samples to evaluate the effectiveness of the testing.

The analytical results for in-situ groundwater and vapor monitoring and groundwater sampling indicated evidence that oxidation and stimulation of aerobic biodegradation occurred as part of the pilot test to reduce the concentrations of MGP-related constituents of concern (COCs) within groundwater. However, the analytical results for soil sampling indicated that MGP-related COCs remained within the test area following the pilot test. These results suggest the in-situ chemical oxidation may not be an effective technology for source removal/reduction. However, as demonstrated by the reduction in dissolved-phase concentrations of MGP-related COCs, the technology may have some application to target dissolved-phase impacts in the OSDA following the implementation of remedial measures to address FMA source material (i.e., NAPL and heavily impacted soil).

1.5.3.9 Yard Storage Area Interim Remedial Measure

National Grid conducted an IRM in 2007 to address environmental concerns in the yard storage area. The removal limits of the IRM are shown on Figure 1-5. The objectives of the Yard Storage Area IRM consisted of the following:

- Remove soil containing PCBs at concentrations exceeding soil cleanup objectives of 1 ppm for surface soil (defined as soil at depths less than 1 foot below grade) and 10 ppm for subsurface soil.

- Remove surface and subsurface soil containing elevated concentrations of semi-volatile organic compounds (SVOCs).

- Address safety concerns associated with the uneven surface conditions in the yard storage area.

Approximately 3,100 cubic-yards (CY) of soil was removed from excavation areas to depths ranging from one to six feet below grade. An additional 2,900 CY of soil, gravel, and debris was generated during site grading activities completed as part of the IRM. Waste materials generated during the completion of the IRM were disposed of at High Acres Landfill located in Fairport, New York (for non-hazardous waste) or Model City Landfill located in Model City, New York (for waste containing PCBs at a concentration exceeding 50 ppm), as described in the 2007 *Yard Storage Area Interim Remedial Measure Summary Report* (Arcadis, 2007b). Site restoration activities consisted of backfilling excavation areas with existing on-site material and imported fill material, placing and compacting a 6-inch NYSDOT Type 2 subbase course (gravel), and paving the Yard Storage Area with a 3-inch layer of NYSDOT Type 3 binder course (asphalt pavement).

1.5.3.10 Soil Vapor Intrusion Investigation Activities

At the request of the NYSDEC and New York State Department of Health (NYSDOH), soil vapor intrusion (SVI) investigations activities have been completed at the site to determine the potential for volatile organics in soil beneath Building #2 and the Vehicle Maintenance Building to migrate to indoor air. As an initial effort, soil vapor, sub-slab vapor, and ambient air samples were collected in November 2008. Based on the results of these initial samples, additional SVI investigation activities that included sub-slab vapor, indoor air, and ambient air sampling were completed in March 2009. Results of the SVI investigation are presented in the *Vapor Intrusion Investigation Report* (Arcadis 2010). Based on the results of the SVI investigation activities, no remedial activities are necessary to address SVI issues at the site.

1.5.3.11 FS Support Activities

Since the Draft FS Report was submitted to NYSDEC, the following additional activities have been conducted to support the preparation of this Draft FS Report:

- Conducting bench-scale in-situ solidification (ISS) treatability testing to evaluate the feasibility of implementing ISS to treat MGP-related residuals in soil at the site. Bench-scale ISS treatability testing was conducted by Arcadis to evaluate and identify potential mix designs that could be used to solidify soil containing MGP-related residual materials. Treatability testing samples were collected for bench-scale testing from an area located east of Building 2 where subsurface purifier waste was identified and from a NAPL-impacted area in the central portion of the FMA located to the west and north of the Vehicle Maintenance Building. Treatability testing has been completed and the results indicate that ISS can be used to successfully treat waste from both the purifier waste area east of Building 2 and the central portion of the FMA located west and north of the Vehicle Maintenance Building.

- Conducting a utility survey to map underground utilities and related infrastructure located in the FMA. The utility survey was conducted by a private utility locating company (Underground Services, Inc.). The utility survey identified both known and previously unknown storm sewer, sanitary sewer, telephone, electrical, gas, water, and cable lines throughout the site. The updated utility survey information for the former MGP area has been incorporated into the figures presented in this FS Report.

- Conducting a geophysical survey of specific areas in the FMA to evaluate the presence of subsurface foundations and other obstructions that may potentially interfere with proposed remedial efforts. The geophysical survey was conducted by Arcadis using ground-penetrating radar (GPR) to evaluate subsurface obstructions (former MGP building and holder foundations) that would potentially be encountered in the parking lot area south of the Genesee Substation and the GRS during intrusive remedial construction activities.

- Completing additional groundwater flow simulations using the existing hydrogeologic model for the site. Hydrogeologic modeling was conducted by Arcadis to further evaluate (i.e., in addition to the hydraulic modeling scenarios previously evaluated in support of the Draft FS Report) the potential effects of conducting ISS activities and installing low-permeability barriers on site hydrogeology. In general, the modeling evaluated potential changes to local water table elevation, vertical hydraulic gradients, and groundwater flow paths. The results of the MODFLOW groundwater flow model simulations (prepared in support of the Draft FS Report) are presented in the technical memorandum included as Appendix B. Additional groundwater flow simulations are presented on the figures included as Appendix C.

Results for the bench-scale ISS treatability testing will be provided to the NYSDEC under separate cover. Information obtained during the utility and GPR surveys and the results for the updated hydrogeologic modeling effort are incorporated in this Draft FS Report.

1.6 Site Characterization

This section presents an overall site characterization and a summary of the nature and extent of impacted media at the site based on the results obtained for the site investigation activities conducted to date (as described in Section 1.5.3). The site characterization consists of a summary of the following:

- Site topography and drainage
- Site geology and hydrogeology
- Nature and extent of impacts

A discussion of site topography and drainage is presented below.

1.6.1 Site Topography and Drainage

Surface topography in the vicinity of the North Albany Service Center slopes gently towards the south and east. Site topography is generally of low relief, with ground surface elevations ranging from approximately 16 feet above mean sea level (AMSL) along the eastern side of the site to approximately 32 feet AMSL near the northwestern corner of the FMA. A topographic map of the area in the immediate vicinity of the site is presented as Appendix D.

Stormwater is conveyed off-site via a series of catch basins, manholes, and piping which are shown on Figure 1-2. All stormwater flow from the onsite storm water sewer system is conveyed to a single manhole (manhole MH-3) that discharges to off-site storm sewers. Stormwater discharged from manhole MH-3 is ultimately conveyed to the Hudson River. The on-site storm sewer system was cleaned during a December 1999 IRM, as described in Section 1.5.3.6, and the storm sewer system is not considered to be a preferential pathway for migration of COCs. Major portions of the site storm sewer system were replaced during 2012 to improve drainage conditions at the site.

1.6.2 Site Geology and Hydrogeology

Geologic and hydrogeologic conditions at the site are discussed below.

1.6.2.1 Geologic Characterization

The general geologic stratigraphy underlying the site is characterized as follows (with increasing depth from grade):

- General fill (ranging in thickness from 0 to 18 feet), consisting primarily of sand with ash, brick, cinders, coal, slag and wood.

- Glaciofluvial deposits (ranging in thickness from 4 to 31 feet), consisting predominantly of sand and silt, with occasional layers of clay or peat. This unit includes a semi-confining/discontinuous silt and clay layer.

- Weathered bedrock (encountered at depths between 7 and 34 feet below ground surface [bgs]).

- Bedrock (bedrock surface encountered 12 to 38 feet bgs).

Bedrock beneath the site is the Black Snake Hill Shale. The upper portion of the bedrock unit consists of a weathered zone that extends up to seven feet in thickness. The weathered bedrock is underlain by more competent gray to black shale.

Subsurface stratigraphy at the site is depicted on geologic cross-sections. Geologic cross-section locations are shown on Figure 1-5 and geologic cross-sections are presented on Figures 1-6 through 1-10. The semi-confining silt and clay layer that is part of the glaciofluvial stratigraphic unit described above is further depicted on an isopach map (Figure 1-11), which indicates the thickness of the silt and clay materials, and a top of silt and clay map (Figure 1-12), which contours the top of the semi-confining unit.

Based on a review of the silt and clay isopach and top of surface maps, there are several areas where the silt and clay unit is missing or thin (less than 2 feet thick). The following observations were noted:

- The silt and clay unit was not encountered in soil borings completed along the western property boundary. In the northwestern corner of the property (near the Genesee Street Substation and the 250,000 CF relief holder), the silt and clay unit appeared to be thicker (up to approximately 8 feet). However, the clay was missing in the immediate location of the substation and the holder, indicating that the silt and clay unit may have been physically removed during the installation of these features. Where present in this area, the silt and clay surface slopes downward from the northwest toward the southeast.

- The silt and clay unit was not encountered in soil borings completed along the northern property boundary and extending south from the northern property boundary to the approximate northern edge of the Vehicle Maintenance Building.

- The silt and clay unit was not encountered in a small area centered near monitoring well MW-104 southwest of the Vehicle Maintenance Building. Additionally, the silt and clay unit is thin immediately west of the Vehicle Maintenance Building. This area also aligns with a depression in the surface of the silt and clay. This depression and the thinning of the clay unit in this area is reflected on cross-section C-C' (Figure 1-8) near soil borings SB-202 and SB-205 and monitoring well MW-103.

A GPR geophysical survey was conducted in February 1997 in the area east of the facility (i.e., from the eastern facility perimeter fence to the rail yard between Interstate I-787 and Erie Boulevard) to help characterize the relative bedrock elevations and subsurface features in the area downgradient of the facility. Additionally, more than 70 soil borings were completed to the top of the bedrock surface as part of the site characterization efforts. Based on the top of the bedrock elevation, as determined by the soil borings and the GPR survey results, the interpreted bedrock surface generally slopes to the east/southeast in the area east of the facility. A top of weathered bedrock surface topographic map is included as Figure 1-13.

Approximately 42 feet of bedrock coring was conducted at monitoring wells MW-16R, MW-21R and MW-22R (approximately 14 feet of boring at each location). Based on coring logs for these locations, bedrock is described as dark gray shale, soft, folded, slightly calcareous and slightly weathered. Fractures were observed during coring, and were typically described as 50-degree fractures along bedding planes with occasional high-angle 80-degree fractures. The rock quality designation (RQD) ranged from 0 (due to core barrel blockage) to 94 percent, with rock quality improving with depth.

1.6.2.2 Hydrogeologic Characterization

Across most of the site, the water table is located in the shallow overburden/fill. Along the eastern portion and downgradient of the site, the water table drops in elevation into the semi-confining (glaciofluvial silt and clay) layer. Where the silt and clay unit is present, two separate hydrostratigraphic units (a shallow overburden unit and a deep overburden unit) are present. A water table elevation map reflecting groundwater elevations measured in December 2007 is included as Figure 1-13. Groundwater in the shallow overburden unit flows generally to the east/southeast. Based on water level elevations measured at bedrock monitoring wells MW-16R, MW-21R and MW-22R, groundwater in the shallow bedrock generally flows to the southeast.

The horizontal hydraulic gradient in the shallow overburden varies across the site. Steeper hydraulic gradients are encountered at upgradient locations (close to monitoring well MW-20D), south of Building #2, and along the eastern property boundary. Relatively shallow groundwater (approximately 3 to 5 feet bgs) was encountered at monitoring wells MW-6S, MW-7, MW-13 and MW-15S. These wells are located near the eastern property boundary where the silt and clay layer is more continuous. Based on the observed head difference between well pairs in shallow and deep overburden units (such as monitoring wells MW-7/MW-14 and MW-6S/MW-6A), it appears that groundwater in the shallow overburden unit at these locations is perched on top of the silt/clay layer. Based on site geology, groundwater at shallow overburden monitoring wells MW-13 and MW-15S may also be perched.

Slug testing was conducted to calculate hydraulic conductivities of the hydrostratigraphic units across the site. The geometric mean hydraulic conductivity for each hydrostratigraphic unit is presented in the table below.

Hydrostratigraphic Unit	Geometric Mean Hydraulic Conductivity
Shallow Overburden	8.0×10^{-3} cm/sec (22.7 ft/day)
Deep Overburden	2.8×10^{-2} cm/sec (79.4 ft/day)

Hydrostratigraphic Unit	Geometric Mean Hydraulic Conductivity
Bedrock	4.4×10^{-5} cm/sec (0.12 ft/day)

Several of the deep overburden wells are partially screened within the weathered bedrock. As indicated above, the results of the hydraulic conductivity testing indicate that the deep overburden is the most transmissive unit for groundwater flow at the site (likely due to the weathered bedrock component).

Downward vertical hydraulic gradients were observed between shallow overburden and deep overburden at on-site groundwater monitoring wells MW-6, MW-26, MW-27 and MW-28, and piezometer PZ-01. The gradients were generally greater than 0.2 ft/ft, likely due to the perched groundwater conditions in areas of the site where these wells are located. East of the FMA, smaller downward vertical hydraulic gradients were observed between shallow overburden and deep overburden (<0.1 ft/ft at monitoring wells MW-17 and MW-22). Slightly upward vertical hydraulic gradients were observed between competent shale bedrock and deep overburden at monitoring wells MW-16, MW-21 and MW-22.

1.6.3 Nature and Extent of Impacts

This section presents a summary of the nature and extent of MGP- and non-MGP-related environmental concerns identified at the site. MGP- and non-MGP-related environmental concerns identified by the site investigation results include:

- The presence of MGP-related materials, including coal tar (i.e., DNAPL) and tar-saturated wood chips (i.e., potentially purifier waste materials), as well as soil and groundwater containing PAHs, BTEX and cyanide associated with the former MGP operations conducted in the northern portion of the site.

- LNAPL, PAHs and BTEX in soil and groundwater related to former on-site petroleum storage (underground and aboveground storage tanks) and dispensing.

- PCBs in surface and subsurface soil in the YSA which were previously addressed by the IRM implemented during 2007.

These materials and compounds are collectively considered to be the COCs and materials of concern (MOCs) for this site.

Although cyanide is identified as a COC, it was not detected in a substantial number of soil or groundwater samples. Where cyanide was detected at concentrations exceeding applicable soil and/or groundwater cleanup values, it was co-located with other COCs and/or MOCs. Therefore, cyanide is not considered to be a COC that would substantially influence development or selection of a particular remedial alternative. In addition, PCBs in site soil are no longer an issue since the YSA IRM achieved NYSDEC recommended soil cleanup objectives. The YSA IRM also removed surface and subsurface soil containing elevated concentrations of SVOCs.

There are no current surface soil impacts associated with the site. The northern portion of the site is paved. As indicated above, surface soil impacts associated with the yard storage area south of Building #2 were addressed as part of the IRM conducted in 2007.

A summary of the nature and extent of MGP- and non-MGP-related environmental concerns in site media is presented below.

1.6.3.1 Subsurface Soil

Former MGP Area

As indicated above, the site is an operating commercial facility and surrounding land use is primarily commercial/industrial. Based on discussions with National Grid personnel, the foreseeable future land use of the facility will continue to be as an active utility service center.

MGP- and non-MGP-related environmental concerns in subsurface soil in the FMA consist of BTEX and PAHs; LNAPL, DNAPL, and tar saturated soils (TSS); and MGP-related waste materials consisting of tar-saturated wood chips (i.e., potentially purifier waste materials). Soil sampling locations where visual indications of MGP- and non-MGP-related environmental concerns were encountered are shown on Figure 1-15 and summarized in Table 1-1. Soil analytical results for total BTEX and total PAHs are shown on Figure 1-16. Samples containing BTEX and PAHs at concentrations greater than 10 ppm and 500 ppm, respectively, are highlighted on the figure.

As indicated on Figure 1-15, visual indications of NAPL in subsurface soil were encountered throughout the northern portion of the site. The heaviest MGP- and non-MGP-related impacts (based on thickness of NAPL saturation) are present in the northwestern corner of the site (in the vicinity of the former 250,000 CF relief gas holder and the active Genesee Street Substation) and along the eastern North Albany Service Center property boundary (east and northeast of Building #2, in the vicinity of a former 3,000,000 CF gas holder). MGP-related impacts identified in these areas include the following:

- NAPL/TSS observed throughout overburden in the northwestern corner of the site (the area including sample locations SB-18, SB-19A, SB-109, SB-110 and MW-2) at a thickness of 14.5 feet (soil boring SB-109) and depths ranging from approximately 4 to 24 feet bgs. Total PAH concentrations in this area ranged up to greater than 1,000,000 ppm (laboratory anomaly) in a soil sample collected at soil boring location SB-110. Soil borings to the west (SB-121) and the north (SB-111 and SB-136) of the Genesee Street Substation did not indicate the presence of visual impacts or the presence of detectable concentrations of BTEX or PAHs.

- NAPL/TSS observed northeast of Building #2 (i.e., the area including sample locations SB-12, SB-23, MW-7, and MW-14) at thicknesses of up to 7.5 feet (soil boring completed at monitoring well MW-13) and depths ranging from approximately 2 to 26 feet bgs. The majority of NAPL in these areas was encountered above and slightly into (i.e., approximately two feet) the silt and clay unit, which is more prevalent and continuous in the eastern part of the FMA. NAPL and tar-coated wood fragments were also observed in soil borings completed in the area immediately east of Building #2 (the area including sample locations SB-10, SB-119 and MW-6S/6A) at depths from approximately 6 to 16 feet bgs. Total PAH concentrations in this area ranged up to 182,000 ppm at soil boring SB-12.

Outside of these two areas, the most visually impacted soils and soils containing the highest concentrations of PAHs were located immediately west and southwest of the Vehicle Maintenance Building. Several borings were completed in this area as part of the MGP/RCRA Investigation and as part of the in-situ chemical oxidation pilot test baseline testing conducted at the site in 2005. Soil borings completed in this area (SB-202, SB-203, SB-206, SB-143, and MW-5) contained NAPL and trace amounts of NAPL that extended from shallow subsurface soils (approximately 4 feet bgs) and into the deep overburden and weathered bedrock (16 to 22 feet bgs). Several sampling locations in this area also contained NAPL saturated soils (SB-11, SB-15, SB-16 and SB-114).

The majority of the visual indications of NAPL/TSS across the site are in the saturated zone (i.e., below the groundwater table). At several soil boring locations, visual indications of NAPL/TSS were present immediately above a discontinuous silt and clay unit that divides the shallow and deep overburden hydrostratigraphic units. However, at several locations

NAPL/TSS was also observed below the silt and clay unit. The potential confining properties of the silt and clay (where present) combined with the fact that the silt and clay unit is missing in some areas may influence the distribution of NAPL and TSS at the site.

Although subsurface investigation activities have not been implemented to evaluate the presence of subsurface environmental concerns beneath Building #2, the location of NAPL-impacted soils, groundwater flow direction, and the top of bedrock slope, suggest that NAPL and other MGP- and/or non-MGP-related COCs and MOCs may be present beneath the eastern portion of the building.

Hazardous Waste Storage Tank Area

An oil sheen and droplets of separate-phase material were observed on the surface of groundwater that infiltrated an excavation beneath a concrete slab associated with a truck dock that was removed as part of the TSDF closure activities. The truck dock is located within Building #2 immediately northwest of the area identified as the HWSTA on Figure 1-2. Additionally, black oil-like material, observed in amounts ranging from trace to saturated, was noted in soil samples collected at soil boring SB-17 from 3.5 to 12.2 feet bgs. Analytical results indicate that total PAHs were detected in soil samples collected from this area at a maximum concentration of 52.89 ppm in sample SB-102 (4-6').

Off-Site/Downgradient Area

Soil borings SB-123 and SB-124A were the only locations in the OSDA where visual indications of MGP- and/or non-MGP-related environmental concerns were encountered within overburden soils. Soil boring SB-123 contained sheens from 6 to 10 feet bgs and in weathered bedrock. Soil boring SB-124A contained staining and NAPL at 6 feet bgs and NAPL in weathered bedrock at 22 feet bgs. NAPL/TSS was encountered in weathered bedrock at soil borings SB-129 and SB-131, located downgradient (topographically and hydraulically) from soil boring SB-124A. A total of 21 subsurface soil samples were collected from overburden soils from 13 locations in the OSDA and were submitted for analysis of BTEX and PAHs. The analytical results indicated:

- BTEX was not detected at concentrations greater than laboratory detection limits in 14 samples. Samples from 5 locations did not identify BTEX at concentrations greater than laboratory detection limits.

- PAHs were not detected at concentrations greater than laboratory detection limits in 8 samples. Samples from 1 location did not identify PAHs at concentrations greater than laboratory detection limits.

- The concentration of total BTEX compounds exceeded the 10 ppm SCO in one sample - SB-124 (4-6') (23.78 ppm).

- The remaining samples did not exceed SCOs and the next highest concentrations were lower by approximately an order of magnitude. Soil impacts in the OSDA were generally identified immediately east of the Vehicle Maintenance Building and greatly decreased with distance from the FMA, often to non-detectable concentrations.

A total of 7 weathered bedrock samples collected from 6 locations within the OSDA were submitted for analysis of BTEX and PAHs. The analytical results indicated:

- BTEX and PAHs were not detected at concentrations above laboratory detection limits in 1 sample, and were below SCOs in 4 samples.

- The concentration of total BTEX compounds exceeded the 10 ppm SCO in one SB-129 (24-26') (76.79 ppm).

- The concentration of total PAHs exceeded the 500 ppm SCO in one sample - SB-129 (24-26') (1,913 ppm).

1.6.3.2 Bedrock

As indicated above, NAPL was observed in samples collected at several locations in the saturated overburden below the silt and clay unit (where present) and within weathered bedrock in the FMA. MGP-related material (coal tar) was also encountered in weathered bedrock at soil borings SB-129 and SB-131 located in the OSDA. Arcadis installed three bedrock monitoring wells (MW-16R, MW-21R and MW-22R) to investigate the potential presence of site related COCs and MOCs in bedrock in the OSDA. Weathered bedrock analytical results for BTEX and PAHs (Section 1.6.3.1) identified exceedances at SB-129, but not SB-131, indicating a reduction in NAPL impacts with distance from the FMA. Bedrock monitoring well MW-16R was installed immediately downgradient of the eastern side of Building #2 where NAPL and tar-coated wood fragments were observed along with total PAH concentrations up to 152,170 ppm (the area including sample locations SB-10, SB-119, SB-149 through SB-153 and MW-6S/6A) at depths from approximately 6 to 16 feet bgs. No visual observations or elevated PID reading indicating the potential presence of MGP- or non-MGP-related materials were noted during rock coring at this location and NAPL was not identified during subsequent gauging events.

Bedrock monitoring wells MW-21R and MW-22R were installed at off-site locations determined to be hydraulically downgradient and down-slope along the interpreted bedrock surface from soil borings SB-124A, SB-129 and SB-131 where NAPL has been observed off-site. Analytical results for soil samples collected from MW-21R and MW-22R did not indicate detectable concentrations of BTEX compounds, and only low level detections of total PAHs were identified in one sample from each boring. No visual observations or elevated PID reading indicating the potential presence of MGP- or non-MGP-related materials were noted during rock coring at these locations. Additionally, NAPL has not been encountered in deep monitoring wells in the OSDA during periodic monitoring events conducted at the site (as described in Section 1.6.3.4).

1.6.3.3 Groundwater

There are no current or likely future users of site-related groundwater and there are no known drinking water supply wells within a one-half mile radius of the North Albany Service Center. Residents and commercial establishments in the vicinity of the North Albany Service Center obtain municipal drinking water from the City of Albany.

As indicated in Section 1.5.3.3, periodic groundwater monitoring has been conducted at the site since 1997. Groundwater samples were collected from select monitoring wells and submitted for laboratory analysis. Analytical results for total BTEX and total PAHs from the most recent sampling event for each monitoring well are presented on Figure 1-17. A summary of the results obtained for the periodic monitoring program is presented below.

Former MGP Area

Groundwater sampling during previous monitoring activities within the FMA has been limited by the presence of NAPL encountered within select monitoring wells (i.e., groundwater samples are not collected from monitoring wells where NAPL is encountered). Analytical results for groundwater samples indicate that dissolved-phase constituents are present in groundwater at concentrations exceeding NYSDEC groundwater quality standards and guidance values (including samples collected from monitoring wells MW-2, MW-4, MW-5 and MW-14, and well clusters MW-26, MW-27 and MW-28). Monitoring wells in the FMA that are sampled as part of the periodic monitoring program consist of MW-26S, MW-26D, MW-27S, MW-27D, MW-28S, MW-28D. The analytical results for the periodic groundwater monitoring indicate that concentrations of COCs in on-site groundwater generally appear to be relatively stable. Groundwater monitoring results are described in detail in the annual Groundwater Monitoring and NAPL Monitoring/Recovery reports prepared by National Grid and submitted to the NYSDEC.

Off-Site/Downgradient Area

Previous monitoring results indicate that dissolved-phase COCs are present at concentrations exceeding NYSDEC groundwater quality standards and guidance values in groundwater samples collected from several monitoring wells located hydraulically downgradient of the FMA (including monitoring wells MW-16D, MW-16R, MW-17S, MW-17D, MW-18S and MW-23S), which are located west of/within Erie Boulevard (i.e., immediately downgradient of the FMA). Analytical results for groundwater samples collected at additional monitoring locations (i.e., monitoring wells MW-15S, MW-21S, MW-21D, MW-21R, MW-22S, MW-22D, MW-22R, MW-24S, and MW-25S) further downgradient from the FMA (i.e., east of Erie Boulevard and south of the MW-16 cluster) have not indicated the presence of dissolved-phase COCs at concentrations greater than laboratory detection limits. The off-site/downgradient extent of dissolved phase COCs in groundwater is defined by groundwater samples collected from the most hydraulically downgradient wells in each hydrostratigraphic unit that do not contain COCs at detectable concentrations. Groundwater analytical data indicates that impacted groundwater within the OSDA is generally located along the eastern boundary of the FMA north of Building #2, and concentrations decrease with distance from the FMA to the east and south, often to non-detectable concentrations.

1.6.3.4 NAPL

As indicated in Section 1.5.3.3, quarterly NAPL monitoring and recovery activities have been conducted since 2000 (with more frequent monitoring conducted between 1996 and 2000). The NAPL monitoring and recovery activities are being implemented to monitor the presence, thickness and recharge rate of NAPL within select monitoring wells.

Light Non-Aqueous Phase Liquid

LNAPL has been encountered in the following areas at the site:

- *FMA* – Measurable quantities of LNAPL have been observed in monitoring wells MW-4, MW-8, MW-13 and MW-14 in the FMA (with LNAPL thicknesses of greater than one foot at monitoring well locations MW-4 and MW-8).

- *OSDA* – LNAPL accumulation has not been observed in any OSDA monitoring wells during the quarterly NAPL monitoring program. Measurable amounts of LNAPL have not been encountered in monitoring wells located in the OSDA.

- *HWSTA* –LNAPL was observed during the completion of soil boring SB-17 in the area immediately south of the former TSDF (south of Building #2), but analytical results collected at this location were less than SCOs. In addition, during the TSDF closure activities, LNAPL was observed on the surface of groundwater encountered following the removal of concrete flooring and subsurface fill materials beneath a truck dock inside Building #2.

Mobile LNAPL has previously been encountered at monitoring well MW-10 located in the southeastern portion of the site. However, measureable quantities of NAPL have not been present in the well since September 2005 (i.e., 12 consecutive monitoring events without encountering a measurable thickness of NAPL). Where observed, LNAPL has been recovered to the extent possible using a disposable bottom-loading bailer and/or peristaltic pump. Over the course of the NAPL monitoring program a total of approximately 0.13 gallons of LNAPL has been recovered. A summary of measured LNAPL thicknesses is included as Table 1-2.

Dense Non-Aqueous Phase Liquid

Measurable quantities of accumulated DNAPL have been observed during previous monitoring activities in on-site monitoring wells MW-5, MW-6S, MW-7, MW-13 and MW-14. However, attempts to recover DNAPL (i.e., via bottom-loading bailers and a peristaltic pump) within the on-site monitoring wells have generally been unsuccessful due to the viscosity and density of the DNAPL at these locations. No indications of DNAPL have been observed in any monitoring wells located in the OSDA. A summary of apparent DNAPL thicknesses is included as Table 1-3. As indicated in Table 1-3, there was variability in the thickness of DNAPL between monitoring events due to the interpreted depth to refusal by field personnel and the depth to the bottom of several wells appears to be getting shallower over time due to potential sedimentation of the wells or potential well screen failure. The accuracy of NAPL measurements at MW-6S are questionable considering that 4.55 feet of NAPL was identified in December 2005 and none was detected in following monitoring event (March 2006), and there was no NAPL removal performed by field personnel. Over the course of the NAPL monitoring program, a minimal quantity of DNAPL has been recovered.

DNAPL samples were collected in March 2009 to characterize NAPL within the FMA. NAPL samples were collected from the following locations:

- Monitoring well MW-6S located near the southeast corner of Building #2
- A composite from monitoring points (installed as part of the 2005 chemical oxidation pilot testing activities) located in the northwest corner of North Albany Service Center
- A composite from monitoring wells and pilot test sampling points located west of the Vehicle Maintenance Building (including MW-5R and MW-103).

Laboratory analysis of the NAPL collected from monitoring well MW-6S indicated a specific gravity greater than 1.2 and a viscosity of more than 150,000 centipoise (cP) at 70^{o}F (i.e., the NAPL in this area is highly viscous). These results are consistent with the previous observations of NAPL in the area east and northeast of Building #2. Following laboratory processing, an insufficient volume of NAPL remained to analyze the samples collected from the area west of the Vehicle Maintenance Building and in the northwest corner of the North Albany Service Center. However, based on visual characterization by field personnel, the NAPL collected from these areas in March 2009 was significantly less viscous than the NAPL collected from monitoring well MW-6S, which is consistent with the previous observations of NAPL in these respective areas of the FMA.

1.6.3.5 Conceptual Model for Distribution of Site Impacts

The following general conclusions support the conceptual model for the distribution of NAPL/TSS at the site:

- Areas containing the heaviest visual impacts (e.g., NAPL saturated soils) generally align with former MGP structures including the northwest corner of the site (i.e., the 250,000 CF relief holder), the area southwest of the Vehicle Maintenance Building (i.e., tar tanks and tar pit), and northeast of Building #2 (i.e., the 3,000,000 CF gas holder).

- NAPL observed on top of the silt and clay east and northeast of Building #2 is highly viscous and NAPL observed in the central portion of the FMA west of the Vehicle Maintenance Building and in the vicinity of the Genesee Street Substation and GRS in the northwest corner of the site is less viscous.

- NAPL and/or NAPL-impacted soil have not been encountered to the north or west from the former relief holder area in the northwestern corner of the site.

- NAPL observed in the northwest corner of the site does not appear to be migrating as supported by observations in soil borings completed downgradient of this area (i.e., SB-120, SB-139, SB-140, SB-141, and MW-26).

- NAPL observed in the eastern portion of the FMA does not appear to be mobile as indicated by the very low recovery rates for the NAPL monitoring in this area as described in Section 1.6.3.4.

- The highest concentrations of PAHs and BTEX in site soils coincide with the areas containing the heaviest visual impacts.

- The majority of soil and groundwater within the FMA contains PAHs and BTEX at elevated concentrations. Elevated concentrations of PAHs and BTEX and/or visual indications of MGP- or non-MGP-related materials have not been encountered near the northwest corner of Building #2 (soil sampling locations SB-112 and SB-113) and the northern-most portion of the FMA (soil sampling locations SB-20, SB-154 through SB-161, SB-177, SB-178 and MW-3).

- A semi-confining, discontinuous silt and clay layer is encountered across portions of the FMA. At several locations, particularly along the eastern portion of the FMA where the silt and clay unit is thicker (e.g., SB-10, SB-119, SB-150 through SB-153), NAPL/TSS is present immediately above the silt and clay unit.

- NAPL/TSS is also present beneath the silt and clay. NAPL/TSS beneath the silt and clay unit may have migrated downward or originated in an area where the clay unit was missing or thin.

- NAPL/TSS was encountered at several locations within the weathered bedrock (e.g., SB-12, SB-14, SB-109, SB-124A, SB-129, SB-131, and SB-144) and more consistently toward the eastern portion of the FMA. The weathered bedrock is the most hydraulically transmissive unit at the site.

Although, attempts at passive NAPL recovery from existing monitoring wells have not yielded significant amounts of NAPL, visual observation of NAPL in the northwest corner of the site and near the southwest corner of the Vehicle Maintenance Building suggest that the NAPL in these areas is less viscous than the NAPL encountered in on-site monitoring wells along the eastern property boundary. Therefore, recovery of NAPL is still considered a viable alternative given a properly designed collection/recovery method.

2. Standards, Criteria, and Guidelines

2.1 General

This section presents potentially applicable standards, criteria, and guidelines (SCGs) relative to the implementation of remedial alternatives to address environmental concerns at the site. Potentially applicable SCGs were identified as set forth in NYSDEC DER 10 (NYSDEC 2010). SCGs are used to identify RAOs and evaluate potential remedial alternatives, but do not dictate a particular alternative and do not set remedial cleanup levels.

2.1.1 Definition of SCGs

Definitions of the SCGs are presented below:

- *Standards and Criteria* – are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations that are generally applicable, consistently applied, and officially promulgated under federal or state law that are either directly applicable or relevant and appropriate to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances.

- *Guidelines* – are non-promulgated criteria that are not legal requirements and do not have the same status as "standards and criteria," however, remedial programs should be designed with consideration given to guidelines that, based on professional judgment, are determined to be applicable to the project [6NYCRR Part 375-6-1.10(c)(1)(ii)].

2.1.2 Types of SCGs

NYSDEC has provided guidance on applying the SCG concept to the Remedial Investigation/Feasibility Study (RI/FS) process. In accordance with NYSDEC guidance, SCGs are to be progressively identified and applied on a site-specific basis as the RI/FS proceeds. The SCGs considered for the potential remedial alternatives identified in this Feasibility Study Report were categorized into the following classifications:

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

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

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

2.2 SCGs

The SCGs identified for the evaluation of remedial alternatives are presented below.

2.2.1 Chemical-Specific SCGs

The potential chemical-specific SCGs are summarized in Table 2-1. Chemical-specific SCGs that potentially apply to the waste materials generated during remedial activities are the RCRA and New York State regulations regarding the identification and listing of hazardous wastes outlined in 40 CFR 261 and 6NYCRR Part 371, respectively. Included in these regulations are the regulated levels for the toxicity characteristic leaching procedure (TCLP) constituents. The TCLP constituent levels are a set of numerical criteria at which solid waste is considered a hazardous waste by the characteristic of toxicity. In addition, the hazardous characteristics of ignitability, reactivity, and corrosivity may also apply, depending upon the results of waste characterization analyses. Additionally, the soil cleanup objectives to be considered under New York State remedial programs presented in 6NYCRR Part 375-6 are potentially applicable. Specially, 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use are applicable given the nature of ongoing utility service center operations and the intended continued use of the site as a service center.

Another set of potentially applicable chemical-specific SCGs are the Universal Treatment Standards/Land Disposal Restrictions (UTSs/LDRs), as listed in 6NYCRR Part 376. These standards and restrictions identify hazardous wastes for which land disposal is restricted and define acceptable treatment technologies for those hazardous wastes on the basis of their waste code characteristics. The UTSs/LDRs also provide a set of numerical criteria at which hazardous waste is restricted from land disposal, based on the concentration of select constituents. In addition, the UTSs/LDRs define hazardous debris and specify treatment methods required to treat and destroy hazardous constituents on or in hazardous debris. MGP-impacted material is considered to be a hazardous waste in New York State if it is removed (generated) and exhibits a characteristic of a hazardous waste. However, if the MGP-impacted material only exhibits the hazardous characteristic of toxicity for benzene

(D018), it is conditionally exempt from the hazardous waste management requirements (6NYCRR Parts 370-374 and 376) when destined for permanent thermal treatment, in accordance with the requirements set forth in NYSDEC's DER-4, *Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment* (NYSDEC, 2002). If MGP-related hazardous wastes are destined for land disposal in New York, federal and state hazardous waste regulations apply, including LDRs and alternative LDR treatment standards for hazardous waste soil.

Groundwater is subject to the NYSDEC Class GA groundwater standards and guidance values defined in 6NYCRR Parts 700-705. These standards identify acceptable levels of constituents in groundwater based on potable use. The Class GA Groundwater standards and guidance values are also presented in NYSDEC TOGS 1.1.1 (NYSDEC, 2004). TOGS 1.1.1 also provides a compilation of general criteria for constituents that do not have individual standards or guidance values.

2.2.2 Action-Specific SCGs

Potential action-specific SCGs are summarized in Table 2-2. Action-specific SCGs include general health and safety requirements and general requirements regarding handling and disposing of hazardous waste (including transportation and disposal, permitting, manifesting for disposal and treatment facilities).

The United States Department of Transportation (USDOT) rules for the transport of hazardous materials are provided under 49 CFR Parts 107 and 171.1 through 172.558. NYSDOT rules for transportation of hazardous materials are provided in and 6NYCRR 372.3. These rules include procedures for packaging, labeling, manifesting and transporting hazardous materials, and would be potentially applicable to the transport of hazardous materials under any remedial alternative. New York State requirements for waste transporter permits are included in 6NYCRR Part 364, as well as with standards for the collection, transport and delivery of regulated wastes within New York State. Contractors transporting waste materials for off-site treatment and/or disposal during the selected remedial alternative would need to be permitted.

Remedial activities conducted at the site would need to comply with applicable Occupational Safety and Health Administration (OSHA) requirements. General industry standards outlined under 29 CFR 1910 specify time-weighted average concentrations for worker exposure to various compounds and training requirements for workers involved with hazardous waste operations. The types of safety equipment and procedures to be followed during site remediation are specified under 29 CFR 1926, and recordkeeping and reporting-related regulations are outlined under 29 CFR 1904.

In addition to the requirements outlined under OSHA, the preparedness and prevention procedures, contingency plan and emergency procedures outlined under RCRA (40 CFR 264) are potentially relevant and appropriate to those remedial alternatives that include the generation, treatment or storage of hazardous wastes.

2.2.3 Location-Specific SCGs

Potential location-specific SCGs for the site are summarized in Table 2-3. Examples of potential location-specific SCGs include regulations and federal acts concerning activities conducted in floodplains, wetlands and historical areas, and activities affecting navigable waters and endangered/threatened or rare species. Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, Community Panel No. 360001, dated 1980, the North Albany Service Center is located within the limits of a 100-year floodplain. Location-specific SCGs also include local requirements, such as local building permit conditions for permanent or semi-permanent facilities constructed during the remedial activities (if any), and influent/pre-treatment requirements for publicly-owned treatment works (POTW).

3. Remedial Action Objectives

3.1 General

This section presents remedial action objectives (RAOs) for impacted media that have been identified at the site. These site-specific RAOs represent medium-specific goals that are protective of human health and the environment (USEPA 1988a; NYSDEC 2010). These objectives are, in general, developed by considering the results of the RI and potential SCGs identified for the site. RAOs are developed to specify the COCs at the site and to assist in developing quantitative goals for COCs in each media that may require remediation.

3.2 Remedial Action Objectives

RAOs are medium-specific goals that, if met, would be protective of human health and the environment for the environmental concerns identified at the site. Potential remedial alternatives are evaluated relative to their ability to meet the RAOs and be protective of human health and the environment. The RAOs for the site, in consideration of COCs and MOCs, exposure pathways, and receptors, are presented in the following table.

RAOs for Soil COCs: BTEX and PAHs MOCs: NAPL, TSS, and Purifier Waste
RAOs for Public Health Protection 1) Prevent ingestion and direct contact with subsurface soil containing MGP- and/or non-MGP-related materials in soil. 2) Prevent inhalation of or exposure to MPG- and/or non-MPG-related constituents volatilizing from COCs and/or MOCs in soil. *RAOs for Environmental Protection* 3) Prevent migration of MGP- and/or non-MGP-related MOCs that could result in exceedances(s) of NYSDEC groundwater quality standards and guidance values.

RAOs for Groundwater COCs: BTEX and PAHs MOCs: NAPL
RAOs for Public Health Protection 1) Prevent ingestion of groundwater with dissolved-phase COC concentrations exceeding NYSDEC groundwater quality standards and guidance values. 2) Prevent contact with, or inhalation of volatiles from groundwater containing MGP- and/or non-MGP-related COCs at concentrations exceeding NYSDEC groundwater quality standards and guidance values. *RAOs for Environmental Protection* 3) Restore groundwater quality to pre-disposal/pre-release conditions, to the extent practicable. 4) Remove the source of groundwater impacts.

Based on the results of site reconnaissance and sampling activities, and the YSA IRM performed during 2007, there is no complete exposure pathway for surface soil at the site and an RAO is not needed.

4. Technology Screening and Development of Remedial Alternatives

4.1 General

This section identifies remedial alternatives to potentially achieve the RAOs presented in Section 3. As an initial step in developing the remedial alternatives, general response actions (GRAs) were identified to address impacted site media. GRAs are medium-specific and describe actions that will satisfy the RAOs, and may include various actions such as treatment, containment, institutional controls, excavation, or any combination of such actions. From the GRAs, potential remedial technology types and process options were identified and screened to determine those that are the most appropriate to address the environmental concerns identified at the site. Technologies/process options retained following the screening were then combined (as appropriate) to develop remedial alternatives. Detailed evaluations of these remedial alternatives are presented in Section 5.

According to the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a), the term "technology type" refers to general categories of technologies. The term "technology process options" refers to specific processes within each technology type. A series of technology types and associated technology process options has been assembled for each GRA identified. In accordance with the USEPA's guidance document, each technology type and associated process options are briefly described and evaluated against preliminary and secondary screening criteria. This approach is used to determine if the application of a particular technology type or process option is applicable given the site-specific conditions for remediation of the impacted media. Based on this screening, remedial technology types and process options are eliminated or retained and subsequently combined into potential remedial alternatives for further, more detailed evaluation. This approach is consistent with the screening and selection process provided in the NYSDEC DER-10 (NYSDEC, 2010).

The NYSDEC Division of Environmental Remediation's (DER's) *Presumptive/Proven Remedial Technologies* (DER-15) allows for use of the industry's experience related to remedial cleanups to focus the evaluation of technologies on those that have been proven to be both feasible and cost-effective for specific site types/or contaminants. The objective of DER-15 is to use experience gained at remediation sites and scientific and engineering evaluation of performance data to make remedy selection efficient and consistent.

4.2 Identification of Remedial Technologies

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

- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a)
- *Technology Screening Guide for Treatment of CERCLA Soils and Sludges* (USEPA, 1988b)
- *Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010)
- *Presumptive/Proven Remedial Technologies for New York States Remedial Programs* (DER-15) (NYSDEC, 2007)
- *Remediation Technologies Screening Matrix and Reference Guide* (USEPA and United States Air Force [USAF], 2002)
- *Management of Manufactured Gas Plant Sites* (Gas Research Institute [GRI], 1996)

According to USEPA guidance (USEPA, 1988a), remedial technology types and process options can be identified by drawing on a variety of sources, including regulatory references and standard engineering texts not specifically directed toward impacted sites. Although each former MGP site offers its own unique site characteristics, the evaluation of remedial technology types and process options that are applicable to MGP-related impacts, or have been implemented at other MGP sites, is well documented. This collective knowledge and experience, and regulatory acceptance of previous feasibility studies performed on MGP-related sites with similar impacts, were used to reduce the universe of potentially applicable process options for the site to those with documented success in achieving similar RAOs.

4.3 General Response Actions

Based on the RAOs presented in Section 3, the following potential GRAs have been identified:

Subsurface Soil

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

Groundwater

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

4.4 Remedial Technology Screening

Potentially applicable technologies and technology process options associated with each of the GRAs underwent preliminary and secondary screening to retain the technologies that would most-effectively achieve the RAOs identified for the site. Criteria used to complete the preliminary and secondary screening are presented in the following subsections.

For the purposes of the screening evaluations, technology refers to a general category of technologies, such as capping or immobilization, while the technology process is a specific process within each technology type (e.g., asphalt cap, multi-media cap, jet-grouting, shallow soil mixing). A “No Action” GRA has been included and retained through the screening evaluation. The “No Action” GRA will serve as a baseline for comparing the potential overall effectiveness of the other technologies.

4.4.1 Preliminary Screening

The preliminary screening was performed to reduce the number of potentially applicable technologies and technology processes based on technical implementability. This screening was based on several considerations, including: successful full-scale demonstrations of the technology; compatibility of the technology with the specific media, location, and constituent distribution; time-frame to acquire necessary permits; and area required for setup/operation relative to available space at the site.

4.4.2 Secondary Screening

A number of potentially applicable technologies and technology processes were retained through the preliminary screening. To further reduce the technology processes to be assembled into remedial alternatives, a secondary screening of the processes was conducted. The objective of the secondary screening was to choose, when possible, one representative remedial technology process for each remedial technology category to simplify the subsequent development and evaluation of the remedial alternatives. Criteria used for secondary screening include:

- *Effectiveness* – This criterion evaluates the extent to which the technology process will mitigate potential threats to public health and the environment through the reduction in toxicity, mobility, and/or volume of constituents in impacted environmental media.

- *Implementability* – This criterion evaluates the ability to construct, reliably operate, and meet technical specifications or criteria associated with each technology process. This evaluation also considers the operation and maintenance (O&M) required in the future, following completion of remedial construction.

4.5 Summary of Retained Remedial Technologies

Results of the remedial technology screening process for soil and groundwater are presented in Tables 4-1 and 4-2, respectively. Remedial technologies retained through secondary screening are summarized below.

Media	Technology Type	Technology Processes
Soil	No Action	No Further Action
	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices
	Capping	Asphalt/Concrete Cap

Media	Technology Type	Technology Processes
Soil (cont'd)	Immobilization	Solidification/Stabilization
	Excavation	Excavation
	Disposal	Solid Waste Landfill
Groundwater	No Action	No Further Action
	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices
	Biological Treatment	Monitored Natural Attenuation, Enhanced Aerobic Biodegradation
	NAPL Removal	Active Removal, Passive Removal, Collection Trenches/Passive Barrier Wall

As presented in Section 1.6.3, complete exposure pathways do not exist for human exposure to surface soil. RAOs, therefore, were developed to reflect potential exposure to subsurface soil containing MGP- and non-MGP-related COCs. Maintaining the existing surface cover material at the former MGP property would achieve these RAOs and therefore will be retained throughout the screening process and included in each alternative. Screening of additional technology types and process options for surface soil is therefore not necessary.

4.6 Development of Remedial Alternatives

Based on the nature and extent of impacts described in Section 1 and the remedial technologies and associated technology processes retained through the preliminary and secondary screening, none of the retained remedial technologies have the individual ability to meet the RAOs established for the site. Therefore, as presented in the following subsections, individual technologies (and associated technology processes) have been combined into remedial alternatives to achieve the RAOs and address the MGP- and non-

MGP-related environmental concerns for each of the site areas (i.e., FMA, HWSTA, and OSDA).

DER-10 requires an evaluation of the following alternatives:

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

Additional alternatives were developed based on the current, intended and reasonably anticipated future use of the site, as well as removal of source area(s) of impacts.

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

Remedial alternatives that have been assembled and developed for addressing the impacted media are presented below. Detailed technical descriptions of the remedial alternatives are presented in Section 5 as part of the detailed remedial alternative evaluations.

4.6.1 FMA Alternatives

Remedial alternatives that have been developed for addressing MGP- and non-MGP-related environmental concerns in the former MGP area are presented below.

Based on the nature and extent of impacts in the HWSTA (i.e., separate phase material observed on the surface of groundwater during excavation [Section 1.6.3.1] and soil boring installation activities), passive NAPL recovery is the only retained technology applicable for addressing impacts in this area. Therefore, potential remedial alternatives for the HWSTA are not evaluated separately in this Feasibility Study. Monitoring and passive recovery of LNAPL in the HWSTA is included as a component of each FMA alternative.

Additionally, based on the nature and extent of site impacts, as presented in Section 1, MGP- and non-MGP-related impacts may be present beneath the eastern portion of Building #2. Demolition of Building #2 to access soil beneath the building is not technically practicable and is not considered a viable component of any of the FMA alternatives. However, all of the remedial alternatives include means to mitigate MGP- and non-MGP-related impacts that are potentially presented beneath Building #2 (through monitoring and passive NAPL recovery, or containment). Also, as discussed in Section 1.5.3.10, National Grid completed SVI investigation activities to evaluate potential SVI issues for Building #2 and the Vehicle Maintenance Building. Results for the SVI investigation indicate that remedial measures are not required to address SVI issues at the site.

4.6.1.1 Alternative FMA-1 – No Further Action

Under this alternative, no remedial activities would be completed.

4.6.1.2 Alternative FMA-2 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

This alternative utilizes a combination of soil removal, passive NAPL recovery, and capping to address MGP- and non-MGP-related impacts in the former MGP area. This alternative consists of excavating approximately 17,400 CY of heavily NAPL-impacted soil and NAPL-coated woodchips encountered east and northeast of Building #2, including soil down to and including approximately the top two feet of the silt and clay unit (i.e., approximately 12 feet bgs). Alternative FMA-2 also includes construction of a passive NAPL barrier wall and NAPL collection wells in the northwest corner of the site near the Genesee Street Substation to reduce the potential for migration of NAPL from this area, which contains heavily NAPL-impacted soil. Although technically feasible, removal or in-situ treatment of impacted soil in this area of the site is not practical and is prohibitive at this time due to the presence of existing infrastructure (i.e., an active electrical substation and the GRS, and associated subsurface utilities in this area). Containment of this area would sufficiently prevent potential migration of NAPL located beneath the Genesee Street Substation and near the GRS. If at some point in the future, the Genesee Street Substation is de-energized or relocated, National Grid will evaluate remedial measures to address the NAPL and impacted soils that are currently not accessible due to the presence of the substation. Remaining on-site soil that contains MGP- and non-MGP-related impacts would be addressed by passive removal of NAPL via collection wells, construction of an asphalt cap, and implementation of institutional controls to restrict the property to industrial use only and to notify future owners of the presence of remaining impacted material. This would prevent potential site COCs and NAPL from contacting human receptors.

Actively addressing these materials (to be contained under this alternative) would be considered if the substation is ever decommissioned in the future.

4.6.1.3 Alternative FMA-3 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

This alternative is similar to Alternative FMA-2; however, it includes installation of a passive NAPL barrier wall along the eastern property boundary to enhance collection of the mobile fraction of NAPL (relative to collection wells alone as included in Alternative FMA-2). The passive barrier wall would prevent potential migration of LNAPL and DNAPL both in the saturated and unsaturated zones beyond the FMA and facilitate the collection of potentially mobile NAPLs. This alternative includes the same components of passive NAPL recovery, removal, capping, and institutional controls as alternative FMA-2.

4.6.1.4 Alternative FMA-4 – ISS, Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

Alternative FMA-4 includes the same removal, capping, institutional control, and passive NAPL barrier walls and NAPL recovery components as Alternative FMA-3. This alternative also includes ISS of saturated and unsaturated soil in the vicinity of (i.e., west of) the Vehicle Maintenance Building that contains significant visual evidence of NAPL (i.e., soils saturated with NAPL, not including staining, sheens, or blebs) and/or PAHs at concentrations greater than 1,000 ppm. ISS involves mixing Portland cement and other pozzolanic materials with soil to solidify the material to reduce leachability and mobility of COCs and NAPL. As part of this alternative, approximately 12,600 CY of soil would be pre-excavated to a depth of approximately five feet bgs to facilitate ISS of approximately 36,200 CY of site soils (i.e., assume to be completed up to 1.5 feet into weathered bedrock).

4.6.1.5 Alternative FMA-5 – Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

This alternative consists of excavating approximately 244,300 CY of soil containing COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives and transporting the excavated material off-site for treatment/disposal. As part of Alternative FMA-5, Building #2, the Vehicle Maintenance Building, and the Genesee Street Substation and GRS (as well as supporting infrastructure) would be removed to facilitate soil excavation activities.

4.6.2 OSDA Alternatives

Remedial alternatives that have been developed for addressing MGP- and non-MGP-related environmental concerns in the OSDA are presented below.

As indicated in Section 1.6.3.1, soil borings SB-123 and SB-124A are the only locations within the OSDA that contain visual MGP- and/or non-MGP-related impacts in the overburden and are likely a continuation of the impacts observed within the FMA. Analytical results exceeding SCOs for PAHs (soil boring location SB-129 [24-26']) and BTEX (soil boring locations SB-124 [4-6'] and SB-129 [24-26']) were identified close to the eastern FMA site boundary. However, both visual and analytical characterization of soil and groundwater indicate that site-related impacts decrease readily with distance from the site (both south and east), often to non-detectable concentrations. As described in Section 4.6.1, the FMA alternatives include various options for addressing impacted overburden material within the FMA. Based on the presence of the railroad immediately east of the North Albany Service Center property and the limited extent of impacted overburden material in the OSDA, excavation is impractical (i.e., not technically feasible) for addressing impacted overburden material in this area. Similarly, excavation of NAPL observed in weathered bedrock at soil boring locations SB-129 and SB-131 is technically impractical, as these locations in the OSDA are beneath the railroad right-of-way and Erie Boulevard.

Potential remedial alternatives to address MGP- and non-MGP-related environmental concerns in the OSDA focus on options to monitor, recover, and/or treat NAPL within the weathered bedrock and low level dissolved-phase groundwater impacts identified within the saturated zone of the OSDA. The groundwater impacts were generally identified beneath and west of Erie Boulevard.

4.6.2.1 Alternative OSDA-1 – No Further Action

Under this alternative, no remedial activities would be completed.

4.6.2.2 Alternative OSDA-2 – Passive NAPL Recovery, Groundwater Monitoring, and Institutional Controls

This alternative consists of installing DNAPL collection wells in the OSDA to monitor for and passively recover DNAPL (if encountered). This alternative would rely on natural attenuation of dissolved-phase COCs to achieve NYSDEC groundwater quality standards and guidance values. A long-term groundwater monitoring program would be established to monitor concentrations of dissolved-phase COCs in groundwater downgradient of the North Albany Service Center property. Additionally, institutional controls would be established to restrict groundwater use in the OSDA, which would reduce the potential for exposure to site-related COCs and NAPL. Combined with the fact that groundwater is not used for potable sources within a one-half mile radius of the site, this alternative would be protective of human health.

4.6.2.3 Alternative OSDA-3 – Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

Similar to Alternative OSDA-2, this alternative consists of installing DNAPL recovery wells in the OSDA to monitor for and passively recover DNAPL (if encountered). Additionally, amendments would be added to the groundwater to enhance the natural attenuation of dissolved-phase COCs in groundwater to achieve the RAOs in a potentially shorter period of time (i.e., relative to not adding groundwater amendments). Groundwater amendments would be applied to the saturated zone via application wells and/or injection points installed along the hydraulically upgradient portion of the OSDA. As with Alternative OSDA-2, a long-term groundwater monitoring program would be established to monitor concentrations of dissolved-phase COCs in groundwater downgradient of the North Albany Service Center property and institutional controls would be established to restrict groundwater use in the OSDA.

5. Detailed Evaluation of Remedial Alternatives

5.1 General

This section presents detailed descriptions of the remedial alternatives developed to achieve the site-specific soil and groundwater RAOs. Each of the retained remedial alternatives is evaluated with respect to the criteria presented in DER-10. The results of the detailed evaluation of remedial alternatives are used to aid in the recommendation of appropriate alternatives to be implemented at the site.

5.2 Description of Evaluation Criteria

The detailed evaluation of remedial alternatives presented in this section consists of an assessment of each assembled alternative (presented in Section 4.6) against the following eight evaluation criteria:

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

These evaluation criteria encompass statutory requirements and include other gauges such as overall feasibility. Descriptions of the evaluation criteria are presented in the following sections.

Additional criteria, including public and state acceptance, will be addressed following submittal of the final Feasibility Study Report. The community acceptance assessment will be completed by the NYSDEC after community comments on the Proposed Remedial Action Plan (PRAP) are received. The results of the evaluation are typically considered when the NYSDEC selects a preferred remedial alternative and are typically presented in a Responsiveness Summary completed by the NYSDEC. The Responsiveness Summary is part of the Record of Decision (ROD) for the project and responds to all comments and questions raised during a public meeting associated with the PRAP, as well as comments received during the associated public comment period.

5.2.1 Short-Term Impacts and Effectiveness

The short-term impacts and effectiveness criterion is used to evaluate the remedial alternative relative to its effect on public health and the environment during construction and/or implementation of the alternative. The evaluation of each alternative with respect to its short-term effectiveness will consider the following:

- Potential short-term adverse impacts and nuisances to which the public and environment may be exposed during implementation of the alternative.

- Potential impacts to workers during implementation of the remedial actions and the effectiveness and reliability of protective measures.

- Amount of time required to implement the remedy and the time until the remedial objectives are achieved.

- The sustainability and use of green remediation practices utilized during implementation of the remedy.

5.2.2 Long-Term Effectiveness and Permanence

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

- Potential impacts to human receptors, ecological receptors, and the environment from untreated waste or treatment residuals remaining at the completion of the remedial alternative.

- The adequacy and reliability of institutional and/or engineering controls (if any) that will be used to manage treatment residuals or remaining untreated impacted media.

5.2.3 Land Use

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

5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

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

5.2.5 Implementability

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

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

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

5.2.6 Compliance with SCGs

This criterion evaluates the remedial alternative’s ability to comply with SCGs. The following items are considered during evaluation of the remedial alternative:

- Compliance with chemical-specific SCGs
- Compliance with action-specific SCGs
- Compliance with location-specific SCGs

This evaluation criterion also addresses whether the remedial alternative would be in compliance with other appropriate federal and state criteria, advisories, and guidance. Applicable chemical-, action-, and location-specific SCGs are presented in Tables 2-1 through 2-3, respectively.

5.2.7 Overall Protection of Public Health and the Environment

This criterion evaluates whether the remedial alternative provides adequate protection of public health and the environment based on the following:

- How the alternative would eliminate, reduce, or control (through removal, treatment, containment, other engineering controls, or institutional controls) any existing or potential human exposures or environmental impacts that have been identified.
- The ability of the remedial alternative to meet the site-specific RAOs.
- A combination of the above-listed criteria including: long-term effectiveness and permanence; short-term impacts and effectiveness; and compliance with SCGs.

5.2.8 Cost Effectiveness

This criterion evaluates the estimated total cost to implement the remedial alternative. The total cost of each alternative represents the sum of the direct capital costs (materials, equipment, and labor), indirect capital costs (engineering, licenses/permits, and contingency allowances), and O&M costs. O&M costs may include operating labor, energy, chemicals, and sampling and analysis. These costs will be estimated with an anticipated accuracy between -30% to +50% in accordance with the USEPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a). A 20% contingency factor is included to cover unforeseen costs incurred during implementation of the remedial alternative. Present-worth costs are calculated for alternatives expected to last more than 2 years. In accordance with USEPA guidance a 5% discount rate (before taxes and after inflation) is used to determine the present-worth factor.

5.3 No Further Action Alternative

The “No Further Action” alternative was retained for evaluation for each of the environmental media to be addressed at the site as required by USEPA‘s *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a) and NCP regulations. Because the “No Further Action” alternative applies to each remediation area, this alternative is evaluated in detail once below.

The “No Further Action” alternative serves as the baseline for comparison of the overall effectiveness of the other remedial alternatives. The “No Further Action” alternative would not involve implementation of any remedial activities to address the COCs in the environmental media at the site. The site would be allowed to remain in its current condition and no effort would be made to change the current site conditions.

Short-Term Impacts and Effectiveness – No Further Action

No remedial action would be implemented for the impacted environmental media at the site; therefore, there would be no short-term environmental impacts or risks posed to the community.

Long-Term Effectiveness and Permanence – No Further Action

Under the "No Further Action" alternative, the COCs in site media would not be addressed. As a result, this alternative would not meet the RAOs identified for the site.

Land Use – No Further Action

Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State. A GRS and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas.

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

Reduction of Toxicity, Mobility, or Volume through Treatment – No Further Action

Under the "No Further Action" alternative, environmental media would not be treated (other than by natural processes), recycled, or destroyed. Therefore, the toxicity, mobility, and volume of the COCs in the impacted environmental media at the site would not be reduced through treatment.

Implementability – No Further Action

The “No Further Action” alternative does not require implementation of any remedial activities.

Compliance with SCGs – No Further Action

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

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

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

Overall Protection of Public Health and the Environment – No Further Action

The “No Further Action” alternative does not address the impacted environmental media. Therefore, the “No Further Action” alternative would be ineffective and would not meet the RAOs established for environmental media at the site.

Cost Effectiveness – No Further Action

The “No Further Action” alternative does not involve implementation of any remedial activities; therefore, there are no costs associated with this alternative.

5.4 Detailed Evaluation of FMA Alternatives

This section presents the detailed analysis of the following FMA alternatives that were previously identified in Section 4.

- Alternative FMA-2 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

- Alternative FMA-3 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

- Alternative FMA-4 – ISS, Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

- Alternative FMA-5 – Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

Each alternative is evaluated against the seven evaluation criteria described above.

5.4.1 Alternative FMA-2 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

The major remedial components of Alternative FMA-2 consist of the following:

- Excavating soil east and northeast of Building #2
- Constructing a passive NAPL barrier wall in the northwest corner of the site
- Installing NAPL collection wells and upgradient NAPL monitoring wells
- Constructing an asphalt cap over remaining site soil
- Establishing institutional controls

Under this alternative, approximately 17,400 CY of soil would be excavated to address the most accessible, visually impacted soil and MOCs (i.e., highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips) encountered in the FMA. Approximate removal limits are shown on Figure 5-1 and excavations would be completed to approximately two feet into the silt and clay confining layer (the top of which varies from approximately 10 to 12 feet below grade). Excavation of material to this depth would permanently remove a majority of the visually impacted material identified during previous investigations from this area. Excavation into the top two feet of the confining layer would also remove soil containing the highest concentrations of BTEX and PAHs detected at each location. Analytical results of soil to be excavated (in or above the confining layer) were often two to six orders of magnitude greater than soils below the confining layer, as summarized at the following four locations:

Soil Boring ID	PAH above Silt and Clay (ppm)	PAH within/below Silt and Clay (ppm)
SB-10	152,170	0.51
SB-12	182,000	5,125
SB-119	117,700	5.18
MW-14	17,570	5.81

Excavation activities would be conducted using conventional construction equipment such as backhoes, excavators, front-end loaders, dump trucks, etc. Based on the proposed extent of excavation activities for Alternative FMA-2, excavation support (e.g., sheet pile, soldier piling, etc.) is anticipated to be required. The dead and live loads associated with Building #2 and the railroad along the eastern portion of the North Albany Service Center would be evaluated to determine how these loads would affect the stability of the excavation. The final excavation plan would be developed as part of a remedial design. Additionally, it is anticipated that an excavation support structure (e.g., Sprung structure) equipped with a vapor collection and treatment system would be constructed over the proposed excavation area to reduce the potential for exposures and off-site migration of vapors and odors during excavation activities. A stormwater pollution prevention plan (SWPPP) would be developed as part of the remedial design and erosion controls (e.g., silt fencing, hay bales) would be placed around excavation and material staging areas to reduce soil erosion in these areas. The excavation area would be backfilled with clean imported fill.

Excavated material would be segregated based on the presence/absence of visual impacts (i.e., NAPL, sheens) and staged to facilitate sampling for waste characterization and evaluation of treatment and disposal requirements. For the purpose of developing a cost estimate, it has been assumed that 50% of excavated material (approximately 8,700 CY) would require treatment/disposal via LTTD and the remaining 50% of excavated material would be disposed of as non-hazardous waste at a solid waste landfill.

Based on the presence of the Genesee Street Substation and GRS located in the northwest corner of the North Albany Service Center (as well as the extensive subsurface components of these utilities), excavation to address visually impacted soil and NAPL in this area is not practical. Therefore, this alternative also includes construction of a passive NAPL barrier wall to reduce the potential for migration of NAPL observed in this area. The passive NAPL wall would be installed to the limits shown on Figure 5-1 to depths up to 25 feet below grade and keyed into bedrock. The placement/alignment of the wall was selected to address the contiguous area of low-viscosity NAPL (i.e., relative to other coal tar) identified in the northwest corner of the site.

A long-stick excavator would be used to remove soil and a biopolymer slurry would be serve as a stabilizing fluid to support the open trench excavation. The excavation would be completed to a depth of approximately 25 feet below grade and keyed into bedrock. Excavated soil would be staged, characterized, and treated/disposed with soil excavated from near Building #2. Pea gravel (or other appropriate granular material) would then be placed within the slurry-supported trench and the biopolymer slurry would be degraded to promote free flow of groundwater through the wall.

The pea gravel serves a high-conductivity area within the subsurface to promote NAPL collection. The high-conductivity zone created by pea gravel (as compared to surrounding site soil) allows DNAPL to settle to the bottom of the trench where it can be directed (through sloping of the excavation bottom) to collection sumps and DNAPL recovery wells installed within the passive barrier wall. DNAPL recovery wells would be installed within the permeable wall and LNAPL migration would mitigated by installing a low-permeability “curtain” within the upper portion of the wall (that would extend below the annual low water table elevation). The curtain would consist of high-density polyethylene (HDPE) or other appropriate material to prevent LNAPL from migrating further downgradient. LNAPL collection wells would be installed immediately upgradient of the curtain within the wall and screened across the top of the water table. The presence of subsurface gas and electrical utilities would obstruct the installation of the passive NAPL barrier wall in close proximity to the utilities. Therefore, jet-grouting techniques would be utilized to create a localized continuous low-permeability barrier wall around the utilities to prevent NAPL migration in the area immediately beneath the utility. Jet-grouting consists of applying a cement bentonite (CB) grout mixture into a column of soil using high pressure injection equipment (i.e., without excavation of soil). The high-pressure injection breaks the soil structure and mixes the soil and grout in-situ, thereby creating a homogeneous mixture which subsequently solidifies into a weakly-cemented material.

The CB grout would likely consist of a mixture of blast furnace slag cement (BFS), Portland cement, bentonite, and water, which can achieve the strength and permeability of compact clay. Bench-scale testing would be required to evaluate the compatibility of various grout mixtures with COCs and NAPL in soil and groundwater in the FMA. Mixtures would be tested for density, permeability, strength, and leachability of COCs to identify a mix design to meet performance objectives that would be established as part of the remedial design.

Following construction of the passive NAPL barrier wall, a low-permeability asphalt cap would be constructed over remaining MGP- and non-MGP-impacted soil that contains COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. The asphalt cap would serve to minimize the potential for exposure to impacted soil that would remain at the site and limit the amount of surface water infiltration through impacted soil. Prior to the installation of the cap, the top one-foot of existing surface material (assumed to consist of six inches of asphalt pavement in various states of disrepair and six inches of gravel subbase) would be removed (approximately 9,100 CY). For the purpose of developing a cost estimate for this alternative, it has been assumed that surface material would be disposed of as construction and demolition (C&D) debris at a solid waste landfill. The asphalt cap would be constructed to the limits shown on Figure 5-1 and would consist of the following:

- A new 6-inch thick layer of asphalt subbase (i.e. gravel) placed, compacted, and graded to match existing site grades

- A 4-inch thick base course of bituminous asphalt

- A 2-inch thick wearing course of bituminous asphalt

The future intended use of the FMA is continued operation as a National Grid service center. Site-related traffic would be allowed to drive over the cap and use the capped surface as a parking area. Following installation of the asphalt cap, an annual monitoring and maintenance program would be developed and implemented to monitor the cap for cracking and to repair the cap, as needed, to maintain the cap's integrity.

Alternative FMA-2 would also include the installation of LNAPL and DNAPL collection wells to passively recover potentially mobile NAPL at the downgradient boundary of the FMA and in the HWSTA. As indicated in Section 1, less viscous NAPL has been observed in soil borings and monitoring wells located west of the Vehicle Maintenance Building in the central portion of the FMA and in the vicinity of the Genesee Street Substation and GRS in the northwest corner of the North Albany Service Center. Collection wells would be installed at the approximate locations shown on Figure 5-1, where NAPL has been observed and is mostly likely to accumulate. The final number and layout of NAPL collection wells would be determined during the remedial design. Per NYSDEC's request, this FMA alternative would also include installation of "sentinel" NAPL monitoring wells located west of Broadway. The NAPL monitoring wells would be periodically gauged (i.e., assumed quarterly) to verify that MGP-related impacts are not migrating upgradient of the FMA.

Consistent with the monitoring activities currently conducted at the site, new NAPL collection/monitoring wells would be gauged quarterly to evaluate the presence/absence of NAPL. NAPL (if encountered) would be recovered using manual techniques (to the extent practicable) and placed in appropriate containers for transportation off-site and disposal at an appropriate facility.

As indicated in Section 1.6.3.3, BTEX and PAH concentrations in groundwater samples, collected from monitoring wells within the FMA over the course of consecutive annual groundwater sampling events appear to be stable. Although Alternative FMA-2 includes the removal of 17,400 CY of heavily impacted soil and passive NAPL removal via NAPL recovery wells, NAPL and NAPL-impacted soil would remain in the FMA. Therefore, dissolved-phased groundwater impacts within the FMA would be expected to remain under Alternative FMA-2. Continued monitoring of groundwater within the FMA is not included as part of this alternative. Instead, Alternative FMA-2 would include measures to reduce the potential for exposure to impacted groundwater through capping and institutional controls. Continued monitoring of groundwater downgradient of the FMA is included as part of the OSDA alternatives described in Section 5.5.

Institutional controls in the form of environmental easements (i.e., environmental land use restrictions [ELURs]) and deed restrictions, to prohibit the use of site groundwater and limit the future development and use of the property, would be established as part of this alternative. Additionally, this alternative would include preparation of a Site Management Plan (SMP) to document the following:

- Known locations of soil remaining in the FMA that contains MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use

- Requirements for asphalt cap inspection and maintenance

- Protocols for NAPL monitoring and recovery

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

- Restrictions on invasive activities to mitigate potential damage to and/or short-circuiting of the passive barrier wall

- Provisions for additional investigation and remediation activities in the northwest corner of the site if the Genesee Street Substation is de-energized or relocated.

Annual reports would be submitted to NYSDEC to document that institutional controls and the asphalt cap are maintained and remain effective.

<u>Short-Term Impacts and Effectiveness – Alternative FMA-2</u>

Implementation of this alternative may result in short-term exposure of the surrounding community and site workers to site-related COCs as a result of excavation, material handling, and off-site transportation activities. Additionally field personnel may be exposed to impacted groundwater and/or NAPL during NAPL collection well installation activities. Potential exposure mechanisms would include ingestion and dermal contact with impacted soil and/or groundwater and inhalation of volatile organic vapors or dust containing COCs during remedial construction. Potential exposure of remedial workers would be minimized through the use of appropriately trained field personnel and the appropriate level of personal protective equipment (PPE), as specified in a site-specific Health and Safety Plan (HASP) that would be developed as part of the remedial design. Air monitoring would be performed during excavation and backfilling activities to evaluate the need for additional engineering controls (e.g., use of water sprays to suppress dust, modify the rate of construction, etc.). Community access to the site is restricted by permanent security fencing and temporary fencing would be used to restrict access to excavation and work areas. A Community Air Monitoring Plan (CAMP) would be prepared and community air monitoring would be performed during excavation and backfilling activities to evaluate the need for additional engineering controls.

Additional worker safety concerns include working with and around large construction equipment, noise generated from operating construction equipment, and increased vehicle traffic associated with transportation of excavated material from the site and delivery of fill materials. These concerns would be minimized by using engineering controls and appropriate health and safety practices. Off-site transportation of excavated material and importation of clean fill materials would result in approximately 2,800 tractor trailer round trips (assuming 20 CY per tractor trailer). This increase in local truck traffic would create a nuisance to the surrounding community, as well as an increase in the potential for motor vehicle accidents on local roads and highways. Transportation activities would be managed to minimize en-route risks to the community.

Soil excavation, passive barrier wall construction, backfilling, and capping activities are anticipated to be completed in approximately 13 months and NAPL monitoring activities would be conducted over an assumed 30-year period. Note that remedial construction activities may be conducted over multiple construction seasons/phases and therefore, actual construction durations could increase.

The relative carbon footprint of Alternative FMA-2 (as compared to the other FMA alternatives) is considered moderate. The greatest contribution to greenhouse gases would occur as a result of LTTD treatment of impacted soil and heavy equipment operation during excavation, backfilling, and transportation activities.

<u>Long-Term Effectiveness and Permanence – Alternative FMA-2</u>

This remedial alternative would reduce potential long-term exposures to impacted site media. Although Alternative FMA-2 does not include the excavation of all soil in the FMA containing MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use, the most accessible, heavily impacted soil (i.e., highly viscous NAPL and impacted soil east and northeast of Building #2) would be permanently removed from the site. NAPL and impacted soil in the northwest corner of the North Albany Service Center would be isolated via an asphalt cap that would be installed over remaining soil in the FMA that contains MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Additionally, a passive NAPL barrier wall (and NAPL collection wells) would be installed in the northwest corner of the site to facilitate the collection of potentially mobile NAPL in this area.

Based on the results of predictive simulations conducted using the existing MODFLOW groundwater flow model for the site, the steady-state (i.e., long-term) impacts of Alternative FMA-2 on hydrogeologic site conditions consist of the following:

- Groundwater mounding would likely occur behind (i.e., upgradient of) a low-permeability barrier wall constructed in the northwest corner of the North Albany Service Center. Any increase in the groundwater table elevation could cause an increased downward vertical hydraulic gradient which could impact NAPL migration. Therefore, a permeable, passive NAPL barrier would be installed in the northwest corner of the site to minimize changes in site hydrogeology.

- If excavations are completed to an approximate depth of 12 feet below grade and the fill material placed in the excavation area (i.e., east and northeast of Building #2) has a higher hydraulic conductivity that the existing material to be excavated, the water table elevation in this area would be expected to be slightly lower relative to the current groundwater elevation in this area. Vertical hydraulic gradients in the vicinity of the excavation area may be slightly upward from the till/weathered bedrock to the overburden, while currently there is a slight downward vertical gradient in this area of the site.

The results of the MODFLOW groundwater flow model simulations are discussed in greater detail in the technical memorandum included as Appendix B and additional groundwater modeling simulations (prepared in 2012) are included as Appendix C.

Select soil removal and installation of the cap coupled with institutional controls would reduce the potential for exposure to impacted soil. Excavation is a permanent process and capping requires monitoring and maintenance, along with use restrictions of the capped area for this alternative to remain effective and reliable over the long-term. Annual inspection of the cap would be conducted and maintenance activities would potentially include replacing and repairing eroded or damaged areas. Cap repairs would be easily accomplished as asphalt materials are readily available. Periodic reports would be submitted to NYSDEC to confirm that the cap and institutional controls are being maintained.

Under this alternative, impacted groundwater in the FMA would not be addressed through active treatment. Routine site operations do not include contact with or exposure to site groundwater. Additionally, drinking water for the North Albany Service Center and the surrounding community is provided via municipal supply. This alternative does not include removal of all NAPL within the FMA. However, monitoring and recovery activities would be conducted using new NAPL recovery wells and a passive NAPL barrier wall to reduce the potential for migration of NAPL.

<u>Land Use – Alternative FMA-2</u>

Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State. A GRS and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas.

Implementation of Alternative FMA-2 is not anticipated to alter current or anticipated future use of the site. Although excavation activities would cause a short-term disruption to service center operations and the surrounding community, the disturbed portions of the site would be restored to match existing conditions.

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

This alternative would include the removal and off-site disposal of approximately 17,400 CY of soil containing highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips. Soil containing MGP- and non-MGP-related impacts with COC concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use would remain on-site beneath an asphalt cap. Additionally, mobile NAPL (if present) in the northwest corner of the North Albany Service Center would be collected by the passive NAPL barrier wall, which would reduce the potential for further NAPL migration.

Alternative FMA-2 does not include remedial activities to directly address impacted groundwater within the FMA. For the purposes of estimating a cost for this alternative, it is assumed that NAPL recovery activities would consist of quarterly monitoring of NAPL collections wells to facilitate recovery of mobile NAPL. The actual frequency of monitoring would be determined after performing several monitoring events and assessing the amount of NAPL entering the wells, if any. NAPL would be removed (if encountered), which would reduce the volume of NAPL presented in the FMA, thereby reducing the volume of material that is serving as a source of dissolved-phase groundwater impacts.

Implementability – Alternative FMA-2

This remedial alternative would be both technically and administratively implementable. Equipment and materials necessary to excavate soil and install an asphalt cap are readily available. Remedial contractors are also available to perform these activities (i.e., no highly specialized equipment, materials, or personnel would be required). Remedial contractors capable of constructing passive NAPL barrier walls are also available. Passive NAPL barrier walls have been constructed at numerous MGP and non-MGP sites throughout the United States, including in New York State. Equipment and personnel qualified to install collection wells and conduct NAPL recovery activities are also readily available.

Potential challenges associated with the implementation of this alternative would consist of the following:

- Conducting remedial activities within an active service center. Implementation of the remedial activities would require extensive coordination with National Grid Service Center personnel to minimize the disruption to daily service center operations.

- Excavating soil in close proximity to Building #2 and the railroad immediately east of the North Albany Service Center property. The effects of these activities would be assessed during the remedial design to evaluate excavation stability in this portion of the site.

- Conducting work in close proximity to the Genesee Street Substation and GRS in the northwest corner of the North Albany Service Center. Excavation activities in this area (i.e., passive barrier wall pre-installation excavation) would be conducted using a back hoe and by hand-digging to identify and locate subsurface electrical transmission lines and natural gas distribution lines, as well as clear the numerous subsurface obstructions/foundations located in this portion of the FMA. Additionally, appropriate utility clearance distances would be maintained during installation of the asphalt cap in this area and temporary shielding or deactivation of these utilities would be coordinated with National Grid.

- Recovering LNAPL and DNAPL, if any, from collection wells installed in the eastern portion of the FMA. Based on previous attempts to recover DNAPL, recovery efforts may have limited effectiveness due to the viscous nature of the NAPL.

Compliance with SCGs – Alternative FMA-2

- *Chemical-Specific SCGs* – Chemical-specific SCGs are presented in Table 2-1. Potentially applicable chemical-specific SCGs for soil include 6NYCRR Part 375-6 soil cleanup objectives and 40 CFR Part 261 and 6NYCRR Part 371 regulations for the identification of hazardous materials. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values.

  A majority of soil within the FMA contains VOCs and SVOCs at concentrations greater than the 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Under this alternative, the most accessible heavily NAPL-impacted soil and NAPL-coated woodchips would be removed from an area east and northeast of Building #2. An asphalt cap would be installed to provide a physical barrier from remaining subsurface soil that contains COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Additionally, mobile NAPL (if present) in the northwest portion of the North Albany Service Center would be collected by the passive barrier wall. Excavated material would be characterized in accordance with 40 CFR Part 261 and 6NYCRR Part 371 to determine appropriate off-site treatment/disposal requirements. NYS LDRs would apply to materials that are characterized as a hazardous waste.

Groundwater within the FMA contains VOCs and SVOCs at concentrations greater than NYSDEC Class GA standards and guidance values. As this alternative does not include active remedial measures to address all soil containing MGP- and non-MGP-related impacts, this alternative would likely not achieve groundwater SCGs within a determinate period of time.

- *Action-Specific SCGs* – Action-specific SCGs are presented in Table 2-2. Potentially applicable action-specific SCGs include health and safety requirements and regulations associated with handling impacted media. Work activities would be conducted in accordance with OSHA requirements that specify general industry standards, safety equipment and procedures, and record keeping and reporting regulations. Compliance with these action-specific SCGs would be accomplished by following a site-specific HASP.

  Excavated soil would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following a NYSDEC-approved Remedial Design/Remedial Action Work Plan (RD/RA Work Plan) and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), excavated material from a former MGP site that is characteristically toxic for benzene only is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (i.e., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

- *Location-Specific SCGs* – Location-specific SCGs are presented in Table 2-3. Potentially applicable location-specific SCGs generally include regulations on conducting excavation, backfilling, and construction activities on flood plains. Compliance with these SCGs would be achieved by obtaining a joint United States Army Corp of Engineers (USACE) and NYSDEC permit, and applicable local permits, prior to conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances.

<u>Overall Protection of Public Health and the Environment – Alternative FMA-2</u>

Alternative FMA-2 would mitigate potential long-term exposure to soil and groundwater containing MOCs and COCs by excavating the most accessible, highly viscous NAPL and heavily impacted soil, installing an asphalt cap over remaining soil in the FMA that contains COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use, and implementing institutional controls. Excavated material would be permanently transported off-site for treatment/disposal. A passive barrier wall would be constructed to collect mobile NAPL (if present) and reduce the potential migration of NAPL observed in the northwest corner of the North Albany Service Center. NAPL collection wells would be installed to facilitate monitoring and permanent removal of LNAPL and DNAPL.

Implementation of Alternative FMA-2 would not have significant negative long-term impacts on the current hydrogeologic conditions (i.e., changes in groundwater flow direction, vertical hydraulic gradients, water table elevation) at the site. Potential short-term impacts to site workers and the community from remedial construction and off-site transportation of excavated material would be managed by following site plans and establishing appropriate engineering controls (e.g., site fencing, signage, barricades, etc.). Potential short-term exposures to COCs during implementation of this alternative would be mitigated by appropriate health and safety planning and practices.

Through excavation, capping, passive NAPL recovery via a barrier wall and wells, and institutional controls, Alternative FMA-2 would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to MGP- and non-MGP-related impacts. Additionally, this alternative would achieve groundwater RAOs #1 and #2 by mitigating potential exposure to impacted groundwater. Alternative FMA-2 is not expected achieve groundwater RAO #3 and restore groundwater to pre-disposal/pre-release conditions within a determinate amount of time. This alternative would partially achieve groundwater RAO #4, as excavation of more than 17,400 CY of heavily impacted soil and passive NAPL removal via wells would reduce the amount of material that serves as a source for dissolved-phase impacts.

Cost Effectiveness – Alternative FMA-2

The estimated costs associated with Alternative FMA-2 are presented in Table 5-1. The total estimated 30-year present worth cost for this alternative is approximately $15,000,000. The estimated capital cost, including costs for soil excavation and off-site disposal and installation of a passive NAPL barrier wall, NAPL collection wells, and an asphalt cap, is approximately $14,100,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting quarterly NAPL monitoring and annual inspection and maintenance of the asphalt cap, is approximately $900,000.

5.4.2 Alternative FMA-3 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

Alternative FMA-3 consists of the same components of Alternative FMA-2, as well as the construction of a passive NAPL barrier wall along the eastern property boundary. Alternative FMA-3 consists of the following major remedial components:

- Constructing a passive NAPL barrier wall along the eastern property boundary
- Excavating soil east and northeast of Building #2
- Constructing a passive NAPL barrier wall in the northwest corner of the site
- Installing NAPL collection wells and upgradient NAPL monitoring wells
- Constructing an asphalt cap over remaining site soil
- Establishing institutional controls

Similar to Alternative FMA-2, Alternative FMA-3 would include excavation of 17,400 CY of the most accessible highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated wood chips east and northeast of Building #2. Approximate removal limits are shown on Figure 5-2 and excavations would be completed approximately two feet into the silt and clay confining layer (the top of which varies from approximately 10 to 12 feet below grade). Excavation into the top two feet of the confining layer would also remove soil containing the highest concentrations of BTEX and PAHs at each location. Analytical results of soil to be excavated (in or above the confining layer) were often two to six orders of magnitude greater than soils below the confining layer, as summarized above (Section 5.4.1). Excavation of material to this depth would permanently remove a majority of the visually impacted material identified during previous investigations from this area. Excavation, staging, and transportation and disposal activities would be conducted consistent with those described for Alternative FMA-2. Alternative FMA-3 would also include construction of a passive NAPL barrier wall in the northwest corner of the North Albany Service Center to prevent the potential migration of NAPL observed in this area.

Alternative FMA-3 would include construction of a passive NAPL barrier wall along the hydraulically downgradient boundary of the North Albany Service Center property to enhance the collection of potentially mobile NAPL in the FMA. Passive barrier wall construction techniques would be equivalent to those described under FMA-2. A long-stick excavator would be used to remove soil and biopolymer slurry would serve as a stabilizing fluid to support the open trench excavation. The excavation would be completed to an average depth of approximately 25 feet below grade and keyed into bedrock. Pea gravel (or other appropriate granular material) would then be placed within the slurry-supported trench and the biopolymer slurry would be degraded to promote free flow of groundwater through the wall.

The pea gravel serves a high-conductivity area within the subsurface to promote NAPL collection. The high-conductivity zone created by pea gravel (as compared to surrounding site soil) allows DNAPL to settle to the bottom of the trench where it can be directed (through sloping of the excavation bottom) to collection sumps and DNAPL recovery wells installed within the passive barrier wall. LNAPL migration would be mitigated by installing a low-permeability “curtain” within the upper portion of the wall that would extend below the annual low water table elevation. The curtain would consist of HDPE or other appropriate material to prevent LNAPL from migrating further downgradient. LNAPL collection wells would be installed immediately upgradient of the curtain within the wall and screened across the top of the water table. Similar to Alternative FMA-2, new LNAPL and DNAPL collection wells would be installed to facilitate passive collection/recovery of mobile NAPL within the passive barrier walls and in the HWSTA to facilitate NAPL monitoring/recovery. Per NYSDEC’s request, this FMA alternative would also include installation of “sentinel” NAPL monitoring wells located west of Broadway. The NAPL monitoring wells would be periodically gauged (i.e., assumed quarterly) to verify that MGP-related impacts are not migrating upgradient of the FMA. The final number and layout of NAPL collection/monitoring wells would be determined during the remedial design. Consistent with Alternative FMA-2 and current site monitoring activities, these wells would be gauged on a quarterly basis for the presence/absence of NAPL.

Alternative FMA-3 would also include construction of an asphalt cap over the same area as Alternative FMA-2 to minimize the potential for exposure to remaining soil that contains MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Asphalt cap construction activities would be consistent with those presented in Section 5.4.1 for Alternative FMA-2 and would include removal of the existing surface material (approximately 9,100 CY), installation of new subbase and asphalt, and annual monitoring.

Although Alternative FMA-3 includes the removal of 17,400 CY of heavily impacted soil and passive NAPL removal via NAPL collection wells and a passive barrier wall, MGP- and non-MGP-impacted soil would remain in the FMA. Therefore, dissolved-phased groundwater impacts within the FMA would be expected to remain under Alternative FMA-3. Continued monitoring of groundwater within the FMA is not included as part of this alternative. Instead, Alternative FMA-3 would include measures to reduce the potential for exposure to impacted groundwater through capping and institutional controls. Continued monitoring of groundwater downgradient of the FMA is included as part of the OSDA alternatives described in Section 5.5.

Similar to Alternative FMA-2, Alternative FMA-3 would include institutional controls in the form of environmental easements (i.e., ELURs) and deed restrictions, to prohibit the use of site groundwater and limit the future development and use of the property. Additionally, this alternative would include preparation of an SMP to document the following:

- Known locations of soil remaining in the FMA that contains MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use
- Requirements for asphalt cap inspection and maintenance
- Protocols for NAPL monitoring and recovery
- Protocols (including health and safety requirements) for conducting invasive activities within the FMA and managing potentially impacted material encountered during these activities
- Restrictions on invasive activities to mitigate potential damage to and/or short-circuiting of the passive NAPL barrier walls
- Provisions for additional investigation and remediation activities in the northwest corner of the site if the Genesee Street Substation is de-energized or relocated.

Annual reports would be submitted to NYSDEC to document that institutional controls and the asphalt cap and passive barrier wall are maintained and remain effective.

<u>Short-Term Impacts and Effectiveness – Alternative FMA-3</u>

Implementation of this alternative may result in short-term exposure of the surrounding community and site workers to site-related COCs as a result of excavation, material handling, and off-site transportation activities. Additionally field personnel may be exposed to impacted groundwater and/or NAPL during NAPL collection well installation activities. Potential exposure mechanisms would include ingestion and dermal contact with impacted soil and/or groundwater and inhalation of volatile organic vapors or dust containing COCs during remedial construction. Potential exposure of remedial workers would be minimized through the use of appropriately trained field personnel and the appropriate level of PPE, as specified in a site-specific HASP that would be developed as part of the remedial design. Air monitoring would be performed during excavation and backfilling activities to evaluate the need for additional engineering controls (e.g., use of water sprays to suppress dust, modify the rate of construction, etc.). Community access to the site is restricted by permanent security fencing and temporary fencing would be used to restrict access to excavation and work areas. A site-specific CAMP would be prepared and community air monitoring would be performed during excavation and backfilling activities to evaluate the need for additional engineering controls.

Additional worker safety concerns include working with and around large construction equipment, noise generated from operating construction equipment, and increased vehicle traffic associated with transportation of excavated material from the site and delivery of fill materials. These concerns would be minimized by using engineering controls and appropriate health and safety practices. Off-site transportation of excavated material and importation of clean fill materials would result in approximately 3,050 tractor trailer round trips (assuming 20 CY per tractor trailer). This increase in local truck traffic would create a nuisance to the surrounding community, as well as an increase in the potential for motor vehicle accidents on local roads and highways. Transportation activities would be managed to minimize en-route risks to the community.

Soil excavation, passive barrier wall construction, backfilling, and capping activities are anticipated to be completed in approximately 14 months and NAPL monitoring activities would be conducted over an assumed 30-year period. Note that remedial construction activities may be conducted over multiple construction seasons/phases and therefore, actual construction durations could increase.

The relative carbon footprint (as compared to the other FMA alternatives) is considered moderate. The greatest contribution to greenhouse gases would occur as a result of LTTD treatment of impacted soil and heavy equipment operation during excavation, backfilling, and transportation activities.

<u>Long-Term Effectiveness and Permanence – Alternative FMA-3</u>

This remedial alternative would reduce potential long-term exposures to impacted site media. Although Alternative FMA-3 does not include the excavation of all soil in the FMA containing MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use, the most accessible, heavily impacted soil (i.e., highly viscous NAPL and impacted soil east and northeast of Building #2) would be permanently removed from the site. NAPL and impacted soil in the northwest corner of the North Albany Service Center would be isolated via an asphalt cap that would be installed over remaining soil in the FMA that contains COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Additionally, a passive NAPL barrier wall (and NAPL collection wells) would be installed in the northwest of the site and the along the eastern property boundary of the site to facilitate the collection of potentially mobile NAPL in these areas.

Based on the results of predictive simulations conducted using the existing MODFLOW groundwater flow model for the site, the steady-state (i.e., long-term) impacts of Alternative FMA-3 on hydrogeologic site conditions consist of the following:

- Groundwater mounding would likely occur behind (i.e., upgradient of) a low-permeability barrier wall constructed in the northwest corner of the North Albany Service Center. Any increase in the groundwater table elevation could cause an increased downward vertical hydraulic gradient which could impact NAPL migration. Therefore, a permeable, passive NAPL barrier would be installed in the northwest corner of the site to minimize changes in site hydrogeology.

- If excavations are completed to an approximate depth of 12 feet below grade and the fill material placed in the excavation area (i.e., east and northeast of Building #2) has a higher hydraulic conductivity that the existing material to be excavated, the water table elevation in this area would be expected to be slightly lower relative to the current groundwater elevation in this area. Vertical hydraulic gradients in the vicinity of the excavation area may be slightly upward from the till/weathered bedrock to the overburden, while currently there is a slight downward vertical gradient in this area of the site.

The results of the MODFLOW groundwater flow model simulations are discussed in greater detail in the technical memorandum included as Appendix B and additional groundwater modeling simulations (prepared in 2012) are included as Appendix C.

Select soil removal and installation of the cap coupled with institutional controls would reduce the potential for exposure to impacted soil. Excavation is a permanent process and capping requires monitoring and maintenance, along with use restrictions of the capped area for this alternative to remain effective and reliable over the long-term. Annual inspection of the cap would be conducted and maintenance activities would potentially include replacing and repairing eroded or damaged areas. Cap repairs would be easily accomplished as asphalt materials are readily available. Periodic reports would be submitted to NYSDEC to confirm that the cap and institutional controls are being maintained.

Under this alternative, impacted groundwater in the FMA would not be addressed through active treatment. Routine site operations do not include contact with or exposure to site groundwater. Additionally, drinking water for the North Albany Service Center and surrounding community is provided via a municipal supply. This alternative does not include removal of all NAPL within the FMA. However, monitoring and recovery activities would be conducted using new NAPL collection wells and passive NAPL barrier walls to reduce the potential for migration of NAPL.

Land Use – Alternative FMA-3

Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State. A GRS and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas.

Implementation of Alternative FMA-3 is not anticipated to alter current or anticipated future use of the site. Although excavation activities would cause a short-term disruption to service center operations and the surrounding community, the disturbed portions of the site would be restored to match existing conditions.

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

Similar to Alternative FMA-2, this alternative would include the removal and off-site disposal of 17,400 CY of soil containing highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips. Soil containing MGP- and non-MGP-related impacts with COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use would remain on-site beneath an asphalt cap. Additionally, mobile NAPL (if present) would be collected by the passive NAPL barrier walls installed in the northwest corner and along the eastern portion of the North Albany Service Center, which would reduce the potential for further NAPL migration.

Also like Alternative FMA-2, Alternative FMA-3 does not include remedial activities to directly address impacted groundwater within the FMA. For the purposes of estimating a cost for this alternative, it is assumed that NAPL recovery activities would consist of quarterly monitoring of NAPL collection wells to recover potentially mobile NAPL. The actual frequency of monitoring would be determined after performing several monitoring events and assessing the amount of NAPL entering the wells, if any. NAPL would be removed (if encountered), which would reduce the volume of NAPL present in the FMA, thereby reducing the volume of material that is serving as a source of dissolved-phase groundwater impacts.

Implementability – Alternative FMA-3

This remedial alternative would be both technically and administratively implementable. Equipment and materials necessary to excavate soil and install an asphalt cap are readily available. Remedial contractors are also available to perform these activities (i.e., no highly specialized equipment, materials, or personnel would be required). Remedial contractors capable of constructing passive NAPL barrier walls are also available. Passive NAPL barrier walls have been successfully constructed in the United States, including in New York State. Equipment and personnel qualified to install collection wells and conduct NAPL recovery activities are also readily available.

Potential challenges associated with the implementation of this alternative would consist of the following:

- Conducting remedial activities within an active service center. Implementation of the remedial activities would require extensive coordination with North Albany Service Center personnel to minimize the disruption to daily service center operations.

- Excavating soil in close proximity to Building #2 and the railroad immediately east of the North Albany Service Center property. The effects of these activities would be assessed during the remedial design phase to evaluate excavation stability in this portion of the site.

- Installing the passive barrier wall in close proximity to the railroad immediately east of the National Grid property. Loading effects from the railroad would be assessed during the remedial design phase to evaluate excavation stability.

- Conducting work in close proximity to the Genesee Street Substation and GRS in the northwest corner of the North Albany Service Center. Installation of a continuous passive barrier under subsurface gas lines may not be practicable and it may be necessary to use jet grouting or other methods to treat soil immediately under the gas lines. Excavation activities in this area (i.e., passive barrier wall pre-installation excavation) would be conducted using a back hoe and by hand-digging to identify and locate subsurface electrical transmission lines and natural gas distribution lines, as well as clear the numerous subsurface obstructions/foundations located in this portion of the FMA. Additionally, appropriate utility clearance distances would be maintained during installation of the asphalt cap in this area and temporary shielding or deactivation of these utilities would be coordinated with National Grid.

- Recovering LNAPL and DNAPL, if any, from the collection wells installed within the passive barrier wall. Based on previous attempts to recover DNAPL, recovery efforts may have limited effectiveness due to the viscous nature of the NAPL.

<u>Compliance with SCGs – Alternative FMA-3</u>

- *Chemical-Specific SCGs* – Chemical-specific SCGs are presented in Table 2-1. Potentially applicable chemical-specific SCGs for soil include 6NYCRR Part 375-6 soil cleanup objectives and 40 CFR Part 261 and 6NYCRR Part 371 regulations for the identification of hazardous materials. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values.

  A majority of soil within the FMA contains VOCs and SVOCs at concentrations greater than the 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Under this alternative, only the most accessible heavily NAPL-impacted soil and NAPL-coated woodchips would be removed from an area east and northeast of Building #2. An asphalt cap would be installed to provide a physical barrier from remaining subsurface soil that contains COCs at concentrations greater than the 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Additionally, mobile NAPL (if present) would be collected by the passive barrier walls constructed in the northwest corner and along the eastern portion of the North Albany Service Center. Excavated material would be characterized in accordance with 40 CFR Part 261 and 6NYCRR Part 371 to determine appropriate off-site treatment/disposal requirements. NYS LDRs would apply to materials that are characterized as a hazardous waste.

  Groundwater within the FMA contains VOCs and SVOCs at concentrations greater than NYSDEC Class GA standards and guidance values. As this alternative does not include active remedial measures to address all soil containing MGP- and non-MGP-related impacts, this alternative would likely not achieve groundwater SCGs within a determinate period of time.

- *Action-Specific SCGs* – Action-specific SCGs are presented in Table 2-2. Potentially applicable action-specific SCGs include health and safety requirements and regulations associated with handling impacted media. Work activities would be conducted in accordance with OSHA requirements that specify general industry standards, safety equipment and procedures, and record keeping and reporting regulations. Compliance with these action-specific SCGs would be accomplished by following a site-specific HASP.

Excavated soil would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following a NYSDEC-approved RD/RA Work Plan and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), excavated material from a former MGP site that is characteristically toxic for benzene only is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (i.e., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

- *Location-Specific SCGs* – Location-specific SCGs are presented in Table 2-3. Potentially applicable location-specific SCGs generally include regulations on conducting excavation, backfilling, and construction activities on flood plains. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and applicable local permits, prior to conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances.

Overall Protection of Public Health and the Environment – Alternative FMA-3

Alternative FMA-3 would mitigate potential long-term exposure to soil and groundwater containing MOCs and COCs by excavating the most accessible, highly viscous NAPL and heavily impacted soil, installing an asphalt cap over remaining soil in the FMA that contains COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use, and implementing institutional controls. Excavated material would be permanently transported off-site for treatment/disposal. Passive NAPL barrier walls would be installed in the northwest corner of the North Albany Service Center and at the hydraulically downgradient boundary of the North Albany Service Center property to facilitate NAPL recovery. NAPL collection wells would be installed within the passive barrier walls and at locations within the FMA and HWSTA to facilitate monitoring and permanent removal of LNAPL and DNAPL.

Implementation of Alternative FMA-3 would not have significant negative long-term impacts on the current hydrogeologic conditions (i.e., changes in groundwater flow direction, vertical hydraulic gradients, water table elevation) at the site. Potential short-term impacts to site workers and the community from remedial construction and off-site transportation of excavated material would be managed by following site plans and establishing appropriate engineering controls (e.g., site fencing, signage, barricades, etc.). Potential short-term exposures to COCs during implementation of this alternative would be mitigated by appropriate health and safety planning and practices.

Through excavation, capping, passive NAPL recovery via wells and passive barrier walls, and institutional controls, Alternative FMA-3 would achieve soil RAOs #1, #2, and #3 by mitigating exposure to COCs and migration of MGP- and non-MGP-related impacts. Additionally, this alternative would achieve groundwater RAOs #1 and #2 by mitigating exposure to impacted groundwater. Alternative FMA-3 is not expected to achieve groundwater RAO #3 and restore groundwater to pre-disposal/pre-release conditions within a determinate amount of time. This alternative would partially achieve groundwater RAO #4, as excavation of more than 17,400 CY of heavily impacted soil and passive NAPL removal via wells and a barrier wall would reduce the amount of source material for dissolved-phase impacts.

Cost Effectiveness – Alternative FMA-3

The estimated costs associated with Alternative FMA-3 are presented in Table 5-2. The total estimated 30-year present worth cost for this alternative is approximately $15,700,000. The estimated capital cost, including costs for soil excavation and off-site disposal and installation of passive barrier walls, NAPL collection wells, and an asphalt cap, is approximately $14,800,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting quarterly NAPL monitoring and annual inspection and maintenance of the asphalt cap, is approximately $900,000.

5.4.3 Alternative FMA-4 – ISS, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

Alternative FMA-4 consists of the same components as Alternative FMA-3 and in addition, treats MGP-impacted soil using ISS technologies. The major remedial components of Alternative FMA-4 consist of the following:

- Treating soil via ISS
- Excavating soil east and northeast of Building #2
- Constructing a passive NAPL barrier wall in the northwest corner of the site
- Constructing a passive NAPL barrier wall along the eastern property boundary
- Installing NAPL collection wells and upgradient NAPL monitoring wells
- Constructing an asphalt cap over site soil
- Establishing institutional controls

Through a combination of excavation and ISS treatment, Alternative FMA-4 would address the most impacted site soils. Under this alternative, approximately 36,200 CY of saturated and unsaturated soil would be treated via ISS in the vicinity of (i.e., west and north of) the

Vehicle Maintenance Building that contains significant visual evidence of NAPL (i.e., soils saturated with NAPL, not including staining, sheens, or blebs) and/or PAHs at concentrations greater than 1,000 ppm. The ISS process involves mixing Portland cement (and other pozzolanic materials) with impacted site soil to reduce the leachability and mobility of COCs and NAPL present in site soil. The resulting mixture is generally a homogeneous mixture of soil and grout that hardens to become a weakly-cemented material.

The ISS process would solidify NAPL and NAPL-impacted soil into a solid mass (micro-encapsulation), as well as soil surrounding NAPL-impacted soil (macro-encapsulation), thereby preventing migration of COCs and NAPL beyond the stabilized mass. ISS bench-scale testing has been conducted to evaluate various soil stabilization mixtures and evaluate the effectiveness of each mixture at meeting performance goals for permeability, strength, and leachability. The results for the ISS bench-scale treatability testing will be submitted to the NYSDEC under separate cover.

Prior to conducting the ISS activities, the area to be solidified (shown on Figure 5-3) would be excavated to a depth of approximately five feet bgs to account for material bulking caused by the ISS treatment and to verify the locations of subsurface obstructions (i.e., utilities and former foundations and structures). A pre-design investigation may be required to determine the presence of former MGP-related structures (e.g., holders), as removal of these structures would be required to facilitate ISS treatment for deeper soils. Approximately 12,600 CY of surface material (asphalt and soil to a depth of 1 foot) and subsurface soil would be generated by the pre-ISS excavation activities. Excavated material would be managed as described for Alternatives FMA-2 and FMA-3. For the purpose of developing a cost estimate, it has been assumed that surface material would be disposed of as C&D debris and shallow soil removed during pre-ISS excavation would be disposed of as a non-hazardous waste.

Based on the extent of the treatment area, ISS would most likely be completed using excavator bucket mixing techniques or small diameter augers to mix soil while CB grout is pumped into the subsurface. Weathered bedrock in the FMA ranges from 2 to 7 feet in thickness, with an average thickness of approximately 3.5 feet. For the purposes of developing a cost estimate, this alternative assumes that the top 2 feet of weathered bedrock could be treated via ISS. ISS quality assurance/quality control (QA/QC) sampling would consist of sampling ISS slurry (i.e., creating test cylinders) to verify that performance criteria (e.g., unconfined compressive strength [UCS], permeability, etc.) are met. If performance criteria are not achieved in certain locations, soil would be re-mixed at these locations.

As shown on Figure 5-3, multiple natural gas distribution and electrical transmission lines transect the ISS treatment area. The ability to relocate these subsurface utilities would be assessed during the remedial design. If it is not feasible to relocate the gas lines and other subsurface utilities (i.e., to locations outside the limits of the ISS area or sequence utility relocation and remedial construction), then it may be technically impracticable to treat soil located beneath or in close proximity to these utilities. Note that based on the presence of the storm sewer system and multiple subsurface utilities immediately north of Building #2 in the vicinity of monitoring MW-4 (where LNAPL has been encountered), ISS activities would not be completed in this area.

Similar to Alternatives FMA-2 and FMA-3, Alternative FMA-4 would also include excavation of 17,400 CY of the most accessible highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated wood chips east and northeast of Building #2. Approximate removal limits are shown on Figure 5-3 and excavations would be completed approximately two feet into the silt and clay confining layer (the top of which varies from approximately 10 to 12 feet below grade). While excavation is anticipated to be completed immediately east of Building #2, the final remedial methods implemented northeast of Building #2 and east of the Vehicle Maintenance Building would be further assessed during the remedial design (i.e., ISS treatment may be more feasible in these areas). Excavation, staging, and transportation and disposal activities would be conducted consistent with those described for Alternatives FMA-2 and FMA-3. Alternative FMA-4 would also include construction of a passive NAPL barrier wall in the northwest corner of the North Albany Service Center to reduce the potential for migration of NAPL observed in this area.

The ability of the ISS equipment to treat all soil to the top of competent bedrock may be limited by the presence of the weathered bedrock. Therefore, similar to Alternative FMA-3, a passive NAPL barrier wall would be constructed along the eastern site boundary (as shown on Figure 5-3) to prevent the potential downgradient migration of NAPL in the weathered bedrock and enhance the collection of potentially mobile NAPL in the FMA. Passive barrier wall construction techniques are described for Alternatives FMA-2 and FMA-3. A long-stick excavator would be used to remove soil and biopolymer slurry would serve as a stabilizing fluid to support the open trench excavation. The excavation would be completed to an average depth of approximately 25 feet below grade and keyed into bedrock. Pea gravel (or other appropriate granular material) would then be placed within the slurry-supported trench and the biopolymer slurry would be degraded to promote free flow of groundwater through the wall. DNAPL recovery wells would be installed within the passive barrier wall and LNAPL migration would be mitigated by installing a low-permeability “curtain” within the upper portion of the wall that would extend below the annual low water table elevation. Similar to Alternatives FMA-2 and FMA-3, new LNAPL and DNAPL collection wells would be installed to facilitate passive collection/recovery of mobile NAPL within the passive barrier wall and in the HWSTA to facilitate NAPL monitoring/recovery. Per NYSDEC’s request, this FMA alternative would also include installation of “sentinel” NAPL monitoring wells located west of Broadway. The NAPL monitoring wells would be periodically gauged (i.e., assumed quarterly) to verify that MGP-related impacts are not migrating upgradient of the FMA. The final number and layout of NAPL collection wells would be determined during the remedial design. Consistent with Alternatives FMA-2 and FMA-3 and current site monitoring activities, these wells would be gauged on a quarterly basis for the presence/absence of NAPL.

Following ISS treatment of FMA soils, an asphalt cap would be installed to the approximate limits shown on Figure 5-3, would cover the same area as the asphalt cap under Alternatives FMA-2 and FMA-3, to restore the area disturbed by ISS activities and reduce the potential for exposure to soils outside the ISS treatment area that contain COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use (i.e., the northwest corner of the North Albany Service Center and near monitoring well MW-4). Asphalt cap construction activities would be consistent with those presented in Section 5.4.1 (for Alternative FMA-2) and would include the installation of new sub-base and asphalt and annual monitoring.

As indicated in Section 1.6.3.3, concentrations of BTEX and PAHs in groundwater samples collected from monitoring wells within the FMA, over the course of consecutive annual groundwater sampling events, appear to be stable. Alternative FMA-4 includes the solidification and removal of approximately 36,200 CY and 17,400 CY (respectively) of NAPL and NAPL-impacted soil. With the stabilization of NAPL and NAPL-impacted soil, natural attenuation processes (e.g., biodegradation, dispersion, dilutions, volatilization, etc.) may act to reduce the extent of dissolved-phase groundwater impacts not treated by ISS in the FMA. Continued monitoring of groundwater downgradient of the FMA is included as part of the OSDA alternatives described in Section 5.5.

Similar to Alternatives FMA-2 and FMA-3, Alternative FMA-4 would include institutional controls in the form of environmental easements (i.e., ELURs) and deed restrictions, to prohibit the use of site groundwater and limit the future development and use of the property. Additionally, this alternative would include preparation of an SMP to document the following:

- The extent of solidified and untreated soil that contains MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use

- Requirements for asphalt cap inspection and maintenance

- Protocols for NAPL monitoring and recovery

- Protocols (including health and safety requirements) for conducting invasive activities within the FMA and managing potentially impacted material encountered during these activities

- Restrictions on invasive activities to mitigate potential damage and/or short-circuiting of the passive NAPL barrier walls

- Provisions for additional investigation and remediation activities in the northwest corner of the site if the Genesee Street Substation is de-energized or relocated.

Annual reports would be submitted to NYSDEC to document that institutional controls and the asphalt cap are maintained and remain effective.

Short-Term Impacts and Effectiveness – Alternative FMA-4

Implementation of this alternative may result in short-term exposure of the surrounding community and site workers to site-related COCs as a result of excavation, soil mixing, material handling, and off-site transportation activities. Additionally field personnel may be exposed to impacted groundwater and/or NAPL during NAPL recovery well installation activities. Potential exposure mechanisms would include ingestion and dermal contact with impacted soil and/or groundwater and inhalation of volatile organic vapors or dust containing COCs. Potential exposure of remedial workers would be minimized through the use of appropriately trained field personnel and the appropriate level of PPE, as specified in a site-specific HASP that would be developed as part of the remedial design. Air monitoring would be performed during excavation, soil mixing, and backfilling activities to evaluate the need for additional engineering controls (e.g., use of water sprays to suppress dust, modify the rate of construction, etc.). Community access to the site is restricted by permanent security fencing and temporary fencing would be used to restrict access to excavation and work areas. A site-specific CAMP would be prepared and community air monitoring would be performed during excavation and soil mixing activities to evaluate the need for additional engineering controls.

Additional worker safety concerns include working with and around large construction equipment, noise generated from operating construction equipment, and increased vehicle traffic associated with transportation of excavated material from the site and delivery of fill and ISS aggregate materials. These concerns would be minimized by using engineering controls and appropriate health and safety practices. Off-site transportation of excavated material and importation of clean fill and ISS aggregate materials would result in approximately 4,200 tractor trailer round trips (assuming 20 CY per tractor trailer). This increase in local truck traffic would create a nuisance to the surrounding community, as well as increase the potential for motor vehicle accidents on local roads and highways. Transportation activities would be managed to minimize en-route risks to the community.

Soil excavation and mixing, passive barrier wall construction, backfilling, and capping activities are anticipated to be completed in approximately 23 months (i.e., over an anticipated 2 to 3 construction seasons) and NAPL monitoring activities would be conducted over an assumed 30-year period. Note that remedial construction activities may be conducted over multiple construction seasons/phases and therefore, actual construction durations could increase.

The relative carbon footprint (as compared to the other FMA alternatives) is considered moderate. The greatest contribution to greenhouse gases would occur as a result of LTTD treatment of impacted soil and heavy equipment operation during excavation, soil mixing, and transportation activities.

Long-Term Effectiveness and Permanence – Alternative FMA-4

This remedial alternative would reduce potential long-term exposures to impacted site media. Although Alternative FMA-4 does not address all soil in the FMA containing MOCs and COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use, the alternative includes the removal of surface material and subsurface soil to facilitate ISS treatment of soil (to the top of weathered bedrock) in the vicinity of (i.e., west of) the Vehicle Maintenance Building that contains significant visual evidence of NAPL (i.e., soils saturated with NAPL, not including staining, sheens, or blebs) and/or PAHs at concentrations greater than 1,000 ppm and removal of the most accessible, heavily impacted soil (i.e., highly viscous NAPL and impacted soil east and northeast of Building #2). ISS QA/QC sampling would be completed to confirm that performance criteria are met for the solidified soil columns. If performance criteria are not specifically met in some locations, columns could be over-bored, and additional solidification agents could be added.

A passive NAPL barrier wall and NAPL collection wells would be installed along the hydraulically downgradient edge of the ISS treatment area to facilitate collection and recovery of NAPL within the weathered bedrock. Additionally, a passive NAPL barrier wall (and NAPL collection wells) would be installed in the northwest of the site and the along the eastern portion of the site to facilitate the collection of potentially mobile NAPL in these areas.

Installation of an asphalt cap would reduce the potential for exposure to impacted soil not treated by ISS that contains COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Annual inspection of the cap would be conducted and maintenance activities would potentially include replacing and repairing eroded or damaged areas. Cap repairs would be easily accomplished as asphalt materials are readily available. Periodic reports would be submitted to NYSDEC to confirm that the cap and institutional controls are being maintained.

Based on the results of predictive simulations conducted using the existing MODFLOW groundwater flow model for the site, the steady-state (i.e., long-term) impacts of Alternative FMA-4 on hydrogeologic site conditions consist of the following:

- Some groundwater mounding (i.e., increases in the water table elevation) would occur following ISS treatment of FMA soil. Modeling indicates that the water table elevation would increase approximately two feet east of the Genesee Street Substation and within the ISS treatment area. The model also predicted a general decrease in the water elevation east of the ISS area including within the proposed soil excavation area. Based on the current water table elevation, the predicted change in water table elevation should not cause flooding or other unfavorable conditions at the site.

- A stronger downward hydraulic gradient would be expected in the vicinity of and beneath the ISS treatment area, due to the increased groundwater elevation. This condition is considered unfavorable as the downward gradient could potentially encourage NAPL migration into bedrock beneath the site.

- If excavations are completed to an approximate depth of 12 feet below grade and the fill material placed in the excavation area (i.e., east and northeast of Building #2) has a higher hydraulic conductivity that the existing material to be excavated, the water table elevation in this area would be expected to be slightly lower relative to the current groundwater elevation in this area. Vertical hydraulic gradients in the vicinity of the excavation area may be slightly upward from the till/weathered bedrock to the overburden, while currently there is a slight downward vertical gradient in this area of the site.

- The solidified soil area west of the Vehicle Maintenance Building would cause groundwater to flow around and/or under the stabilized mass. In some cases, groundwater flow may follow a more southerly direction due to the solidified mass and anticipated groundwater mounding behind the solidified material. The impact of the change in groundwater flow direction on residual amounts of NAPL in soil outside of the ISS area is not known. However, this alternative includes provisions for continued monitoring of NAPL and groundwater.

The results of the MODFLOW groundwater flow model simulations are discussed in greater detail in the technical memorandum included as Appendix B and additional groundwater modeling simulations (prepared in 2012) are included as Appendix C.

Drinking water for the North Albany Service Center and the surrounding community is provided via a municipal supply. Some impacted groundwater within the FMA would be incorporated in the solidified mass during ISS activities. NAPL monitoring and recovery activities would be conducted to reduce the potential for migration of NAPL not solidified during ISS activities (i.e., near the Genesee Street Substation, in weathered bedrock, and beneath Building #2). Additionally, reduction of dissolved-phase groundwater impacts via natural attenuation could occur over a prolonged period of time following treatment and removal of the impacted soil in the FMA.

Land Use – Alternative FMA-4

Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State. A GRS and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas.

Implementation of Alternative FMA-4 is not anticipated to alter current or anticipated future use of the site. Although excavation and soil mixing activities would cause a short-term disruption to service center operations and the surrounding community, the disturbed portions of the site would be restored to match existing conditions. However, the presence of solidified material may limit the potential future development of the site. The solidified material would provide a working platform that could support construction of slab-on-grade structures. Construction of buildings with subgrade basement level and foundation may be more difficult based on the nature of the solidified material. However, the design strength of the solidified mass would be low enough to allow for excavation (that would be conducted in accordance with an SMP).

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

Alternative FMA-4 would include the removal and off-site treatment/disposal of approximately 12,600 CY of surface material and subsurface soil to facilitate ISS treatment of 36,200 CY of subsurface soil in the vicinity of the Vehicle Maintenance Building that contains significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm. Soil subject to ISS treatment would be solidified in-place to reduce the mobility of NAPL and leachability of COCs. Alternative FMA-4 would also include removal and off-site treatment/disposal of 17,400 CY of soil containing highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips located east and northeast of Building #2. Remaining soil (both solidified and untreated) containing MGP- and non-MGP-related impacts with COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use would remain on-site beneath an asphalt cap.

Impacted groundwater and NAPL within the ISS treatment area would be solidified with site soil. Remaining NAPL not solidified through ISS or removed via excavation (i.e., NAPL near the Genesee Street Substation, below Building #2, and/or within weathered bedrock) would be recovered to the extent possible via the passive NAPL barrier walls and quarterly NAPL monitoring of NAPL collection wells installed within the FMA and HWSTA. Dissolved-phase concentrations of COCs in groundwater following the ISS treatment and excavation activities could also be reduced over time via natural attenuation as the volume of material that is serving as a source of dissolved-phase groundwater impacts would be reduced under this alternative.

<u>Implementability – Alternative FMA-4</u>

This remedial alternative would potentially be both technically and administratively implementable, with pre-design investigation, treatability study, planning, and coordination. Equipment and materials necessary to excavate site soil and install an asphalt cap are readily available. Remedial contractors capable of performing the remedial construction activities necessary are also available (i.e., no highly specialized equipment, materials, or personnel would be required). A number of ISS applications have been completed at MGP sites in the United States. Passive NAPL barrier walls have also been constructed at numerous MGP and non-MGP sites throughout the United States, as well as around the world. Equipment and personnel qualified to install collection wells and conduct NAPL recovery activities are readily available.

Potential challenges associated with the implementation of this alternative would consist of the following:

- Conducting remedial activities within an active service center. Implementation of the remedial activities would require extensive coordination with North Albany Service Center personnel to minimize the disruption to daily service center operations.

- Conducting ISS of soils that contain obstructions greater than six inches in diameter. The use of excavators or small diameter augers to conduct the ISS activities could potentially be limited by subsurface obstructions such as cobbles, debris, historic fill materials, and subsurface former building foundations and slabs. Pre-ISS excavation would also be conducted over most of the FMA to identify obstructions and clear the top four feet of fill material (and allow for the expansion of solidified soil). The pre-ISS excavation of soil could create logistical issues with parking, and Vehicle Maintenance Building and Building #2 operations.

- Completing ISS of soils to depths of competent bedrock. As presented in Section 1.6.2.1, weathered bedrock was identified at depths of 7 to 34 feet bgs, and had a thickness of up to 7 feet. The presence of weathered bedrock may limit the equipment's ability to solidify the entire depth of the soil column. Stabilizing the weathered bedrock may not be possible due to excavator bucket or auger refusal when encountering large (i.e., greater than 4-inch diameter) pieces of weathered bedrock. If this geologic unit is not solidified, it may act as a preferential pathway for the potential migration of NAPL and groundwater.

- Solidifying soil in close proximity to subsurface utilities. Following pre-excavation activities to identify and locate subsurface utilities, jet-grouting would be conducted to solidify soil at locations where passive NAPL barrier walls transect subsurface utilities. Additionally, multiple natural gas distribution and electrical transmission lines transect the ISS treatment area may need to be relocated to facilitate ISS in the northern portion of the site. If relocation of the gas lines (and other utilities) outside the limits of the ISS area is not feasible, it may be technically impracticable to treat soil below or in close proximity to the utilities.

- Excavating soil in close proximity to Building #2 and the railroad immediately east of the North Albany Service Center property. The effects of these activities would be assessed during the remedial design phase to evaluate excavation stability in this portion of the site.

- Installing the passive barrier wall in close proximity to the railroad immediately east of the National Grid property. Loading effects from the railroad would be assessed during the remedial design phase to evaluate excavation stability.

- Conducting work in close proximity to the Genesee Street Substation and GRS in the northwest corner of the North Albany Service Center. Excavation activities in this area (i.e., passive barrier wall pre-installation excavation) would be conducted using a back hoe and hand clearing methods to identify and locate subsurface electrical transmission lines and natural gas distribution lines, as well as clear the numerous subsurface obstructions/foundations located in this portion of the FMA. Additionally, appropriate utility clearance distances would be maintained during installation of the asphalt cap in this area and temporary shielding or deactivation of these utilities would be coordinated with National Grid.

- Recovering LNAPL and DNAPL from collection wells installed in the eastern portion of the FMA. Based on previous attempts to recover DNAPL, recovery efforts may have limited effectiveness due to the viscous nature of the NAPL.

<u>Compliance with SCGs – Alternative FMA-4</u>

- *Chemical-Specific SCGs* – Chemical-specific SCGs are presented in Table 2-1. Potentially applicable chemical-specific SCGs for soil include 6NYCRR Part 375-6 soil cleanup objectives and 40 CFR Part 261 and 6NYCRR Part 371 regulations for the identification of hazardous materials. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values.

  A majority of soil within the FMA contains VOCs and SVOCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Under this alternative, subsurface soil in the vicinity of the Vehicle Maintenance Building that contains significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm would be treated via ISS or removed during pre-ISS excavation activities and soil containing highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips located east and northeast of Building #2 would be removed. Following ISS treatment and excavation/backfilling activities, an asphalt cap would be installed to provide a physical barrier from solidified and non-treated soil that may contain COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Excavated material and ISS spoils would be characterized in accordance with 40 CFR Part 261 and 6NYCRR Part 371 to determine appropriate off-site treatment/disposal requirements. NYS LDRs would apply to materials that are characterized as a hazardous waste.

  Groundwater within the FMA contains VOCs and SVOCs at concentrations greater than NYSDEC Class GA standards and guidance values. Although ISS would solidify some impacted soil and NAPL that serve as a source of dissolved-phase groundwater impacts within the FMA, this alternative does not include active remedial measures to address all soil containing MGP- and non-MGP-related impacts. Therefore, this alternative would likely not achieve groundwater SCGs within a determinate period of time.

- *Action-Specific SCGs* – Action-specific SCGs are presented in Table 2-2. Potentially applicable action-specific SCGs include health and safety requirements and regulations associated with handling impacted media. Work activities would be conducted in accordance with OSHA requirements that specify general industry standards, safety equipment and procedures, and record keeping and reporting regulations. Compliance with these action-specific SCGs would be accomplished by following a site-specific HASP.

  Excavated soil would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following a NYSDEC-approved RD/RA Work Plan and using licensed waste transporters and permitted disposal facilities. Per DER-4 (NYSDEC, 2002), excavated material from a former MGP site that is characteristically toxic for benzene only is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (i.e., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

- *Location-Specific SCGs* – Location-specific SCGs are presented in Table 2-3. Potentially applicable location-specific SCGs generally include regulations on conducting excavation, backfilling, and construction activities on flood plains. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and applicable local permits, prior to conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances.

<u>Overall Protection of Public Health and the Environment – Alternative FMA-4</u>

Alternative FMA-4 would mitigate potential long-term exposure to soil and groundwater containing MOCs and COCs by solidifying subsurface soil in the vicinity of the Vehicle Maintenance Building that contains significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm; excavating soil containing highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips located east and northeast of Building #2; installing an asphalt cap over remaining soil in the FMA containing COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use; and implementing institutional controls. Excavated soil would be permanently transported off-site for treatment/disposal. Passive NAPL barrier walls would be installed in the northwest corner of the North Albany Service Center and at the hydraulically downgradient boundary of the property to facilitate NAPL recovery. NAPL collection wells would be installed within the passive barrier wall and at locations within the FMA and HWSTA to facilitate monitoring and permanent removal of LNAPL and DNAPL.

Potential short-term impacts to site workers and the community from remedial construction and off-site transportation of excavated material would be managed by following site plans and establishing appropriate engineering controls (e.g., site fencing, signage, barricades, etc.). Potential short-term exposures to COCs during implementation of this alternative would be mitigated by appropriate health and safety planning and practices.

Predictive simulation results for groundwater modeling of Alternative FMA-4 indicate the potential for increasing the water table elevation, as well as increasing the downward vertical hydraulic gradient within the ISS treatment area. Both of these conditions are considered unfavorable and could result in an increased potential for exposure to expressed groundwater at the ground surface and downward migration of impacted groundwater and NAPL.

Through excavation, solidification, capping, passive NAPL monitoring via wells and passive barrier walls, and institutional controls, Alternative FMA-4 would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to MGP- and non-MGP-related impacts. Additionally, this alternative would achieve groundwater RAOs #1 and #2 by mitigating potential exposure to impacted groundwater. Alternative FMA-4 is not expected to achieve groundwater RAO #3, which is to restore groundwater to pre-disposal/pre-release conditions. Additionally this alternative would achieve groundwater RAO #4, as the source of dissolved-phase groundwater impacts (i.e., NAPL and impacted soil) would be solidified through ISS treatment. This alternative would partially achieve groundwater RAO #4, as the solidification of 36,200 CY of impacted soil and excavation of more than 17,400 CY of heavily impacted soil and passive NAPL removal via wells and barrier walls would reduce the amount of source material for dissolved-phase impacts.

<u>Cost Effectiveness – Alternative FMA-4</u>

The estimated costs associated with Alternative FMA-4 are presented in Table 5-3. The total estimated 30-year present worth cost for this alternative is approximately $23,500,000. The estimated capital cost, including costs for ISS treatment, soil excavation and off-site disposal and installation of passive barrier walls, NAPL collection wells, and an asphalt cap, is approximately $22,600,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting quarterly NAPL monitoring and annual inspection and maintenance of the asphalt cap, is approximately $900,000.

5.4.4 Alternative FMA-5 – Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

The major remedial components of Alternative FMA-5 consist of the following:

- Demolition of Building #2 and the Vehicle Maintenance Building
- Removing the Genesee Street Substation and GRS
- Excavating soil containing COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives

Under this alternative, approximately 244,300 CY of soil would be excavated to address soil containing COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives. Soil excavation activities would include the removal of surface material (approximately 11,000 CY) and unsaturated and saturated soil and weathered bedrock to the top of the competent bedrock surface (approximately 233,300 CY). The approximate limits of impacted soil to be removed under this alternative are shown on Figure 5-4. Implementation of this alternative requires demolition of Building #2 and the Vehicle Maintenance Building and the removal and relocation of the Genesee Street Substation and GRS, including the subsurface components associated with the utilities (i.e., natural gas distribution and electrical transmission lines). For the purpose of establishing a cost estimate, it has been assumed that approximately 50% of the soil located below the footprint of the Building #2 would require removal. Implementation of this alternative would also require National Grid to relocate the existing operations at the site to another location. No costs for relocation of National Grid's existing site operations have been incorporated into the Cost Estimate for this alternative.

Similar to Alternatives FMA-2 and FMA-3, excavation activities would be conducted using conventional construction equipment. Given the extent and depth of the removal areas (depths ranging from 18 to 26 feet below grade), excavation support would be required as part of this alternative. For the purpose of developing a cost estimate, it has been assumed that excavation support would consist of water-tight steel sheet piles equipped with tie backs and rock pins. Dead and live loads associated with Interstate 90 along the northern portion of the FMA, the railroad located immediately east of the FMA, Building #2 south of the excavation area, and Broadway located immediately west of the FMA, would be evaluated to determine requirements for the excavation support system(s). It has been assumed that multiple smaller excavation cells would be required based on these loading conditions. The final excavation plan would be developed as part of the remedial design. The remedial design would include development of a SWPPP and erosion controls (e.g., silt fencing, hay bales) would be placed around excavation and material staging areas to reduce soil erosion in these areas. Excavation areas would be backfilled with clean imported fill and a new storm sewer system would be constructed north of Building #2 which would tie into the existing storm sewer system that conveys stormwater beneath Building #2 toward existing manhole MH-3 located in the Yard Storage Area. Surface restoration would consist of a one foot thick gravel cover.

Water generated during excavation area dewatering and soil staging activities would be collected and treated on-site via a temporary water treatment system. The system would be anticipated to consist of solids removal, oil-water separation, and carbon filtration. Treated water would be discharged to a local storm sewer which subsequently discharges to Hudson River. More than 43,000,000 gallons of water are anticipated to require treatment and disposal under this alternative. Residual dissolved-phase groundwater impacts not removed during excavation area dewatering activities would not be addressed through active treatment and would be allowed to degrade over time via natural processes.

Excavated material would be segregated based on the presence/absence of visual impacts (i.e., NAPL, sheens) and staged to facilitate waste characterization and evaluation of treatment and disposal requirements. Multiple material staging areas would be required based on the volume of soil to be excavated under this alternative. Excavated soil from the saturated zone is anticipated to require solidification through the addition of Portland cement (or other soil amendments). For the purpose of developing a cost estimate for this alternative, it has been assumed that approximately 50% of excavated soil (approximately 122,000 CY) would require thermal treatment/disposal via LTTD and remaining 50% of excavated material would be disposed of as a non-hazardous waste at a solid waste landfill.

As Alternative FMA-5 would address a vast majority (if not all) of impacted source materials, dissolved phase COC concentrations downgradient of the excavation area would be expected to naturally attenuate over a short period of time. Therefore, Alternative 5 does not include any groundwater monitoring or institutional control components.

Short-Term Impacts and Effectiveness – Alternative FMA-5

Implementation of this alternative may result in short-term exposure of the surrounding community and site workers to site-related COCs as a result of excavation, material handling, and off-site transportation activities. Additionally field personnel may be exposed to impacted groundwater and NAPL during excavation and NAPL collection well installation. Potential exposure mechanisms would include ingestion and dermal contact with impacted soil and/or groundwater and inhalation of volatile organic vapors or dust containing COCs. Potential exposure of remedial workers would be minimized through the use of appropriately trained field personnel and the appropriate level of PPE, as specified in a site-specific HASP that would be developed as part of the remedial design. Air monitoring would be performed during excavation and backfilling activities to evaluate the need for additional engineering controls (e.g., use of water sprays to suppress dust, modify the rate of construction, etc.). Community access to the site is restricted by permanent security fencing and temporary fencing would be used to restrict access to excavation and work areas. A site-specific CAMP would be prepared and community air monitoring would be performed during excavation activities to evaluate the need for additional engineering controls.

Additional worker safety concerns include working with and around large construction equipment, noise generated from operating construction equipment and driving sheet pile, and increased vehicle traffic associated with transportation of excavated material from the site and delivery of fill materials. These concerns would be minimized by using engineering controls and appropriate health and safety practices. Off-site transportation of excavated material and importation of clean fill materials would result in approximately 25,600 tractor trailer round trips (assuming 20 CY per tractor trailer). This increase in local truck traffic would create a significant and prolonged nuisance to the surrounding community, as well as increase the potential for motor vehicle accidents on local roads and highways. Transportation activities would be managed to minimize en-route risks to the community.

Soil excavation, backfilling, and capping activities are anticipated to be completed in approximately 10 years and NAPL monitoring activities would be conducted over an assumed 30-year period. Note that remedial construction activities may be conducted over multiple construction seasons/phases and therefore, actual construction durations could increase.

The relative carbon footprint (as compared to the other FMA alternatives) is considered significant. The greatest contribution to greenhouse gases would occur as a result of LTTD treatment of impacted soil and heavy equipment operation during excavation, backfilling, and transportation activities.

Long-Term Effectiveness and Permanence – Alternative FMA-5

Alternative FMA-5 would mitigate long-term exposures to impacted site media. This alternative would include permanent removal of a vast majority of (if not all) soil in the FMA that contains COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives. Some residual impacts located within the HWSTA and within the OSDA would not be addressed under this alternative. Excavation of site soil is an irreversible process that would achieve each of the soil and groundwater RAOs.

As indicated for the other FMA Alternatives, routine site activities do not include contact with or exposure to site groundwater. Additionally, drinking water for the North Albany Service Center and the surrounding community is provided via a municipal supply. Impacted groundwater would be removed from excavation areas and treated on-site prior to being discharged to the storm sewer. Residual concentrations of COCs in groundwater would be reduced over time via natural attenuation following the soil excavation activities.

<u>Land Use – Alternative FMA-5</u>

Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State. A GRS and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. The North Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas.

Although implementation of Alternative FMA-5 would not limit the future use of site, the alternative would have a significant impact on current site use. Alternative FMA-5 has been developed assuming that Building #2 and the Vehicle Maintenance Building would be demolished and the Genesee Street Substation and GRS (and associated subsurface utilities) would be removed to facilitate excavation activities. Service center and supporting operations would have to be relocated to implement Alternative FMA-5.

<u>Reduction of Toxicity, Mobility, or Volume through Treatment – Alternative FMA-5</u>

This alternative would include the removal and off-site treatment and/or disposal of approximately 244,300 CY of subsurface soil containing COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives. Impacted groundwater would be removed from excavation areas and subsequently treated via an on-site temporary water treatment system and discharged to the storm sewer. Residual concentrations of dissolved-phase impacts in groundwater beyond the FMA excavation limits would be reduced via natural attenuation following the soil excavation activities.

<u>Implementability – Alternative FMA-5</u>

This remedial alternative would be both technically and administratively implementable. Equipment and materials necessary to excavate site soil are readily available. Remedial contractors are available to perform these activities (i.e., no highly specialized equipment, materials, or personnel would be required). Equipment and personnel qualified to conduct the remedial activities are also readily available.

Potential challenges associated with the implementation of this alternative would consist of the following:

- Implementation of the remedial activities would result in extensive disruptions to the daily service center operations. Building #2 and the Vehicle Maintenance Building would be demolished and Service center operations would have to be relocated.

- Relocating the Genesee Street Substation and GRS/natural gas distribution piping. National Grid would have to construct a new electrical substation and relocate the GRS/gas piping at another location prior to completing these activities.

- Excavating soil in close proximity to Interstate 90 along the northern portion of the FMA, the railroad located immediately east of the FMA, and Broadway located immediately west of the FMA. The effects of these loads would be assessed during the remedial design phase to evaluate excavation stability.

- Excavating a large volume of soil. More than half of the soil excavated would require dewatering/solidification and multiple material staging areas would be required to manage the excavated material. A phased excavation approach would be required and material staging areas would have to be relocated as excavation activities progress.

- Managing, treating, and discharging a large volume of groundwater that would be removed from excavation areas. More than an estimated 43,000,000 gallons of groundwater would be generated during the excavation activities and a temporary treatment system would be constructed on-site and potentially relocated throughout the project as excavation activities progress. As part of the remedial design, an engineering evaluation of the local storm sewer system may have to be conducted to determine if the existing system would be capable of handling the additional flow.

- Identifying a treatment/disposal facility (or a number of treatment/disposal facilities) capable of processing approximately 244,300 CY of excavated material.

- Obtaining and transporting approximately 244,300 CY of clean fill materials. Backfilling activities would be coordinated with multiple clean fill providers to obtain the amount of material required to return the site to the existing grade.

Compliance with SCGs – Alternative FMA-5

- *Chemical-Specific SCGs* – Chemical-specific SCGs are presented in Table 2-1. Potentially applicable chemical-specific SCGs for soil include 6NYCRR Part 375-6 soil cleanup objectives and 40 CFR Part 261 and 6NYCRR Part 371 regulations for the identification of hazardous materials. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values.

  A majority of soil within the FMA contains VOCs and SVOCs at concentrations greater than 6NYCRR Part 375-6 soil cleanup objectives. Under this alternative, soil containing COCs at concentrations greater than the (most stringent) 6NYCRR Part 375-5 unrestricted use soil cleanup objectives would be excavated and transported off-site for treatment and/or disposal. Excavation areas would be backfilled with clean imported fill. Excavated material would be characterized in accordance with 40 CFR Part 261 and 6NYCRR Part 371 to determine appropriate off-site treatment/disposal requirements. NYS LDRs would apply to any materials that are characterized as a hazardous waste.

  Groundwater within the FMA contains VOCs and SVOCs at concentrations greater than NYSDEC Class GA standards and guidance values. This alternative would likely meet these SCGs, as impacted groundwater would be removed (and subsequently treated) from soil excavation areas and the vast majority of (if not all) NAPL and impacted soil, which serves as the source of dissolved-phase impacts, would also be removed. Residual concentrations of dissolved-phase COCs in groundwater would be reduced over time via natural attenuation (e.g., biodegradation, dispersion, dilution, volatilization, etc.).

- *Action-Specific SCGs* – Action-specific SCGs are presented in Table 2-2. Potentially applicable action-specific SCGs include health and safety requirements and regulations associated with handling impacted media. Work activities would be conducted in accordance with OSHA requirements that specify general industry standards, safety equipment and procedures, and record keeping and reporting regulations. Compliance with these action-specific SCGs would be accomplished by following a site-specific HASP.

  Excavated soil would be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these requirements would be achieved by following a NYSDEC-approved RD/RA Work Plan and using licensed waste transporters and permitted disposal facilities. Per DER-4

(NYSDEC, 2002), excavated material from a former MGP site that is characteristically toxic for benzene only is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (i.e., LTTD). All excavated material would be disposed of in accordance with applicable NYS LDRs.

Additionally, a NYSDEC State Pollutant Discharge Elimination System (SPDES) permit would be required to discharge treated water to a local storm sewer and subsequently to the Hudson River. The permit would establish maximum discharge limits and treatment requirements that the water treatment system would have to achieve prior to discharge.

- *Location-Specific SCGs* – Location-specific SCGs are presented in Table 2-3. Potentially applicable location-specific SCGs generally include regulations on conducting excavation, backfilling, and construction activities on flood plains. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and applicable local permits, prior to conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances.

<u>Overall Protection of Public Health and the Environment – Alternative FMA-5</u>

Alternative FMA-5 would mitigate potential long-term exposure to soil and groundwater containing MOCs and COCs by excavating the majority of soil in the FMA that contains COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives. Excavated material would be permanently transported off-site for treatment/disposal. Impacted groundwater would be removed from excavation areas and treated and discharged to the storm sewer. Residual dissolved-phase groundwater impacts (i.e., located beyond the excavation limits) within the FMA would be reduced over time via natural attenuation.

Potential short-term impacts to site workers and the community from remedial construction and off-site transportation of excavated material would be managed by following site plans and establishing appropriate engineering controls (e.g., site fencing, signage, barricades, etc.). Potential short-term exposures to COCs during implementation of this alternative would be mitigated by appropriate health and safety planning and practices.

Through excavation, Alternative FMA-5 would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to COCs and migration of MGP- and non-MGP-related impacts. Additionally, this alternative would achieve groundwater RAOs #1 and #2 by mitigating potential exposure to impacted groundwater. Alternative FMA-5 could also achieve groundwater RAO #3 over time via natural attenuation as this alternative achieves groundwater RAO #4 and permanently removes the source of dissolved-phase groundwater impacts.

Cost Effectiveness – Alternative FMA-5

The estimated costs associated with Alternative FMA-5 are presented in Table 5-4. The total estimated 30-year present worth cost for this alternative is approximately $112,000,000. The estimated cost includes demolition of Building #2 and the Vehicle Maintenance Building, removal of the electrical substation and GRS/gas piing, soil excavation and off-site disposal, and backfilling the excavation area. Implementation of this alternative would also require National Grid to relocate the existing operations at the site to another location. No costs for relocation of National Grid's existing site operations have been incorporated into the Cost Estimate for this alternative. As indicated above, Alternative FMA-5 does not include any groundwater monitoring or institutional control components. Therefore, Alternative FMA-5 does not include any O&M costs.

5.5 Detailed Evaluation of OSDA Alternatives

This section presents the detailed analysis of the following OSDA alternatives which were previously identified in Section 4:

- Alternative OSDA-2 – Passive NAPL Recovery, Groundwater Monitoring, and Institutional Controls

- Alternative OSDA-3 – Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

5.5.1 Alternative OSDA-2 – Passive NAPL Recovery, Groundwater Monitoring, and Institutional Controls

The major remedial components of Alternative OSDA-2 consist of the following:

- Installing NAPL collection wells
- Conducting quarterly NAPL monitoring and recovery
- Conducting annual groundwater monitoring
- Establishing institutional controls

As indicated in Section 1.6.3.4, DNAPL has been observed in the weathered bedrock in the OSDA, but (to date) has not accumulated in any of the monitoring wells in this area. For the purposes of this FS, it has been assumed that up to eight new NAPL collection wells (shown on Figure 5-5) would be installed within the OSDA to facilitate passive NAPL recovery. The final number and locations of NAPL collection wells would be evaluated as part of the remedial design for this alternative. NAPL collection wells would consist of 4-inch diameter PVC wells screened within the weathered bedrock and equipped with 2-foot sumps. Consistent with the monitoring activities currently conducted at the site, it is assumed that new NAPL collection wells would be gauged quarterly to monitor for the presence of NAPL. The actual frequency of monitoring would be determined after performing several monitoring events and assessing the amount of NAPL entering the wells, if any. NAPL (if encountered) would be removed using manual techniques (to the extent practicable) and placed in appropriate containers for transportation and off-site disposal at an appropriate facility.

As indicated in Section 1.6.3.3, dissolved-phase concentrations of BTEX and PAHs have generally decreased in the OSDA over the course of the annual monitoring events. Continued annual groundwater monitoring would also be completed as part of this alternative to evaluate dissolved-phase concentrations of COCs within the OSDA. Analytical results for the samples would be used to assess and document the extent and trends of COC concentrations in OSDA groundwater.

The results of the quarterly NAPL and annual groundwater monitoring would be summarized and presented to the NYSDEC in an annual report to document OSDA conditions. Based on the results of the monitoring activities, National Grid may request to modify the monitoring program and/or conduct monitoring activities less frequently.

As indicated in Section 1.6.3.3, there are no current or likely future users of site-related groundwater. Additionally, there are no known drinking water supply wells within a one-half mile radius of the North Albany Service Center. Based on the presence of dissolved-phase COCs and DNAPL in the OSDA, this alternative includes establishment of institutional controls in the form of ELURs, appropriate signage, and/or deed restrictions to mitigate potential exposure through ingestion of and/or direct contract by potential future workers with groundwater containing COCs at concentrations greater than NYSDEC Class GA standards and guidance values. As National Grid does not own the property in the OSDA, establishment of institutional controls in this area will be negotiated with the current property owners.

For the purpose of providing a cost estimate, it has been assumed that monitoring and reporting activities associated with Alternative OSDA-2 would be conducted for 30 years.

Short-Term Impacts and Effectiveness – Alternative OSDA-2

Implementation of this alternative could result in short-term exposure of field personnel to impacted groundwater and NAPL during NAPL collection well installation activities. Potential exposure mechanisms would include ingestion or dermal contact with impacted groundwater and NAPL and/or inhalation of volatile organic vapors. Potential exposure to field personnel would be minimized through the use of appropriately trained field personnel and PPE, as specified in a site-specific HASP. Air monitoring would be performed during well installation activities to confirm that volatile organic vapors are within acceptable levels, as specified in a site-specific HASP. Potentially impacted soil and groundwater generated during well installation activities would be properly managed to minimize the potential for exposure to the surrounding community.

This remedial alternative could be implemented in less than one month and monitoring would be conducted over an assumed 30-year period.

The relative carbon footprint of this alternative (compared to the other OSDA alternatives) is considered minimal. The greatest contribution to greenhouse gases would occur as a result of equipment used during well installation activities.

Long-Term Effectiveness and Permanence – Alternative OSDA-2

Alternative OSDA-2 would potentially reduce potential long-term exposure to COCs in groundwater and NAPL. Under this alternative, impacted groundwater would not be addressed through active treatment. Institutional controls would be established to restrict potential future groundwater use in this area. This alternative would include the permanent removal of NAPL from the weathered bedrock via passive NAPL recovery. Additionally, dissolved-phase groundwater impacts could decrease over time via natural attenuation.

Soils would not be disturbed during monitoring activities and workers would only be potentially exposed to impacted groundwater and NAPL during the periodic monitoring activities. NAPL collection wells in the OSDA would be equipped with lockable covers to restrict access by unauthorized personnel.

Land Use – Alternative OSDA-2

Land use in the surrounding area is primarily commercial/industrial, including in the OSDA which consists of the railroad, roadway, and rail yard. Land use in the OSDA is not anticipated to change in the near future and installation of the NAPL collection wells would not limit potential future uses of the OSDA.

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

Soil analytical results indicate that concentrations greater than SCOs are confined to two locations (SB-124A and SB-129) east of the Vehicle Maintenance Building in close proximity to the eastern boundary of the FMA. Analytical results for groundwater samples collected during annual monitoring events indicate a general decrease in BTEX and PAH concentrations in OSDA groundwater. These results suggest that the dissolved-phase plume has reached equilibrium and that natural attenuation of dissolved-phase groundwater impacts is occurring at a rate that prevents further downgradient migration of the leading edge of the dissolved-phase plume.

This alternative does not include direct treatment or containment of groundwater containing dissolved-phase impacts. However, Alternative OSDA-2 would include annual groundwater monitoring to document the potential long-term reduction (i.e., toxicity and volume) of dissolved-phase groundwater impacts via natural attenuation. Additionally, this alternative includes installation of NAPL collection wells to monitor for and facilitate recovery of DNAPL that has been observed in the weathered bedrock at two locations (SB-129 and SB-131) in the OSDA. DNAPL monitoring and recovery would reduce the potential for DNAPL to migrate further downgradient in the OSDA. DNAPL removal would also reduce the volume of material that is serving as a source to dissolved-phase groundwater impacts. This removal would reduce the flux of COCs from source material to groundwater and thereby reduce the toxicity and volume of dissolved-phase groundwater impacts. Natural attenuation processes could also reduce dissolved COC concentrations in groundwater in the OSDA over time.

Implementability – Alternative OSDA-2

This alternative would be both technically and administratively implementable. Equipment and personnel qualified to install collection wells and conduct NAPL recovery and groundwater monitoring activities are readily available.

Potential challenges associated with implementation of this alternative would consist of the following:

- Recovering DNAPL from the weathered bedrock. Based on previous attempts to recover DNAPL from monitoring wells in the FMA, recovery efforts may have limited effectiveness due to the viscous nature of the NAPL.

- Conducting NAPL collection well installation and groundwater/NAPL monitoring activities at locations not within the North Albany Service Center property. Access agreements with the property owner(s) would be required prior to implementation of this alternative.

- Establishing institutional controls on property not owned by National Grid. National Grid would have to negotiate with the current property owner(s) to establish institutional controls.

<u>Compliance with SCGs – Alternative OSDA-2</u>

- *Chemical-Specific SCGs* – Chemical-specific SCGs are presented in Table 2-1. Potentially applicable chemical-specific SCGs include NYSDEC Class GA standards and guidance values. Groundwater within the OSDA contains BTEX and PAHs at concentrations exceeding the SCGs. Through removal of DNAPL from the weathered bedrock and natural attenuation of dissolved-phase groundwater impacts, this alternative could potentially meet these SCGs over an extended period of time.

  Process residuals generated during the implementation of this alternative (e.g., drilling waste and development/purge water from well installation) would be managed in accordance with 40 CFR Part 761, 40 CFR 261, and 6NYCRR Part 371 regulations. Process residuals would be characterized to determine off-site treatment/disposal requirements. NYS LDRs would apply to any materials that are characterized as a hazardous waste.

- *Action-Specific SCGs* – Action-specific SCGs are presented in Table 2-2. Potentially applicable action-specific SCGs are associated with general health and safety requirements. Workers would conduct monitoring and recovery activities in accordance with OSHA regulations that specify general industry standards, safety equipment and procedures, and recordkeeping and reporting requirements. Compliance with action-specific SCGs would be accomplished by following a site-specific HASP.

  Process residuals generated during implementation of this alternative may be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these SCGs would be achieved by following a site-specific NYSDEC-approved work plan and utilizing licensed waste transporters and properly permitted disposal facilities.

- *Location-Specific SCGs* – Location-specific SCGs are presented in Table 2-3. Potentially applicable location-specific SCGs generally include regulations on construction activities on flood plains. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and applicable local permits, prior to conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances.

Overall Protection of Public Health and the Environment – Alternative OSDA-2

Alternative OSDA-2 would mitigate potential long-term exposure to groundwater in the OSDA containing COCs by implementing institutional controls. NAPL collection wells would also be installed in the OSDA to monitor for and facilitate removal of DNAPL from weathered bedrock (if encountered). Dissolved-phase groundwater impacts within the OSDA could be reduced over time via natural attenuation. Annual groundwater monitoring would be conducted to document the potential reduction of dissolved-phase groundwater impacts. Potential short-term exposures to COCs during implementation of this alternative would be mitigated by appropriate health and safety planning and practices.

Through passive NAPL recovery via wells and implementation of institutional controls, Alternative OSDA-2 would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to COCs and migration of MGP- and non-MGP-related impacts. Implementation of institutional controls would also achieve groundwater RAOs #1 and #2 by mitigating potential exposure to impacted groundwater. Although natural attenuation of impacted groundwater is likely occurring in the OSDA, Alternative OSDA-2 is not expected to achieve groundwater RAO #3 and restore groundwater to pre-disposal/pre-release conditions. This alternative would partially achieve groundwater RAO #4 through removal of DNAPL, which is a source for dissolved-phase groundwater impacts in the OSDA.

Cost Effectiveness – Alternative OSDA-2

The estimated costs associated with Alternative OSDA-2 are presented in Table 5-5. The total estimated 30-year present worth cost for this alternative is approximately $950,000. The estimated capital cost, including costs for installing DNAPL collection wells, is approximately $100,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting annual groundwater and quarterly NAPL monitoring, is approximately $850,000.

5.5.2 Alternative OSDA-3 – Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

The major remedial components of Alternative OSDA-3 consist of the following:

- Installing NAPL collection wells
- Enhanced biodegradation of dissolved-phase COCs in groundwater
- Conducting quarterly NAPL monitoring and recovery
- Conducting annual groundwater monitoring
- Establishing institutional controls

Alternative OSDA-3 would include the same DNAPL collection well installation, NAPL and groundwater monitoring, and institutional control components as Alternative OSDA-2. Alternative OSDA-3 would also include enhancing the biodegradation of dissolved-phase COCs present in groundwater at concentrations greater than NYSDEC Class GA standards and guidance values. Enhancing the biodegradation of dissolved-phase COCs can be achieved by adding amendments (e.g., nutrients, oxygen) to the groundwater to increase the rate of biodegradation. Amendments can be added to the groundwater via application/injection wells periodically (e.g., semi-annual application of proprietary products) or on a constant basis (e.g., oxygen or ozone injections).

For the purpose of developing this alternative, it has been assumed that enhanced biodegradation of dissolved-phase COCs in the OSDA would be achieved through the use of an oxygen-releasing compound (ORC). ORCs are proprietary products that provide a slow-releasing source of oxygen and organic nutrients that promote aerobic conditions within the saturated zone. The additional source of oxygen and nutrients thereby enhances the biodegradation processes that appear to have stabilized (or in some cases have caused a reduction in) concentrations of COCs in OSDA groundwater. Natural attenuation processes would continue to address dissolved-phase groundwater impacts downgradient of the ORC application area. Prior to remedial design of this alternative, additional information may be required concerning subsurface conditions, including pilot-scale testing and additional hydrogeologic modeling of the proposed treatment area.

Application wells would be installed approximately every 20 feet along the upgradient portion of the OSDA for approximately 780 linear feet, as shown on Figure 5-6. ORC application wells would consist of 2-inch diameter PVC wells screened across the saturated zone and equipped with canisters suspended from cables within the wells. The ORC packages (referred to as “socks”) would be periodically placed in the canisters within the wells. For the purpose of developing this alternative, it has been assumed that the oxygen and nutrients in the ORC socks would be utilized in approximately 6 months and the socks would be replaced on a semi-annual basis during two of the quarterly NAPL monitoring events. The actual frequency of monitoring would be determined after performing several monitoring events and assessing the amount of NAPL entering the wells, if any. Appropriate ORC application methods, number and location of application wells, well design and spacing, and application/change-out rates would be evaluated as part of the remedial design.

For the purpose of providing a cost estimate, it has been assumed that ORC application, and groundwater and NAPL monitoring and reporting activities associated with Alternative OSDA-3 would be conducted for 30 years. ORC application wells would be replaced every 10 years as the addition of oxygen and nutrients would promote biological growth that would foul well screens, thereby reducing the quantity of amendments supplied to the groundwater surrounding the applications wells.

<u>Short-Term Impacts and Effectiveness – Alternative OSDA-3</u>

Implementation of this alternative could result in the short-term exposure of field personnel to impacted groundwater and NAPL during NAPL collection and ORC well installation activities. Potential exposure mechanisms would include ingestion or dermal contact with impacted groundwater and NAPL and/or inhalation of volatile organic vapors. Potential exposure to field personnel would be minimized through the use of appropriately trained field personnel and PPE, as specified in a site-specific HASP. Air monitoring would be performed during well installation activities to confirm that volatile organic vapors are within acceptable levels, as specified in a site-specific HASP. Potentially impacted soil and groundwater generated during well installation activities would be properly managed to minimize the potential for exposure to surrounding community.

This remedial alternative could be implemented in less than one month and monitoring would be conducted over an assumed 30-year period. For the purposes of estimating a cost for this alternative, it has been assumed that ORC application wells would be replaced every 10 years.

The relative carbon footprint of this alternative (compared to the other OSDA alternatives) is considered minimal. The greatest contribution to greenhouse gases would occur as a result of equipment used during well installation activities.

Long-Term Effectiveness and Permanence – Alternative OSDA-3

Alternative OSDA-3 would potentially reduce long-term exposure to COCs in groundwater and NAPL. Under this alternative, impacted groundwater would be treated through enhanced biodegradation. Institutional controls would be established to restrict potential future groundwater use in this area. This alternative would include the permanent removal of NAPL from the weathered bedrock via passive NAPL recovery. Additionally, dissolved-phase groundwater impacts would be reduced via enhanced biodegradation.

Soils would not be disturbed during monitoring activities and workers would only be potentially exposed to impacted groundwater and NAPL during the periodic monitoring and ORC change-out activities. Therefore, groundwater and NAPL monitoring activities would result in minimal increased risks to the surrounding community. NAPL collection and ORC application wells in the OSDA would be equipped with lockable covers to restrict access by unauthorized personnel.

Land Use – Alternative OSDA-3

Land use in the surrounding area is primarily commercial/industrial, including in the OSDA which consists of the railroad, roadway, and rail yard. Land use in the OSDA is not anticipated to change in the near future and installation of the NAPL collection wells and application of groundwater amendments would not limit potential future uses of the OSDA.

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

Soil analytical results indicate that concentrations greater than SCOs are confined to two locations in close proximity to the eastern boundary of the FMA. Analytical results for groundwater samples collected during annual monitoring events indicate a general decrease in BTEX and PAH concentrations in OSDA groundwater. These results suggest that the dissolved-phase plume has reached an equilibrium and that natural attenuation of dissolved-phase groundwater impacts is occurring at a rate that prevents further downgradient migration of the leading edge of the dissolved-phase plume.

As part of Alternative OSDA-3, natural attenuation of dissolved-phase groundwater impacts would be enhanced through the addition of groundwater amendments. The amendments would provide a source of oxygen and nutrients to promote enhanced biodegradation of dissolved-phase groundwater impacts (at a faster rate than compared to natural processes alone). This alternative would include annual groundwater monitoring to document the reduction (i.e., the toxicity and volume) of dissolved-phase groundwater impacts. Additionally, this alternative includes installation of NAPL collection wells to monitor for and facilitate recovery of DNAPL that has been observed in the weathered bedrock at two locations (SB-129 and SB-131) in the OSDA. DNAPL monitoring and recovery would reduce the potential for DNAPL to migrate further downgradient in the OSDA. DNAPL removal would also reduce the volume of material that is serving as a source to dissolved-phase groundwater impacts. This removal would reduce the flux of COCs from source material to groundwater and thereby reduce the toxicity and volume of dissolved-phase groundwater impacts.

Implementability – Alternative OSDA-3

This alternative would be both technically and administratively implementable. Groundwater amendments are readily available from a variety of vendors. Equipment and personnel qualified to install collection and amendment application wells and conduct NAPL recovery and groundwater monitoring activities are readily available.

Potential challenges associated with implementation of this alternative would consist of the following:

- Recovering DNAPL from the weathered bedrock. Based on previous attempts to recover DNAPL from monitoring wells in the FMA, recovery efforts may have limited effectiveness due to the viscous nature of the NAPL.

- Conducting NAPL collection and amendment well installation and groundwater/NAPL monitoring activities at locations not within the North Albany Service Center property. Access agreements with the property owner(s) would be required prior to implementation of this alternative.

- Establishing institutional controls on property not owned by National Grid. National Grid would have to negotiate with the current property owner(s) to establish institutional controls.

Compliance with SCGs – Alternative OSDA-3

- *Chemical-Specific SCGs* – Chemical-specific SCGs are presented in Table 2-1. Potentially applicable chemical-specific SCGs include NYSDEC Class GA standards and guidance values. Groundwater within the OSDA contains BTEX and PAHs at concentrations greater than these SCGs. Through removal of DNAPL from the weathered bedrock and enhanced biodegradation of dissolved-phase groundwater impacts, COCs in groundwater could potentially be reduced to levels that would meet these SCGs over an extended period of time.

Process residuals generated during the implementation of this alternative (e.g., drilling waste and development/purge water from well installation) would be managed in accordance with 40 CFR Part 761, 40 CFR 261, and 6NYCRR Part 371 regulations. Process residuals would be characterized to determine off-site treatment/disposal requirements. NYS LDRs would apply to any materials that are characterized as a hazardous waste.

- *Action-Specific SCGs* – Action-specific SCGs are presented in Table 2-2. Potentially applicable action-specific SCGs are associated with general health and safety requirements. Workers would conduct monitoring and recovery activities in accordance with OSHA regulations that specify general industry standards, safety equipment and procedures, and recordkeeping and reporting requirements. Compliance with action-specific SCGs would be accomplished by following a site-specific HASP.

  Process residuals generated during implementation of this alternative may be subject to USDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Compliance with these SCGs would be achieved by following a site-specific NYSDEC-approved work plan and utilizing licensed waste transporters and properly permitted disposal facilities.

- *Location-Specific SCGs* – Location-specific SCGs are presented in Table 2-3. Potentially applicable location-specific SCGs generally include regulations on construction activities on flood plains. Compliance with these SCGs would be achieved by obtaining a joint USACE and NYSDEC permit, and applicable local permits, prior to conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances.

<u>Overall Protection of Public Health and the Environment – Alternative OSDA-3</u>

Alternative OSDA-3 would mitigate potential long-term exposure to groundwater containing COCs by implementing institutional controls. Dissolved-phase groundwater impacts within the OSDA would be reduced via enhanced biodegradation. NAPL collection wells would also be installed in the OSDA to monitor for and facilitate removal of DNAPL in weathered bedrock and annual groundwater monitoring would be conducted to document the potential reduction of dissolved-phase groundwater impacts. Potential short-term exposures to COCs during implementation of this alternative would be mitigated by appropriate health and safety planning and practices.

Through passive NAPL recovery via wells and implementation of institutional controls, Alternative OSDA-3 would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to and migration of MGP- and non-MGP-related impacts. Implementation of institutional controls would also achieve groundwater RAOs #1 and #2 by preventing potential exposure to impacted groundwater. Although enhanced biodegradation could potentially reduce concentrations of COCs in groundwater, Alternative OSDA-3 is not expected to achieve groundwater RAO #3 and restore groundwater to pre-disposal/pre-release conditions. This alternative would partially achieve groundwater RAO #4 through removal of DNAPL, which is a source for dissolved-phase groundwater impacts in the OSDA.

<u>Cost Effectiveness – Alternative OSDA-3</u>

The estimated costs associated with Alternative OSDA-3 are presented in Table 5-6. The total estimated 30-year present worth cost for this alternative is approximately $1,750,000. The estimated capital cost, including costs for installing DNAPL collection wells and ORC application wells, is approximately $250,000. The estimated 30-year present worth cost of O&M activities associated with this alternative, including conducting semi-annual ORC applications and annual groundwater and quarterly NAPL monitoring, is approximately $1,500,000.

6. Comparative Analysis of Alternatives

6.1 General

This section presents the comparative analysis of each remedial alternative using the eight evaluation criteria identified in Section 5.2. The comparative analysis identifies the advantages and disadvantages of each alternative relative to each other and with respect to the evaluation criteria.

6.2 Comparative Analysis of FMA Alternatives

The FMA alternatives evaluated in Section 5 consist of the following:

- Alternative FMA-1 – No Further Action

- Alternative FMA-2 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

- Alternative FMA-3 – Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

- Alternative FMA-4 – ISS, Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

- Alternative FMA-5 – Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

6.2.1 Short-Term Impacts and Effectiveness

Alternative FMA-1 would not include any active remediation and subsequently would not present potential short-term impacts to site workers, the surrounding community, or the environment. Alternatives FMA-2 through FMA-5 would each include excavation, off-site transportation of excavated material, and importation of clean fill. Each alternative would pose potential short-term risks to site workers and the surrounding community from the operation of large construction equipment, work area safety concerns, generation of noise and dust, and increased vehicle traffic. Alternative FMA-4 also poses additional potential short-term risks to site workers due to the operation of ISS equipment. Potential exposures would be mitigated, to the extent practicable, by using proper PPE, air and work space monitoring, implementation of dust control and noise mitigation measures (if necessary based on monitoring results), proper planning and training of site workers, and implementation of engineering controls.

Alternatives FMA-2 through FMA-5 would include the excavation and importation of sequentially larger volumes of impacted soil and clean fill materials. Estimated durations of the remedial activities and tractor trailer round trips for each alternative are summarized below.

- Alternative FMA-2 – 13 months and 2,800 truck trips
- Alternative FMA-3 – 14 months and 3,050 truck trips
- Alternative FMA-4 – 23 months and 4,200 truck trips
- Alternative FMA-5 – 10 years and 25,600 truck trips

Note that remedial construction activities may be conducted over multiple construction seasons/phases and therefore, actual construction durations could increase.

Alternatives FMA-2 through FMA-4 each include the excavation and off-site disposal of heavily impacted material east and northeast of Building #2. However, Alternatives FMA-3 and FMA-4 would both require more time to implement and more truck trips due to the additional remedial components associated with these alternatives (i.e., passive barrier wall for both alternatives and ISS for Alternative FMA-4).

Each of the remedial alternatives would result in increased vehicle traffic and therefore, greater contributions to greenhouse gases. The greatest contribution to greenhouse gas emissions for these alternatives includes LTTD treatment of soil and off-site transportation of excavated material and importation of clean fill.

Alternative FMA-5 would include the excavation and importation of the greatest volume of soil (including the removal of the Genesee Street Substation and the GRS). Therefore, Alternative FMA-5 has the lowest level of short-term effectiveness and has the highest potential for exposure during implementation.

6.2.2 Long-Term Effectiveness and Permanence

Alternative FMA-1 would not be effective at reducing potential risks to public health and the environment. Alternatives FMA-2 and FMA-3 do not include measures to remove or treat all

NAPL-impacted soil in the FMA, but rather rely on installation of an asphalt cap, passive NAPL barrier walls in the northwest corner of the North Albany Service Center (Alternatives FMA-2 and FMA-3 and along the eastern portion of the site (Alternative FMA-3 only), and NAPL recovery, as well as implementation of institutional controls to reduce the potential for exposure to impacted site media. Periodic monitoring and site inspections would be conducted to verify that these measures are in-place and remain effective. Based on predictive simulation results for groundwater modeling of Alternatives FMA-2 and FMA-3, these alternatives are not expected to significantly alter the hydrogeology of the surrounding area.

Significantly impacted material in the vicinity of the Vehicle Maintenance Building would be solidified under Alternative FMA-~~4. ISS~~ would be considered a permanent process for addressing the potential for migration of NAPL and continued dissolution of COCs into groundwater. Remaining NAPL-impacted material (i.e., near the Genesee Street Substation and within deeper portions of weathered bedrock) that would not be solidified would be monitored to facilitate NAPL recovery and reduce the potential for migration beyond the FMA. Predictive simulation results for groundwater modeling of Alternative FMA-4 indicate that although the water table elevation in the vicinity of the solidified soil would increase, groundwater would likely not be expressed at the surface, but an increase in downward vertical hydraulic gradients would occur. These conditions may increase the potential for migration of NAPL and impacted groundwater in the weathered bedrock that is not treated by ISS. Additionally, when comparing Alternatives FMA-3 and FMA-4, mobile NAPL (if present) that would be solidified under Alternative FMA-4 would be collected by the passive NAPL barrier wall constructed along the eastern portion of the site under Alternative FMA-3. Furthermore, as indicated previously, ISS treatment would not address NAPL in weathered bedrock and therefore, a passive NAPL barrier wall would still be required along the eastern portion of the site as part Alternative FMA-4.

Alternative FMA-5 would include removal of the vast majority of (if not all) soil containing COCs at concentrations greater than the 6NYCRR Part 375-6 unrestricted use soil cleanup objectives to reduce future risks to public health and the environment.

6.2.3 Land Use

Land use in the surrounding area is primarily commercial/industrial, with residential areas located to the west of the facility. The site operates as an active utility service center that serves as the primary maintenance, supply, storage, and office support facility for National Grid's operations in Eastern New York State. A GRS and an electrical substation (the Genesee Street Substation) are located in the northwestern corner of the property. The North

Albany Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas.

Implementation of Alternatives FMA-1 through FMA-4 is not anticipated to alter current or anticipated future use of the site. Under each of the alternatives, the site would be restored following the completion of remedial construction activities. However, under Alternative FMA-4, the presence of solidified material may limit the potential future development of the site and construction of buildings with subgrade basement level and foundation may be more difficult based on the nature of the solidified material. Under Alternative FMA-5, service center and supporting operations would have to be relocated.

6.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative FMA-1 would not actively treat, remove, recycle, or destroy impacted site media and therefore, is considered the least effective for this criterion. Alternatives FMA-2 through FMA-4 would include the excavation of approximately 17,400 CY of the most accessible, highly viscous NAPL and heavily impacted soil in the FMA. Excavated material would be permanently transported off-site for treatment/disposal. Additionally, Alternatives FMA-2 and FMA-3 would both include installation of an asphalt cap, passive NAPL barrier wall(s), and NAPL collection wells and rely on continued natural attenuation to address dissolved-phase groundwater impacts. The asphalt cap would reduce the volume of surface water infiltration and the NAPL collection wells would capture NAPL (to facilitate removal), thereby reducing the volume and mobility of NAPL in subsurface soil. Alternative FMA-3 is similar to Alternative FMA-2, but with construction of the passive NAPL barrier wall along the eastern portion of the site, Alternative FMA-3 would be more effective at capturing (and thus removing a greater volume) of NAPL.

Alternative FMA-4 would include ISS treatment of approximately 36,200 CY of soil containing significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm, as well as the excavation of approximately 12,600 CY of surface and shallow subsurface material to facilitate ISS activities. Soil and NAPL that is excavated or solidified would no longer serve as a source to dissolved-phase groundwater impacts. ISS would not reduce the toxicity or volume of impacted site materials, but would reduce the mobility of treated NAPL. NAPL located below the solidified soils (i.e., within the weathered bedrock) could potentially become mobilized due to changes in groundwater flow pattern and velocity, and increased water level and downward hydraulic gradient. Therefore, a passive NAPL barrier wall would still be required along the eastern portion of the site as part Alternative FMA-4. ISS would also reduce the volume impacted groundwater in the FMA by incorporating groundwater in the solidified mixture. The asphalt cap, NAPL collection wells, and passive barrier wall (installed in the northwest corner of the site) included as part of Alternative FMA-4 would further reduce the mobility of NAPL and impacted groundwater in the FMA.

Alternative FMA-5 would provide the largest reduction (relative to the other FMA alternatives) of toxicity, mobility, and volume of site impacts. Under this alternative, a vast majority of (if not all) NAPL and NAPL-impacted soil in the FMA would be removed for off-site treatment/disposal and impacted groundwater within the excavation areas would be removed and treated on-site. Approximately 244,300 CY of soil and more than an estimated 43,000,000 gallons impacted groundwater removed from excavation areas would be addressed by Alternative FMA-5.

6.2.5 Implementability

Alternative FMA-1 would not include the implementation of any remedial activities and therefore, is considered the most implementable. Each of the FMA alternatives includes installation of NAPL collection wells, NAPL monitoring, and implementation of institutional controls. These activities do not require highly specialized equipment or personnel and could be easily implemented. The passive barrier wall(s) and asphalt cap components of Alternatives FMA-2, FMA-3 and FMA-4 are also considered readily implementable and have been used at numerous remediation sites throughout the country. Although ISS treatment has also been completed at multiple MGP sites throughout the country, several site-specific challenges exist for implementing Alternative FMA-4. The excavation component of each of the FMA alternatives (including Alternative FMA-5) is considered technically implementable, but also has several site-specific challenges.

Potential challenges common to each of the FMA alternatives include conducting remedial activities at an active service center and working in close proximity to or around subsurface utilities. Jet-grouting would be conducted to solidify soil at locations where passive NAPL barrier walls transect subsurface utilities under Alternatives FMA-2, FMA-3, and FMA-4. Excavation activities in the northwest corner of the site (i.e., passive barrier wall pre-installation excavation) would be conducted using a back hoe and by hand-digging to identify and locate subsurface electrical transmission lines and natural gas distribution lines, as well as clear the numerous subsurface obstructions/foundations located in this portion of the FMA. The potential challenges associated with subsurface utilities for Alternatives FMA-4 and FMA-5 are significantly greater than Alternatives FMA-2 or FMA-3 given the extent of treatment/removal for each alternative. Alternative FMA-4 would require pre-excavation (including a large amount of hand-digging) to facilitate ISS in the vicinity of the subsurface utilities and multiple natural gas distribution and electrical transmission lines transect the ISS treatment area would need to be relocated. Remedial construction activities would potentially have to be sequenced to allow for the relocation of subsurface utilities to previously remediated areas. If it is not feasible to relocate the gas distribution lines (and other utilities) outside the limits of the ISS area, then it may be impracticable to treat soil located beneath or in close proximity to these utilities. Alternative FMA-5 would require demolition and removal of Building #2 and the Vehicle Maintenance Building and relocation of the Genesee Street Substation and GRS/gas piping currently located in the northwest corner of the North Albany Service Center. The weathered bedrock surface may limit the equipment's ability to solidify the entire depth of the soil column. Alternative FMA-4 has been developed under the assumptions that the top 2 feet of weathered bedrock could be treated via ISS. Challenges associated with the excavation activities common to the FMA alternatives include evaluating forces from nearby structures and features (i.e., Building #2, the railroad, Interstate 90, and Broadway). The need for and the design of potential excavation support systems would be evaluated as part of the remedial design.

Alternative FMA-4 and FMA-5 would cause a significant disruption to facility operations. Both of these alternatives would require remedial construction to be completed in stages to manage site traffic, storage, staging, etc., assuming the facility would be able to remain operational at all. Alternative FMA-5 has the most significant implementation challenges based on the extent and time required to excavate the large volume of soil under this alternative and would require relocation of service center operations. Managing the large volume of soil on-site within staging areas, transporting the material off-site, disposing of the large volume of material, and obtaining enough clean fill to restore the site may prove difficult. Removing the Genesee Street Substation, the GRS, Building #2, and the Vehicle Maintenance Building as part of Alternative FMA-5 would present significant challenges for National Grid.

6.2.6 Compliance with SCGs

- *Chemical-Specific SCGs* – As indicated in Section 5, potentially applicable chemical-specific SCGs for soil include 6NYCRR Part 375-6 soil cleanup objectives and 40 CFR Part 261 and 6NYCRR Part 371 regulations for the identification of hazardous materials. Potentially applicable chemical-specific SCGs for groundwater include NYSDEC Class GA standards and guidance values.

  Alternative FMA-1 would not include any active remediation to remove, treat, or contain COCs. Therefore, this alternative would not achieve the applicable chemical-specific SCGs. Alternatives FMA-2 through FMA-4 each include the removal of the most accessible, heavily impacted soil in the area east and northeast of Building #2 and the top 12 inches of surface material across the entire FMA to facilitate installation of a new asphalt cap over non-excavated soil containing COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial use. Soil excavated as part of Alternatives FMA-2 through FMA-5 would be managed in accordance with federal and NYS hazardous waste regulations. Alternative FMA-4 would include ISS of soil containing significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm and would thereby treat some site soil containing COCs at concentrations greater than 6NYCRR Part 375-6 restricted use soil cleanup objectives for industrial site use. Potential NAPL and impacted soil within weathered bedrock, beneath Building #2, and other areas beyond the ISS limits would not be treated. Under Alternative FMA-5, the vast majority of (if not all) soil containing COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives would be excavated and transported off-site for treatment/disposal.

Alternatives FMA-2 and FMA-3 do not include any measures to address dissolved-phase COCs in groundwater at concentrations exceeding NYSDEC Class GA standards and guidance values. Groundwater quality within the FMA would likely not meet the SCGs within the foreseeable future. Alternative FMA-4 would include ISS of NAPL and impacted soil in the vicinity of the Vehicle Maintenance Building and impacted groundwater in this area would be solidified during ISS treatment. Alternative FMA-5 would be the most effective at achieving groundwater SCGs as the vast majority of (if not all) impacted soil would be excavated as part of this alternative. During excavation, impacted groundwater would be removed from excavation areas and treated on-site prior to being discharged to the storm sewer.

- *Action-Specific SCGs* – As indicated above, Alternative FMA-1 would not include any active remediation to remove, treat, or contain COCs. Therefore, action-specific SCGs are not considered applicable. During implementation of Alternatives FMA-2 through FMA-5, health and safety-based SCGs would be addressed by following a site-specific HASP. Per DER-4 (NYSDEC, 2002) excavated material from a former MGP site that is characteristically toxic for benzene only is conditionally exempt from hazardous waste management requirements when destined for thermal treatment (i.e., LTTD). SCG-requirements related to the handling of hazardous wastes (including packaging, labeling, manifesting, and transportation requirements) would be addressed for each alternative, as appropriate, by following procedures that would be established as part a site-specific NYSDEC-approved RD/RA Work Plan that would be prepared prior to remedial construction. Alternatives FMA-2 through FMA-5 would be equally effective at meeting the action-specific SCGs, assuming proper project planning and implementation of appropriate controls.

- *Location-Specific SCGs* – Alternative FMA-1 would not include any active remediation to remove, treat, or contain COCs. Therefore, location-specific SCGs are not considered applicable. As indicated in Section 5, potentially applicable location-specific SCGs for Alternatives FMA-2 through FMA-5 generally include regulations on conducting excavation, backfilling, and construction activities on flood plains and local building/construction codes and ordinances. Compliance with these SCGs would be achieved by complying with the requirements of a joint USACE and NYSDEC permit, and applicable local permits, before conducting site activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances. Alternatives FMA-2 through FMA-5 would be equally effective at meeting the location-specific SCGs, assuming proper project planning and implementation of appropriate controls.

6.2.7 Overall Protection of Public Health and the Environment

Alternative FMA-1 would provide no added protection to public health and the environment and would not achieve the RAOs. The potential for short-term exposures to site workers and the surrounding community during implementation of the alternatives inherently increases as the duration and amount of treatment/removal increases (i.e., potential for short-term exposures increase from Alternatives FMA-2 through FMA-5). Potential exposures during implementation of any of the FMA alternatives would be mitigated by following appropriate planning and work practices and using proper engineering controls during site work.

Each of the FMA alternatives would provide some degree of long-term protection to public health and the environment as each FMA alternative would include excavation/treatment of impacted soil, passive NAPL recovery, and institutional controls to prohibit use of groundwater and restrict invasive activities in the FMA. Alternative FMA-3 is considered more protective over the long-term compared to Alternative FMA-2 because Alternative FMA-3 would include a passive NAPL barrier wall in the eastern portion of the site to enhance NAPL recovery and prevent potential migration of NAPL beyond the FMA. Alternative FMA-4 would include the same components as Alternative FMA-3 and would also include ISS of NAPL, impacted soil, and impacted groundwater in the vicinity of the Vehicle Maintenance Building. Additionally, as NAPL would remain in the weathered bedrock, a passive NAPL barrier wall is still required as part of Alternative FMA-4. Alternative FMA-5 would potentially eliminate future exposures to public health and the environment through excavation/removal of the vast majority of (if not all) impacted material in the FMA.

Each of the FMA alternatives would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to COCs and migration of MGP- and non-MGP-related impacts. Additionally, each of the FMA alternatives would achieve groundwater RAOs #1 and #2 by mitigating potential exposure to impacted groundwater. Each of the FMA alternatives would work toward achieving groundwater RAO #4 by addressing sources of dissolved-phase groundwater impacts via excavation, recovery, and/or solidification. Although Alternatives FMA-4 and FMA-5 actively address a larger volume of source material, Alternative FMA-3 provides substantial means to greatly reduce the potential for further migration of NAPL beyond the FMA (through the construction of passive NAPL barrier walls in the northwest corner and at the eastern boundary of the site), while not potentially facilitating additional migration of NAPL by significantly changing the site hydrogeologic characteristics. Alternatives FMA-4 and FMA-5 would potentially be more effective at achieving groundwater RAO #3 compared to Alternatives FMA-2 and FMA-3. However, impacted groundwater would remain in the FMA under each of the alternatives.

6.2.8 Cost Effectiveness

The following table summarizes the estimated costs associated with each of the FMA remedial alternatives.

Alternative	Estimated Capital Cost	Estimated Present Worth of O&M Cost	Total Estimated Cost
FMA-1	$0	$0	$0
FMA-2	$14,100,000	$900,000	$15,000,000
FMA-3	$14,800,000	$900,000	$15,700,000
FMA-4	$22,600,000	$900,000	$23,500,000
FMA-5	$112,000,000	$0	$112,000,000

As indicated by the estimates presented above, the cost to install a passive NAPL barrier wall to enhance NAPL recovery at the eastern boundary of the FMA (i.e., the difference between Alternatives FMA-2 and FMA-3) would be approximately $700,000. The cost to solidify significantly impacted soil in the vicinity of the Vehicle Maintenance Building (i.e., the difference between Alternatives FMA-3 and FMA-4) would be approximately $7,800,000 and as NAPL could potentially remain in the weathered bedrock, a passive NAPL barrier wall is still required as part of Alternative FMA-4. Alternative FMA-5 would have the greatest cost associated with implementing the alternative.

6.3 Comparative Analysis of OSDA Alternatives

The OSDA alternatives evaluated in Section 5 consist of the following:

- Alternative OSDA-1 – No Further Action
- Alternative OSDA-2 – Passive NAPL Recovery, Groundwater Monitoring, and Institutional Controls
- Alternative OSDA-3 – Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

6.3.1 Short-Term Impacts Effectiveness

Alternative OSDA-1 would not include any active remediation and subsequently would not present potential short-term impacts to site workers, the surrounding community, or the environment. Alternative OSDA-2 and OSDA-3 would each include installation of NAPL collection wells. Each alternative would pose potential short-term risks to site workers and the surrounding community from exposure to impacted groundwater, NAPL, and volatile organic vapors. Potential exposures would be mitigated during NAPL collection well installation activities (to the extent practicable) by using proper PPE, air and work space monitoring, and proper planning and training of site workers.

The greatest contribution of greenhouse gases for the OSDA alternatives would occur from equipment used to install wells.

6.3.2 Long-Term Effectiveness and Permanence

Alternative OSDA-1 would not be effective at reducing potential risks to human health and the environment, and would not meet the site-specific RAOs. Alternatives OSDA-2 and OSDA-3 each relies on passive NAPL recovery, and implementation of institutional controls to reduce potential risks to human health and the environment. Alternative OSDA-3 also includes enhanced biodegradation of dissolved-phase groundwater impacts through the addition of groundwater amendments.

Alternative OSDA-2 is considered an equally effective alternative over the long-term compared to Alternative OSDA-3 based on the low potential for exposure to impacted groundwater in the OSDA. There are no users of groundwater in the area and current annual groundwater monitoring activities have indicated that the extent (i.e., the plume) of dissolved-phase groundwater impacts has reached equilibrium in the OSDA, and a general decrease in BTEX and PAH concentrations has been identified through annual groundwater sampling.

6.3.3 Land Use

Land use in the surrounding area is primarily commercial/industrial, including in the OSDA which consists of the railroad, roadway, and rail yard. Land use in the OSDA is not anticipated to change in the near future and installation of the NAPL collection wells (under Alternatives OSDA-2 and OSDA-3) and application of groundwater amendments (under Alternative OSDA-3 only) would not limit potential future uses of the OSDA.

6.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Soil analytical results indicate that concentrations greater than SCOs are confined to two locations in close proximity to the eastern boundary of the FMA. As presented in Section 1.6.3.3, analytical results for groundwater samples collected during annual monitoring events indicate a general decrease in BTEX and PAH concentrations in OSDA groundwater. These results suggest that the extent of dissolved-phase groundwater impacts has reached equilibrium and that natural attenuation is occurring at a rate that would prevent further downgradient migration of the leading edge of the dissolve-phase plume.

Alternative OSDA-1 would not actively treat, remove, recycle, or destroy impacted site media and therefore is considered the least effective for this criterion. Alternative OSDA-2 includes passive recovery of NAPL observed in the weathered bedrock of the OSDA. Removal of NAPL would reduce mobility and volume of source material to dissolved-phase groundwater impacts in the OSDA, thereby reducing the flux of COCs from source material to groundwater. Under Alternative OSDA-3, the attenuation of dissolved phase COCs in groundwater would be enhanced through the addition of amendments that would provide a source of oxygen and nutrients to promote enhanced biodegradation (i.e., the toxicity and volume of dissolved-phase impacts would be reduced faster than by natural processes alone). Alternatives OSDA-2 and OSDA-3 both include annual groundwater monitoring to document the reduction of dissolved-phase groundwater impacts.

6.3.5 Implementability

Alternative OSDA-1 would not include the implementation of any remedial activities. Alternatives OSDA-2 and OSDA-3 each includes installation of NAPL collection wells, NAPL and groundwater monitoring, and implementation of institutional controls. These activities do not require highly specialized equipment or personnel and can be easily implemented. The groundwater amendments to be utilized for Alternative OSDA-3 are readily available from a variety of vendors and installation of application wells does not require specialized equipment. Alternative OSDA-3 may also require pilot-scale testing and additional hydrogeologic modeling prior to remedial design.

Potential challenges common to each of the OSDA alternatives include conducting remedial activities (i.e., well installation, NAPL and groundwater monitoring, and ORC application) and implementing institutional controls on property that is not owned by National Grid. National Grid would have to negotiate with the current property owner(s) to establish institutional controls and secure access agreements to implement the OSDA alternatives.

6.3.6 Compliance with SCGs

- *Chemical-Specific SCGs* – As indicated in Section 5, potentially applicable chemical-specific SCGs include NYSDEC Class GA standards and guidance values. Alternative OSDA-1 would not include any active removal, treatment, or containment of impacted groundwater. Therefore this alternative would not achieve the applicable chemical-specific SCGs. Alternatives OSDA-2 and OSDA-3 both include passive removal of DNAPL from bedrock and annual monitoring to document groundwater conditions in the OSDA. Alternative OSDA-3 also includes enhanced biodegradation to treat groundwater, which could potentially reduce dissolved-phase COCs in groundwater over an extended period of time.

  Alternatives OSDA-2 and OSDA-3 both include well installation activities. Process residuals generated during implementation of this alternative (e.g., drill waste and development/purge water) would be managed in accordance with 40 CFR 761, 40 CFR 261, and 6NYCRR Part 371. Process residuals would be characterized to determine off-site treatment/disposal requirements. NYS LDRs would apply to any materials that are characterized as a hazardous waste.

- *Action-Specific SCGs* – As indicated above, Alternative OSDA-1 would not include any active remediation to remove, treat, or contain COCs. Therefore, action-specific SCGs are not considered applicable. Health and safety SCGs associated with Alternatives

OSDA-2 and OSDA-3 would be addressed by following a site-specific HASP. Process residuals generated during construction of these alternatives may be subject to NYSDOT requirements for packaging, labeling, manifesting, and transporting hazardous or regulated materials. Alternatives OSDA-2 and OSDA-3 would be equally effective at meeting the action-specific SCGs, assuming proper project planning.

- *Location-Specific SCGs* – Alternative OSDA-1 would not include any active remediation to remove, treat, or contain COCs. Therefore, location-specific SCGs are not considered applicable. Location-specific SCGs generally include regulations regarding construction activities on flood plains. Compliance with these SCGs would be achieved by complying with the requirements of a joint USACE and NYSDEC permit, and applicable local permits, prior to conducting remedial activities. Additionally, remedial activities would be conducted in accordance with local building/construction codes and ordinances. Alternatives OSDA-2 and OSDA-3 would be equally effective at meeting the location-specific SCGs, assuming proper project planning.

6.3.7 Overall Protection of Public Health and the Environment

Alternative OSDA-1 would provide no added protection of public health and the environment and would not achieve the RAOs. Potential short-term exposures to site workers and the surrounding community are similar for Alternatives OSDA-2 and OSDA-3. Potential exposures during implementation of any of the OSDA remedial alternatives would be mitigated by following proper planning and work practices and using proper engineering controls during remedial activities. Each of the OSDA alternatives would provide some degree of protection to human health and the environment as each alternative includes passive NAPL recovery via wells, annual groundwater monitoring to document OSDA conditions, and implementation of institutional controls to prohibit use of groundwater in the OSDA. Alternative OSDA-3 would enhance the biodegradation of dissolved-phase impacts through the use of groundwater amendments. Based on existing site use in the OSDA and the lack of users of groundwater, both Alternatives OSDA-2 and OSDA-3 provide effective protection of human health and the environment.

Alternatives OSDA-2 and OSDA-3 would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to COCs and migration of MGP- and non-MGP-related impacts. Each of the OSDA alternatives would achieve groundwater RAOs #1 and #2 by mitigating potential exposure to impacted groundwater. Additionally, each OSDA alternative equally works toward achieving groundwater RAO #4 by removing mobile NAPL which acts as a source of dissolved-phase groundwater impacts. As indicated above, none of the OSDA alternatives are expected to achieve groundwater RAO #3 and restore groundwater to pre-release/pre-disposal conditions. Alternative OSDA-3 has greater potential to reduce the extent of dissolved-phase groundwater impacts compared to Alternative OSDA-2. However, Alternative OSDA-2 is considered equally effective compared to Alternative OSDA-3 based on the low of potential for exposure to groundwater in the OSDA.

6.3.8 Cost Effectiveness

The following table summarizes the estimated costs associated with each of the OSDA remedial alternatives.

Alternative	Estimated Capital Cost	Estimated Present Worth of O&M Cost	Total Estimated Cost
OSDA-1	$0	$0	$0
OSDA-2	$100,000	$850,000	$950,000
OSDA-3	$250,000	$1,500,000	$1,750,000

As indicated by the costs presented above, the cost to conduct periodic NAPL and groundwater monitoring activities (Alternative OSDA-2) over an assumed 30-year period would be approximately $950,000. The cost to enhance the biodegradation processes that are likely occurring in the OSDA (Alternative OSDA-3) would be approximately an additional $800,000 over an assumed 30-year period.

7. Preferred Site-Wide Remedy

7.1 General

The results of the comparative analysis (presented in Section 6) were used as a basis for identifying a preferred remedial alternative for the site. The components of the preferred site-wide remedy are presented in the following subsection.

7.2 Summary of Preferred Site-Wide Remedy

Based on the comparative analysis of the remedial alternatives presented in Section 6, the combination Alternatives FMA-4 and OSDA-2 is the preferred site-wide remedial alternative. The combination of these alternatives would cost-effectively achieve the best balance of the NYSDEC evaluation criteria. The preferred site-wide remedy represents a permanent reduction in the toxicity, mobility, and volume of impacted site media and reduces the potential for exposure to remaining material.

As described in the respective subsections of Section 5, the primary components of the preferred site-wide remedy consist of the following:

- Removing approximately 12,600 CY of surface material and shallow subsurface soil during pre-ISS excavation activities.

- Treating approximately 36,200 CY of subsurface saturated and unsaturated soil containing significant visual evidence of NAPL and/or PAHs at concentrations greater than 1,000 ppm.

- Excavating approximately 17,400 CY of highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated wood chips located east and northeast of Building #2.

- Placing clean imported fill material within the excavation area east and northeast of Building #2.

- Constructing (i.e., excavating and installing materials for) passive NAPL barrier walls in the northwest corner of the North Albany Service Center and along the hydraulically downgradient portion of the FMA to facilitate NAPL collection and recovery and prevent potential migration of NAPL beyond the FMA. If the Genesee Street substation is de-energized or relocated in the future, National Grid would re-evaluate potential alternatives for addressing NAPL and impacted soil in this area that are currently inaccessible.

- Removing approximately 6,600 CY of surface material (i.e., asphalt and gravel subbase at locations not subject to ISS treatment or excavation) to facilitate installation of a new asphalt cap.

- Constructing a new asphalt cap in the FMA to prevent potential future exposures to remaining impacted media.

- Treating (via LTTD) and disposing of approximately 8,700 CY of material (50% of material excavated from the area east and northeast of Building #2) that is assumed to be characteristically hazardous for benzene.

- Disposing approximately 21,200 tons of surface material and other debris as a non-hazardous waste at a C&D landfill.

- Disposing approximately 20,600 CY of material excavated from the area east and northeast of Building #2, as well as material excavated to facilitate ISS treatment and installation of the passive NAPL barrier walls as a non-hazardous waste at a solid waste landfill.

- Installing new NAPL collection wells in the FMA and in the HWSTA to facilitate passive recovery of mobile LNAPL and DNAPL, as well as new “sentinel” NAPL monitoring wells west of Broadway.

- Installing up to eight new NAPL collection wells in the OSDA to facilitate passive recovery of DNAPL.

- Conducting quarterly NAPL monitoring in the FMA and OSDA to passively recover LNAPL and DNAPL that may accumulate in new and existing NAPL recovery wells.

- Conducting annual groundwater monitoring in the OSDA to evaluate the dissolved-phase concentrations of COCs in OSDA groundwater.

- Conducting annual inspections of the asphalt cap (to identify cracks, deterioration, etc.) and implementing repairs to the cap, as necessary.

- Establishing institutional controls for the FMA and OSDA to prohibit use of groundwater and limit the future development and use of these areas.

ISS treatment and excavation are a proven technologies for addressing soil that contains MGP- and non-MGP-related impacts. The preferred site-wide remedy also includes passive NAPL barrier walls, passive NAPL recovery, capping, and monitoring to address MGP- and non-MGP-related impacts in the FMA and OSDA. Each of these technologies and processes has been successfully implemented at other MGP sites and are considered technically and administratively implementable.

Potential challenges associated with implementation of the preferred site-wide remedy would include conducting remedial activities at an active service center; completing ISS of soils to depths of competent bedrock; solidifying soil in close proximity to subsurface utilities (if the utilities cannot be relocated); excavating soil in close proximity to Building #2 and the railroad; installing passive NAPL barrier walls in close proximity to the railroad and in areas that contain subsurface obstructions and utilities; conducting work activities in close proximity to the Genesee Street Substation, the GRS, and associated subsurface utilities; recovering DNAPL from weathered bedrock, and conducting work activities and establishing institutional controls on property not owned by National Grid. These challenges would be addressed during the remedial design, pre-design investigation, and with appropriate site/project planning.

Potential short-term impacts to the surrounding community would include increased local truck traffic and potential exposure to impacted soil, groundwater, and dust containing COCs or volatile organic vapors during remedial construction. The preferred site-wide remedy could be implemented in approximately 23 months (i.e., over an anticipated 2 to 3 construction seasons). The potential for exposure would be minimized through the use of proper planning, site monitoring, and engineering controls.

The preferred-site wide remedy is considered effective over the long-term and is protective of human health and the environment. The preferred site-wide remedy would achieve soil RAOs #1, #2, and #3 by mitigating potential exposure to COCs and migration of MGP- and non-MGP-related impacts. Additionally, groundwater RAOs #1 and #2 would be achieved by mitigating potential exposure to impacted groundwater. The preferred site-wide remedy could achieve groundwater RAOs #3 and #4 by solidifying and removing material that serves as a source to dissolved-phase groundwater impacts through ISS treatment, excavation, and passive NAPL recovery.

Alternatives FMA-4 and OSDA-2 are preferred over the other alternatives based on the following:

- The most accessible, highly viscous NAPL and heavily impacted soil would be solidified in place or removed and transported off-site for treatment and/or disposal at appropriate facilities.

- Alternative FMA-4 has a higher level of implementability than Alternative FMA-5, while addressing a greater volume of impacted media (compared to Alternative FMA-3).

- Alternative FMA-4 would require lesser disruption to the current subsurface utilities (i.e., natural gas distribution and electric transmission lines) that exist beneath the site as compared to the excavation activities that would be completed under Alternative FMA-5.

- Under Alternative FMA-4, the ISS treatment would address approximately 36,200 CY of soil that contains significant visual evidence of NAPL (i.e., soils saturated with NAPL, not including staining, sheens, or blebs) and/or PAHs at concentrations greater than 1,000 ppm and the passive NAPL barrier wall would address NAPL in weathered bedrock (assuming ISS treatment would not be completed to the top of competent bedrock).

- Alternative FMA-4 would include NAPL collection wells and passive NAPL barrier walls in the northwest corner and at the eastern boundary of the site that would provide enhanced NAPL recovery and has a greater ability to prevent the potential migration of mobile NAPL beyond the FMA, compared to Alternative FMA-2, which only includes a passive NAPL barrier wall in the northwest corner of the site. Additionally, “sentinel” NAPL monitoring wells would be installed west of Broadway to evaluate the presence of NAPL migrating upgradient of the FMA.

- Alternative FMA-4 requires a shorter construction schedule and a smaller area of disturbance compared to Alternative FMA-5, thereby posing less disruption to North Albany Service Center operations and the surrounding community.

- Alternative FMA-4 represents a smaller contribution to greenhouse gas emissions than Alternative FMA-5.

- Annual groundwater monitoring of the FMA and OSDA has indicated that the extent of the dissolved-phase groundwater impacts is generally stable and a general decrease in BTEX and PAH concentrations has been identified through annual groundwater sampling. This suggests that natural attenuation processes are already reducing dissolved-phase COC concentrations in the OSDA groundwater.

- Alternatives FMA-4 and OSDA-2 have an equivalent long-term effectiveness and level of protection of human health and the environment compared to the other alternatives when considering the physical and institutional controls that would be established to prevent exposure to remaining impacted media.

- Alternatives FMA-4 and OSDA-2 would achieve or have the potential to achieve the soil and groundwater RAOs at a reasonable cost relative to the other alternatives.

Based on this rationale, a site-wide remedy that incorporates Alternatives FMA-4 and OSDA-2 is the preferred remedial alternative for addressing MGP- and non-MGP-related impacts in the FMA, HWSTA, and OSDA.

7.3 Estimated Cost of Preferred Site-Wide Remedy

The total estimated cost associated with implementation of the preferred site-wide remedy is summarized in the following table.

Alternative	Estimated Capital Cost	Estimated Present Worth of O&M Cost	Total Estimated Cost
FMA-4	$22,700,000	$900,000	$23,600,00
OSDA-2	$100,000	$850,000	$950,000
		Total Estimated Present Worth Cost	**$24,550,000**

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Tables

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
SB-5	26.3	16.8	18	Spots of brown NAPL	n/a	n/a	
		18	20.7	Oily sheen	n/a	n/a	
		20.7	22.2	Blebs of brown coal tar	10.6	0.001	
		22.2	24.6	Sheen	n/a	n/a	
SB-10	23.7	3	4	Some tar-like material	n/a	n/a	
		6	8	Tar and wood (potential purifier waste)	n/a	n/a	
		8	10	Trace tar	136,850	1,360	
		8	10	Duplicate sample	152,170	2,140	
SB-11	20.8	2.5	4	Saturated with fuel oil-like material	1,271	9.1	
		4	5.5	Saturated with black fuel-like material	n/a	n/a	
		5.5	6.5	Saturated with black material	n/a	n/a	
		8	9.5	Saturated with black tar-like material	6,820	283	
		9.5	10	Brown coal tar spots			
		10	12	Oily sheen	n/a	n/a	
		12	14	Coal tar splotches	n/a	n/a	
		14	17	Brown coal tar, abundant	7,416	181	
		18	20.5	Few coal tar splotches	90.2	7.51	
SB-12	22.6	2	4	Saturated with black fuel oil-like material	169	45.2	
		4	6	Saturated with black tar-like material	n/a	n/a	
		6	8	Thick black tar	182,000	467	
		8	10	Black coal tar blebs	n/a	n/a	
		10	14	Black coal tar	5,125	129	
		14	16	Brown coal tar splotches	n/a	n/a	
		16	18	Coal tar and oily sheen	n/a	n/a	
		18	20	Brown coal tar blobs	n/a	n/a	
		20	22.6	Coal tar	220	14.6	
SB-14	21.8	18.5	20.5	Brown coal tar	40.6	265	
		20.5	21.8	Saturated with brown coal tar, very strong odor	n/a	n/a	
SB-15	19.8	4.5	8.7	Saturated with black oil-like material	1,194	32.4	
		8.7	10.5	Brown MGP blobs	n/a	n/a	
		12	12.8	Trace brown MGP	266	7.38	
		18	19	MGP impregnation in shale	567	691	

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
SB-16	20.6	4	8	Saturated with oil-like material	1,801	35	
		8	14	Black oil-like material	5,648	657	
		14	18	Oil/coal tar blobs	n/a	n/a	
		18	20	Coal tar	356	18.7	
		20	20.6	Saturated with brown coal tar	884	122	
SB-17	22.6	3.5	4.5	Trace fuel oil	3.53	0.11	
		4.5	6	Saturated with black oil-like material	n/a	n/a	
		6.5	9	Trace black oil-like material	n/a	n/a	
		10	12.2	Saturated with black oil-like material	1.06	0.01	
SB-18	23.8	4	8	Saturated with brown coal tar	17,030	3,520	
		8	14	Saturated with black coal tar	12,550	4,790	
		14	16	Saturated with coal tar	n/a	n/a	
		16	18	Coal tar sheen	n/a	n/a	
		18	20	Black coal tar	47,200	5,920	
		22	23.8	Coal tar	74	44.6	
SB-19A	15.1	10	12	Brown coal tar	n/a	n/a	
		12	14	Saturated with brown coal tar	n/a	n/a	
		14	15.1	Brown coal tar	n/a	n/a	
SB-23	26.3	4.2	8.2	Saturated with black oil-like material	59	21.1	
		8.2	9.2	Saturated with black tar	160,200	543	
		12	12.5	Sheen	n/a	n/a	
		14	16	Thick tar pockets	40,470	1,120	
		16	20	Oily sheen	n/a	n/a	
		26	26.3	Brown coal tar blobs	n/a	n/a	
MW-2	23.6	8.2	10	Brown/black coal tar	R	0.24	
		10	16	Saturated with coal tar	n/a	n/a	
		16	18	Patches of brown coal tar	n/a	n/a	
		18	22.7	Saturated with coal tar	3,064	1,000	
		22.7	23.6	Seams of coal tar	n/a	n/a	
MW-4	18.0	8	9	Oily sheen	n/a	n/a	A measurable quantity of LNAPL has been observed in monitoring well MW-4.
		12	14	Some brown spots	201	18	

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
MW-5	24.4	4	12	Black oil-like material	757	56	A measurable quantity of DNAPL has been observed in monitoring well MW-5. MW-5 has been destroyed.
		12	18	Saturated with coal tar	3,636	450	
		18	22	Abundant coal tar	1,171	194	
		24	24.4	Some coal tar	n/a	n/a	
MW-7	17.0	n/a	n/a	n/a	n/a	n/a	A measurable quantity of DNAPL has been observed in monitoring well MW-7. No boring log was found for monitoring well MW-7. MW-7 has been destroyed.
MW-8	20.9	6.5	8	Some black oil-like material	63.53	12.6	A measurable quantity of LNAPL has been observed in monitoring well MW-8.
		8	9	Oily sheen	n/a	n/a	
		10	12	Oily sheen	n/a	n/a	
		12	12.5	Saturated with brown coal tar	n/a	n/a	
		12.5	14	Oily sheen	n/a	n/a	
		14	16	Strings of brown coal tar	24.2	0.04	
		16	17.8	Brown coal tar spots	n/a	n/a	
		18	18.5	Oily sheen	4.5	0.001	
MW-10	24.5	n/a	n/a	n/a	n/a	n/a	A measurable quantity of LNAPL has been observed in monitoring well MW-10.
MW-13	25.8	4.5	8	Saturated with black oil-smelling material	n/a	n/a	Measurable quantities of DNAPL and LNAPL have been observed in monitoring well MW-13.
		8	12	Saturated with black oil-like material	n/a	n/a	
		12	14	Trace brown coal tar	32.5	0.08	
		14	16	Black oil-like material	n/a	n/a	
		18	20	Sheen	n/a	n/a	
		24	24.5	Sheen	618	13.1	
		24.5	25.8	Thick brown coal tar			
		24.5	25.8	Duplicate sample	544	23.7	

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
MW-14	22.0	6	8	Saturated with MGP material	6,870	131	Measurable quantities of DNAPL and LNAPL have been observed in monitoring well MW-14.
		8	10	Black coal tar	17,570	880	
SB-109	22.5	8	22.5	Saturated with NAPL	2,596 J	80 J	
					2,621	457	
SB-110	19.3	4	6	Sheen	n/a	n/a	
		6	16	Saturated with NAPL	11,464 J	408 J	
		16	18	Tar-like material	n/a	n/a	
		18	19.3	Black tar-like material	1,367,980 J	2,229 J	
SB-113	20.0	4	10	Yellow NAPL	353 J	ND	
		10.5	14	Sheen	n/a	n/a	
SB-114	17.5	4	12.5	Tar-like material	6,310	80.9	
		12.5	16	Trace NAPL	18.5 J	0.09 J	
SB-115	24.5	10	14	Some to little NAPL	753 J	112	
		14	16	Trace NAPL	n/a	n/a	
SB-119	21.7	7.5	16	Tar-like material	61,330 J	6,030	
		7.5	16	Duplicate sample	117,700 J	9,800	
SB-120	21.5	7.5	8	NAPL	n/a	n/a	
		8	14	Dark brown NAPL	167.2 J	204	
		8	14	Duplicate sample	25.93 J	6.23 J	
		14	18	Sheen	125 J	0.7 J	
SB-123	36.5	6	8	Heavy sheen	3.56 J	ND	
SB-124A	22.2	4	8	NAPL	146 J	23.78 J	
		4	8	Duplicate sample	156 J	3.56 J	
		10	11	NAPL on surface of gravel	n/a	n/a	
		20	22	NAPL	n/a	n/a	
SB-129	25.4	24	26	Saturated with coal tar	1,913 J	76.79	
SB-131	29.8	28	29.8	Saturated with NAPL	164	2.24	
SB-135	25.0	11	12	Sheen	n/a	n/a	
		12	14	NAPL	271	50.5	
		12	14	Duplicate sample	n/a	3.9	
		14	14.8	Trace NAPL	n/a	n/a	
SB-139	20.8	10	12	Sheen	n/a	n/a	
		16	18.5	Sheen	n/a	n/a	
		18.5	20.3	Visible NAPL film	326	31.52	
SB-140	19.7	16	19.7	NAPL film	136	82.1	

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
SB-141	18.5	8	10	Trace NAPL	n/a	n/a	
		16	18	Trace tar around soil grains	274	3.16	
SB-142	22.5	12	14	NAPL film	38.4	0.16	
		22	22.5	Trace NAPL film	n/a	n/a	
SB-143	18.5	4	6	Trace NAPL	n/a	n/a	
		6	7.3	Black tar-like material	n/a	n/a	
		7.3	12	Trace tar	2,976	259	
		12	18.5	Trace NAPL	271	26.9	
SB-144	21.9	19	20	Trace coal tar	n/a	n/a	
		20	21.9	Some coal tar	1,460	15.41	
SB-145	23.1	10	12	Trace tar	n/a	n/a	
		20	23.1	Blebs of tar	363	19.5	
		20	23.1	Duplicate sample	n/a	15.4	
SB-147	12.0	0	6	Oil-like material	n/a	n/a	
		6	12	Wood fill coated with black tar-like material	n/a	n/a	
SB-148	20.0	6	20	Oil-like material and tar-like material	n/a	n/a	
SB-150	10.0	8	10	Wood fill coated with black tar-like material (potential purifier waste)	n/a	n/a	
SB-151	10.0	8	10	Wood fill coated with black tar-like material (potential purifier waste)	n/a	n/a	
SB-152	12.0	8	12	Black tar-like material	n/a	n/a	
SB-153	12.0	8	12	Wood fill coated with black tar-like material (potential purifier waste)	n/a	n/a	
SB-160	8.0	5	8.3	Saturated with NAPL	n/a	n/a	
SB-161	8.0	4	6	Trace NAPL	32.3 J	ND	
SB-201	20.0	4	6	Blebs of tar-like material	n/a	n/a	
		6	8	Tar-like material	n/a	n/a	
		8	16	Blebs of tar-like material	588 J	31.3	
		18	20	Blebs of black tar-like material	n/a	n/a	
SB-202	20.0	3	4	Tar-like material	n/a	n/a	
		4	8	Trace tar-like material	n/a	n/a	
		8	12	Blebs of tar-like material	2,155 J	216	
		16	18	Blebs of tar-like material	n/a	n/a	

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
SB-203	17.5	2	17.5	Blebs of tar-like material	5,258 J	187 J	
		2	17.5	Duplicate sample	4,652 J	194 J	
SB-204	20.0	2	4	Black oil/tar-like material	n/a	n/a	
		4	8	Blebs of tar-like material	n/a	n/a	
		8	10	Tar-like material	n/a	n/a	
		10	14	Blebs of tar-like material	2,931 J	n/a	
SB-205	17.5	2	10	Trace tar-like material	n/a	n/a	
		10	15	Blebs of tar-like material	17,700 J	558	
SB-206	20.1	4	16	Blebs of tar-like material	13,140 J	322	
MW-6A	20.0	4	6	Little NAPL	19,400	380	
MW-6S	9.0	7.5	8	NAPL saturated wood chips	n/a	n/a	A measurable quantity of DNAPL has been observed in monitoring well MW-6S.
MW-26D	19.5	8	8.2	Sheen	n/a	n/a	
		8.2	10	Trace black staining	n/a	n/a	
		14	16	Trace NAPL film	4.27	0.93	
		16	18	Sheen	n/a	n/a	
MW-27D	25.1	10	12	Blebs of dark brown oil	n/a	n/a	A measurable quantity of DNAPL has been observed in monitoring well MW-27D.
		12	20	Blebs of tar-like material	578	0.25	
MW-101	18.1	4.8	10	Sheen	n/a	n/a	
		10	16	Blebs of tar-like material	n/a	n/a	
MW-102	16.0	6	10	Blebs of tar-like material	n/a	n/a	
MW-103	19.1	4	6	Trace tar-like material	n/a	n/a	A measurable quantity of DNAPL has been observed in monitoring well MW-103.
		6	10	Blebs of tar-like material (OLM)	n/a	n/a	
		10	12	Trace tar-like material	n/a	n/a	
		12	18	Blebs of tar-like material (OLM)	n/a	n/a	
MW-104	21.0	4	10	Blebs of tar-like material (OLM)	n/a	n/a	
		12	16	Blebs of tar-like material (OLM)	n/a	n/a	
		18	20	Blebs of tar-like material (OLM)	n/a	n/a	
MW-105	23.5	4	22	Blebs of tar-like material	n/a	n/a	
MW-5R	23.1	4	12	Trace tar-like material	n/a	n/a	
		14	22	Blebs of tar-like material	n/a	n/a	
TP-1	4.0	2	4	Coal tar	n/a	n/a	
TP-2	3.5	3	3.5	Yellow oil-like material	n/a	n/a	

Table 1-1
Visual NAPL Summary

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Sample Location	TP/ Boring Max Depth (ft)	Sample Interval (ft)		NAPL Description	Total PAHs	Total BTEX	Notes
TP-5	6.5	4.7	6.5	Black coal tar	n/a	n/a	
TP-7	7.5	4.5	7	Coal tar	n/a	n/a	
TP-8	3.5	0	2	Black coal tar staining	n/a	n/a	
		1.5	3	Brown floating product/ coal tar	n/a	n/a	
EPRI-3	12.0	6	8	Black tar-like material	n/a	n/a	
EPRI-4	12.0	4	6	Trace oil-like material	n/a	n/a	
		6	8	Little dark brown oil-like	n/a	n/a	
		8	10	Little oil-like material	n/a	n/a	
		10	12	Trace oil-like material	n/a	n/a	
EPRI-5	19.5	10	18	Saturated with oily tar-like material	n/a	n/a	
EPRI-6	17.8	10	12	Film of oily tar-like material	n/a	n/a	
		12	14	Coated with oily tar-like material	n/a	n/a	
		14	16	Film of oily tar-like material	n/a	n/a	
		16	17.8	Some oil-like material	n/a	n/a	
EPRI-7	16.0	10	12	Heavily coated with oily tar-like material	n/a	n/a	
		12	14	Coating of oily tar-like material	n/a	n/a	
		14	16	Little dark brown oil-like	n/a	n/a	
EPRI-8	13.5	10	12	Heavily coated with tar-like material	n/a	n/a	
		12	13.5	Little dark brown oil-like	n/a	n/a	

Notes:

R = Rejected sample result.
J = Estimated sample result.
ND = Not Detected.
n/a = Not available.
MGP = Manufactured gas plant.

Table 1-2
LNAPL Recovery Volumes

National Grid - North Albany Former Manufactured Gas Plant Site -
Albany, New York

Monitoring Well ID	Total LNAPL Removed (gal)
MW-04	0.06
MW-05	--
MW-5R	--
MW-08	0.05
MW-10	0.02
MW-13	--
MW-14	--
MW-15S	--
MW-17S	--
MW-23S	--
MW-24S	--
MW-25S	--
MW-26S	--
MW-27S	--
MW-28S	--
	0.13

Notes:
1. Wells monitored on a quarterly basis from March 2003 through December 2006.
2. -- indicates that recoverable amounts of LNAPL were not encountered in well over the monitoring period.
3. MW-5 – Destroyed. Replaced around 2006 with MW-5R which is currently gauged and sampled.
4. MW-23S – Destroyed. Paved over by road maintenance crew.

Table 1-3
Apparent DNAPL Thickness

National Grid - North Albany Former Manufactured Gas Plant Site
Albany, New York

Monitoring Well ID	Total DNAPL Removed (gal)
MW-02	**
MW-05	**
MW-5R	0.06
MW-06A	**
MW-06S	**
MW-07	**
MW-13	**
MW-14	**
MW-16D	--
MW-16R	--
MW-17D	--
MW-19D	--
MW-26D	**
MW-27D	--
MW-28D	--
	0.06

Notes:

1. Wells are were monitored on a quarterly basis from March 2003 through December 2006.
2. ** The presence of DNAPL was detected, but measurable amounts were not able to be recovered.
3. -- No indications of the presence of DNAPL at this well.
4. MW-5 – Destroyed. Replaced around 2006 with MW-5R which is currently gauged and sampled.
5. MW-6A – Partially destroyed. Concrete casing and cap were destroyed during winter 2008. Silt is at 4.80 feet, total depth of well is 18.0 feet.
6. MW-7 – Partially destroyed. Well has been silted in. Silt is at 4.88, total depth of well is 16.80 feet.
7. MW-17D – Partially destroyed. Well has been silted in. Silt is at 18.40 feet, total depth of well is 29.2 feet.

Table 2-1
Potential Chemical-Specific SCGs

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
National Primary Drinking Water Standards	40 CFR Part 141	S	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water supply systems.	These standards are potentially applicable if an action involves future use of ground water as a public supply source.
RCRA-Regulated Levels for Toxic Characteristics Leaching Procedure (TCLP) Constituents	40 CFR Part 261	S	These regulations specify the TCLP constituent levels for identification of hazardous wastes that exhibit the characteristic of toxicity.	Excavated materials may be sampled and analyzed for TCLP constituents prior to disposal to determine if the materials are hazardous based on the characteristic of toxicity.
Universal Treatment Standards/Land Disposal Restrictions (UTS/LDRs)	40 CFR Part 268	S	Identifies hazardous wastes for which land disposal is restricted and provides a set of numerical constituent concentration criteria at which hazardous waste is restricted from land disposal (without treatment).	Applicable if waste is determined to be hazardous and for remedial alternatives involving off-site land disposal.
New York State				
NYSDEC Guidance on Remedial Program Soil Cleanup Objectives	6 NYCRR Part 375	G	Provides an outline for the development and execution of the soil remedial programs. Includes soil cleanup objective tables.	These guidance values are to be considered, as appropriate, in evaluating soil quality.
NYSDEC Guidance on the Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants ("MGPs")	TAGM 4061(2002)	G	Outlines the criteria for conditionally excluding coal tar waste and impacted soil from former MGPs which exhibit the hazardous characteristic of toxicity for benzene (D018) from the hazardous waste requirements of 6 NYCRR Parts 370 - 374 and 376 when destined for thermal treatment.	This guidance will be used as appropriate in the management of MGP-impacted soil and coal tar waste generated during the remedial activities.
NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 (6/98)	G	Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in the NYSDEC programs.	These standards are to be considered in evaluating groundwater and surface water quality.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if materials generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
New York State Surface Water and Groundwater Quality Standards	6 NYCRR Part 703	S	Establishes quality standards for surface water and groundwater.	Potentially applicable for assessing water quality at the site during remedial activities.

Table 2-2
Potential Action-Specific SCGs

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
Occupational Safety and Health Act (OSHA) - General Industry Standards	29 CFR Part 1910	S	These regulations specify the 8-hour time-weighted average concentration for worker exposure to various compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	Proper respiratory equipment will be worn if it is not possible to maintain the work atmosphere below required concentrations. Appropriate training requirements will be met for remedial workers.
OSHA - Safety and Health Standards	29 CFR Part 1926	S	These regulations specify the type of safety equipment and procedures to be followed during site remediation.	Appropriate safety equipment will be on-site and appropriate procedures will be followed during remedial activities.
OSHA - Record-keeping, Reporting and Related Regulations	29 CFR Part 1904	S	These regulations outline record-keeping and reporting requirements for an employer under OSHA.	These regulations apply to the company(s) contracted to install, operate and maintain remedial actions at hazardous waste sites.
RCRA - Preparedness and Prevention	40 CFR Part 264.30 - 264.31	S	These regulations outline requirements for safety equipment and spill control when treating, handling and/or storing hazardous wastes.	Safety and communication equipment will be installed at the site as necessary. Local authorities will be familiarized with the site.
RCRA - Contingency Plan and Emergency Procedures	40 CFR Part 264.50 - 264.56	S	Provides requirements for outlining emergency procedures to be used following explosions, fires, etc. when storing hazardous wastes.	Emergency and contingency plans will be developed and implemented during remedial design. Copies of the plan will be kept on-site.
90 Day Accumulation Rule for Hazardous Waste	40 CFR Part 262.34	S	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers and containment buildings without having to obtain a RCRA hazardous waste permit.	Potentially applicable to remedial alternatives that involve the storing or treating of hazardous materials on-site.
Land Disposal Facility Notice in Deed	40 CFR Parts 264 and 265 Sections 116-119(b)(1)	S	Establishes provisions for a deed notation for closed hazardous waste disposal units, to prevent land disturbance by future owners.	The regulations are potentially applicable because closed areas may be similar to closed RCRA units.
Federal Power Act of 1920	16 USC 79la et.seq. 18 CFR 1-149	S	Authorizes the Federal Energy Regulatory Agency (FERC) to issue licenses for hydropower dams.	Remedial alternatives involving alteration of dam operations would require consideration of existing permits.
RCRA - General Standards	40 CFR Part 264.111	S	General performance standards requiring minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products. Also requires decontamination or disposal of contaminated equipment, structures and soils.	Decontamination actions and facilities will be constructed for remedial activities and disassembled after completion.
Standards Applicable to Transporters of Applicable Hazardous Waste - RCRA Section 3003	40 CFR Parts 170-179, 262, and 263	S	Establishes the responsibility of off-site transporters of hazardous waste in the handling, transportation and management of the waste. Requires manifesting, recordkeeping and immediate action in the event of a discharge.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
United States Department of Transportation (USDOT) Rules for Transportation of Hazardous Materials	49 CFR Parts 107 and 171.1 - 172.558	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous materials.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Clean Air Act-National Ambient Air Quality Standards	40 CFR Part 60	S	Establishes ambient air quality standards for protection of public health.	Remedial operations will be performed in a manner that minimizes the production of benzene and particulate matter.
USEPA-Administered Permit Program: The Hazardous Waste Permit Program	RCRA Section 3005; 40 CFR Part 270.124	S	Covers the basic permitting, application, monitoring and reporting requirements fo off-site hazardous waste management facilities.	Any off-site facility accepting hazardous waste from the site must be properly permitted. Implementation of the site remedy will include consideration of these requirements.
Land Disposal Restrictions	40 CFR Part 368	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous waste must be treated prior to land disposal.	Excavated materials that display the characteristic of hazardous waste or that are decharacterized after generation must be treated to 90% constituent concentration reduction capped at 10 times the UTS.
RCRA Subtitle C	40 U.S.C. Section 6901 et seq.; 40 CFR Part 268	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes UTSs to which hazardous wastes must be treated prior to land disposal.	Potentially applicable to remedial activities that include the dredging and disposal waste material from the site.

Table 2-2
Potential Action-Specific SCGs

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
New York State				
NYSDEC's Monitoring Well Decommissioning Guidelines	NPL Site Monitoring Well Decommissioning dated May 1995	G	This guidance presents procedure for abandonment of monitoring wells at remediation sites.	This guidance is applicable for soil or groundwater alternatives that require the decommissioning of monitoring wells onsite.
Guidelines for the Control of Toxic Ambient Air Contaminants	DAR-1 (Air Guide 1)	G	Provides guidance for the control of toxic ambient air contaminants in New York State and outlines the procedures for evaluating sources of air pollution.	This guidance may be applicable for soil or groundwater alternatives that results in certain air emissions.
Discharges to Public Waters	New York State Environmental Conservation Law, Section 71-3503	S	Provides that a person who deposits gas tar, or the refuse of a gas house or gas factory, or offal, refuse, or any other noxious, offensive, or poisonous substances into any public waters, or into any sewer or stream running or entering into such public waters, is guilty of a misdemeanor.	During the remedial activities, MGP-impacted materials will not be deposited into public waters or sewers without prior pretreatment to applicable standards.
New York Hazardous Waste Management System - General	6 NYCRR Part 370	S	Provides definitions of terms and general instructions for the Part 370 series of hazardous waste management.	Hazardous waste is to be managed according to this regulation.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if solid waste generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities	6 NYCRR Part 372	S	Provides guidelines relating to the use of the manifest system and its recordkeeping requirements. It applies to generators, transporters and facilities in New York State.	This regulation will be applicable to any company(s) contracted to do treatment work at the site or to transport or manage hazardous material generated at the site.
New York Regulations for Transportation of Hazardous Waste	6 NYCRR Part 372.3 a-d	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous waste.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Waste Transporter Permits	6 NYCRR Part 364	S	Governs the collection, transport and delivery of regulated waste within New York State.	Properly permitted haulers will be used if any waste materials are transported off-site.
NYSDEC Technical and Administrative Guidance Memorandums (TAGMs)	NYSDEC TAGMs	G	TAGMs are NYSDEC guidance that are to be considered during the remedial process.	Appropriate TAGMs will be considered during the remedial process.
New York Regulations for Hazardous Waste Management Facilities	6 NYCRR Part 373.1.1 - 373.1.8	S	Provides requirements and procedures for obtaining a permit to operate a hazardous waste treatment, storage and disposal facility. Also lists contents and conditions of permits.	Any off-site facility accepting waste from the site must be properly permitted.
National Pollutant Discharge Elimination System (NPDES) Program Requirements, Administered Under New York State Pollution Discharge Elimination System (SPDES)	40 CFR Parts 122 Subpart B, 125, 301, 303, and 307 (Administered under 6 NYCRR 750-758)	S	Establishes permitting requirements for point source discharges; regulates discharge of water into navigable waters including the quantity and quality of discharge.	Removal activities may involve treatment/disposal of water. If so, water generated at the site will be managed in accordance with NYSDEC SPDES permit requirements.

Table 2-3
Potential Location-Specific SCGs

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
National Environmental Policy Act Executive Orders 11988 and 11990	40 CFR 6.302; 40 CFR Part 6, Appendix A	S	Requires federal agencies, where possible, to avoid or minimize adverse impact of federal actions upon wetlands/floodplains and enhance natural values of such. Establishes the “no-net-loss” of waters/wetland area and/or function policy.	To be considered if remedial activities are conducted within the floodplain or wetlands.
Historical and Archaeological Data Preservation Act	16 USC 469a-1	S	Provides for the preservation of historical and archaeological data that might otherwise be lost as the result of alteration of the terrain.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
National Historic and Historical Preservation Act	16 USC 470; 36 CFR Part 65; 36 CFR Part 800	S	Requirements for the preservation of historic properties.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
Hazardous Waste Facility Located on a Floodplain	40 CFR Part 264.18(b)	S	Requirements for a treatment, storage and disposal (TSD) facility built within a 100-year floodplain.	Hazardous waste TSD activities (if any) will be designed to comply with applicable requirements cited in this regulation.
Floodplains Management and Wetlands Protection	40 CFR 6 Appendix A	S	Activities taking place within floodplains and/or wetlands must be conducted to avoid adverse impacts and preserve beneficial value. Procedures for floodplain management and wetlands protection provided.	To be considered if remedial activities are conducted within the floodplain or wetlands.
New York State				
New York State Floodplain Management Development Permits	6 NYCRR Part 500	S	Provides conditions necessitating NYSDEC permits and provides definitions and procedures for activities conducted within floodplains.	Potentially applicable to remedial activities near the Hudson River.
New York State Freshwater Wetlands Act	ECL Article 24 and 71; 6 NYCRR Parts 662-665	S	Activities in wetlands areas must be conducted to preserve and protect wetlands.	Does not appear to be applicable as the site is not located in a wetlands area.
New York State Parks, Recreation, and Historic Preservation Law	New York Executive Law Article 14;	S	Requirements for the preservation of historic properties.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
Use and Protection of Waters Program	6 NYCRR Part 608	S	Protection of waters permit program regulates: 1) any disturbance of the bed or banks of a protected stream or water course; 2) construction and maintenance of dams; and 3) excavation or fill in navigable waters of the state.	Potentially applicable to remedial activities near the Hudson River.
Endangered & Threatened Species of Fish and Wildlife	6 NYCRR Part 182	S	Identifies endangered and threatened species of fish and wildlife in New York.	Does not appear to be applicable as no endangered species were identified during the Fish and Wildlife Resource Impact Analysis
New York Preservation of Historic Structures or Artifacts	New York State Historic Preservation Act, Section 14.09	S	Requirements for preservation of historical/ archeological artifacts.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
Floodplain Management Criteria for State Projects	6 NYCRR Part 502	S	Establishes floodplain management practices for projects involving state-owned and state-financed facilities.	Portions of the area to be remediated are located within the floodplain. Activities located in these areas will be performed in accordance with this regulation.
Local				
Local Building Permits	N/A	S	Local authorities may require a building permit for any permanent or semi-permanent structure, such as an on-site water treatment system building or a retaining wall.	Substantive provisions are potentially applicable to remedial activities that require construction of permanent or semi-permanent structures.

Table 4-1
Remedial Technology Screening Evaluation for Soil

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
No Action	No Further Action	No Further Action	Alternative would not include any remedial action. A No Action alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a No Action alternative is required by the NCP.	Would not achieve RAOs for surface and subsurface soil.	Implementable.	Low.	Yes
Institutional Controls	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted soils and/or jeopardize the integrity of a remedy. Examples of potential institutional controls include establishing land use restrictions, health and safety requirements for subsurface activities, and restrictions on groundwater use and/or extraction.	When properly implemented and followed, this technology could reduce potential human exposures, and may be effective when combined with other technology processes. Would help to meet the RAO of preventing human exposure to surface soil containing elevated concentrations of PAHs. May not achieve RAOs for environmental protection.	Implementable.	Low.	Yes
In-Situ Containment/ Controls	Capping	Soil Cap	Placing and compacting soil/gravel material over impacted soils.	Would not reduce toxicity or volume of impacts, or address the potential for off-site migration of NAPLs. Current and future use of site as an active service center could jeopardize the integrity/effectiveness of the cap. Addresses the RAOs for preventing exposure to impacted soil during future anticipated site activities, but alone does not address the potential for exposure during potential future invasive activities at the site.	Implementable. Equipment and materials necessary to construct the cap are readily available.	Moderate capital and O&M costs.	No
		Asphalt/Concrete Cap	Application of a layer of asphalt or concrete over impacted soils.	May reduce the mobility of chemical constituents by reducing infiltration; would not reduce toxicity or volume of impacts, or potential off-site migration of NAPLs. Asphalt concrete cap is consistent with current and future site uses. Long-term effectiveness requires ongoing maintenance. Addresses the RAOs for preventing exposure to impacted soil during future anticipated site activities, but alone does not address the potential for exposure during potential future invasive activities at the site.	Implementable. Equipment and materials necessary to construct the cap are readily available.	Moderate capital and O&M costs.	Yes
		Multi-Media Cap	Application of a combination of clay/soils and synthetic membrane(s) over impacted soil.	May reduce the mobility of chemical constituents by reducing infiltration; would not reduce toxicity or volume of impacts, or potential off-site migration of NAPLs. Current and future use of site as an active service center could jeopardize the integrity/effectiveness of the cap. Addresses the RAOs for preventing exposure to impacted soil during future anticipated site activities, but alone does not address the potential for exposure during potential future invasive activities at the site.	Implementable. Equipment and materials necessary to construct the cap are readily available.	Moderate capital and O&M costs.	No

Table 4-1
Remedial Technology Screening Evaluation for Soil

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
In-Situ Containment/ Controls (cont'd)	Containment	Sheet Pile	Steel sheetpiles are driven into the subsurface to contain impacted soils and NAPLs. The sheet pile wall is typically keyed into a confining unit.	Presence of NAPL in weathered bedrock may limit the effectiveness to prevent NAPL migration, as it may not be possible to key sheet piles into bedrock, due to the weathered bedrock layer. This technology alone would not address potential exposure to impacted soils.	Installing sheet piling to necessary depth to contain potential NAPL migration may not be technically practicable.	High capital and O&M costs.	No
		Slurry Walls	Involves excavating a trench and adding a slurry (e.g., soil/cement-bentonite mixture) to control potential migration of groundwater and NAPL from an area. Slurry walls are typically keyed into a low permeability unit (e.g., an underlying silt/clay layer or bedrock).	Would effectively limit the potential for future migration of NAPL. Could be used in conjunction with a low-permeability cap to effectively address soil RAOs. However, based on preliminary groundwater modeling, slurry walls may cause groundwater mounding upgradient of the wall, and therefore could promote NAPL migration.	Implementable, bench-scale study necessary to determine proper slurry mixture to achieve an appropriate permeability and compatibility for NAPL and COCs at the site. May require specialized design or alternative methods to install beneath subsurface utilities.	Moderate capital and low O&M costs.	No
In-Situ Treatment	Immobilization	Solidification/ Stabilization	Addition of material to the impacted soil that limits the solubility and mobility of the NAPL and COCs in soil and groundwater. Involves treating soil to produce a stable material with low leachability of NAPL and associated COCs.	Overall effectiveness of this process would need to be evaluated during a bench-scale treatability study. Treatment to the top of weathered bedrock using this technique may leave some material in the weathered bedrock at the overburden bedrock interface that does not get stabilized. Assuming an effective stabilization mix could be developed, this technology could effectively address each of the RAOs for soil.	Potentially implementable. Underground structures and utilities would need to be removed/protected. Solidification/ stabilization materials are readily available. Underground structures would hinder technology implementability. Technology would effect the existing site hydrogeology.	High capital and low O&M costs.	Yes
	Extraction	Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO)	Steam is injected into the subsurface to mobilize contaminants and NAPLs. The mobilized contaminants are captured and constituents are recondensed, collected, and treated. In addition, HPO can degrade contaminants in subsurface heated zones. In most cases, this technology requires long-term operation and maintenance of on-site injection, collection and/or treatment systems.	Could potentially enhance NAPL mobilization. Focused on saturated zone. Alone, this technology would not effectively address the RAO of preventing direct exposure to impacted soil.	Technically implementable. This option would require a pilot scale study to determine effectiveness. Underground structures and obstructions would need to be removed prior to implementation. Process may result in uncontrolled NAPL migration. Not a preferred technology process due to risks and potential technical implementability issues (e.g., underground utilities, GRS).	High capital and O&M costs.	No
	Chemical Treatment	Chemical Oxidation	Oxidizing agents are added to oxidize and reduce the mass of organic constituents. In-situ chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate or potassium permanganate.	Would require multiple treatments of chemicals to reduce COCs. Based on results of pilot testing, would not be effective at treating NAPL and NAPL-containing soil. Not effective for treating impacts in unsaturated zone.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available.	High capital and O&M costs.	No

Table 4-1
Remedial Technology Screening Evaluation for Soil

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
In-Situ Treatment (Cont'd)	Biological Treatment	Biodegradation	Natural biological and physical processes that, under favorable conditions, act without human intervention to reduce the mass, volume, concentration, toxicity, and/or mobility of COCs. This process relies on long-term monitoring to demonstrate the reduction of impacts.	Less effective for PAHs; not effective for NAPLs; would not achieve RAOs in an acceptable time frame.	Implementable.	Low Capital and O&M costs.	No
		Enhanced Biodegradation	Addition of amendments (e.g., oxygen, nutrients) and controls to the subsurface to enhance indigenous microbial populations to improve the rate of natural degradation.	May not achieve RAOs for soil. Not effective for NAPLs.	Implementable.	Low Capital and Moderate O&M costs.	No
		Biosparging	Air/oxygen injection wells are installed within the impacted regions to enhance biodegradation of constituents by increasing oxygen availability. Low-flow injection technology may be incorporated. This technology requires long-term monitoring.	May not achieve RAOs for soil. Not effective for NAPLs.	Implementable.	Low Capital and Moderate O&M costs.	No
Removal	Excavation	Excavation	Physical removal of impacted soil. Typical excavation equipment would include excavators, backhoes, loaders, and/or dozers. Extraction wells and pumps or other methods may be used to obtain hydraulic control to facilitate use of typical excavation equipment to physically remove soil.	Would achieve RAOs. Proven process for effectively removing impacted soil.	Implementable. Equipment capable of excavating the soil is readily available. Potential concerns associated with extensive subsurface utilities, proximity of impacted soil to railroad, and active service center operations at the site.	High capital cost and low O&M costs.	Yes
Ex-Situ On-Site Treatment and/or Disposal	Immobilization	Solidification/ Stabilization	Addition of material to excavated soil that limits the solubility or mobility of the constituents present. Involves treating soil to produce a stable material with low leachability, that encapsulates the constituents within the solidified matrix.	May achieve RAOs. Proven process for effectively reducing mobility and toxicity of NAPL and organic and inorganic constituents. Overall effectiveness of this process would need to be evaluated during a bench-scale study.	Technically implementable. Solidification/stabilization materials are readily available. Limited space available at the site to conduct operations. Spoils and/or pre-ISS excavation soil may be required.	High capital and O&M costs.	No
	Extraction	Low-Temperature Thermal Desorption	Process by which soils containing organics with boiling point temperatures less than 800^{o} Fahrenheit are excavated, conditioned, and heated; the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Treated soils are returned to the subsurface. Treatment is conducted in a thermal treatment unit that is mobilized or constructed on-site.	Proven process for effectively removing organic constituents from excavated soil. The efficiency of the system and rate of removal of organic constituents would require evaluation during bench-scale and/or pilot-scale testing.	Potential emissions concerns based on site's location near residential area and space required to conduct operations.	Moderate capital and O&M costs.	No

Table 4-1
Remedial Technology Screening Evaluation for Soil

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
Ex-Situ On-Site Treatment and/or Disposal (cont'd)	Thermal Destruction	Incineration	Use of a mobile incineration unit installed on-site for high temperature thermal destruction of the organic compounds present in the media. Soils are excavated and conditioned prior to incineration. Treated soils are returned to the subsurface.	Proven process for effectively addressing organic constituents. The efficiency of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing.	Potential emissions concerns based on site's location near residential area and space required to conduct operations.	High capital and O&M costs.	No
	Chemical Treatment	Chemical Oxidation	Addition of oxidizing agents to degrade organic constituents to less-toxic by-products.	Not known to be effective for NAPL.	Implementable. Equipment and materials necessary to apply oxidizing agents are available. Large amounts of oxidizing agents may be required. Limited space for soil management and application of the chemical oxidation. May require special provisions for storage of process chemicals.	High capital and O&M costs.	No
		Soil Washing	Soil is dissolved or suspended in a pH-adjusted surfactant wash solution or reduced through particle size separation, gravity separation, and attrition scrubbing. Clean portions of soil can be reused as fill at the site.	Process has been proven effective for soil containing metals, non-volatile organics, fuels, and semi-volatile organic compounds. Heterogeneous geology in the subsurface may create channeling and uneven treatment. The presence of non-impacted debris (e.g., brick, rubble) in the subsurface may affect the contact of solution with impacts within the treatment area.	Soil washing has been widely utilized in Northern Europe for remediation of MGP-related soil impacts. Process has not been widely utilized for MGP remediation in the United States. State water quality standards may prohibit the use of surfactants that contain Safe Drinking Water Act (SDWA) constituents at concentrations above the maximum concentration level (MCL).	High capital and O&M costs.	No
	On-Site Disposal	RCRA Landfill	Construction of a landfill that would meet RCRA requirements.	This technology process would be effective at meeting the RAOs for soil. Excavated material would be contained in an appropriately constructed RCRA landfill. Long-term effectiveness requires ongoing maintenance and monitoring.	Space limitations make on-site landfilling infeasible.	High capital and moderate O&M costs.	No
		Solid Waste Landfill	Construction of a landfill that would meet NYSDEC solid waste requirements.	This technology process would be effective at meeting the RAOs for soil. Excavated material would be contained in an appropriately constructed solid waste landfill. Long-term effectiveness requires ongoing maintenance and monitoring.	Space limitations make on-site landfilling infeasible.	High capital and moderate O&M costs.	No

Table 4-1
Remedial Technology Screening Evaluation for Soil

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
Off-Site Treatment and/or Disposal	Recycle/ Reuse	Asphalt Concrete Batch Plant	Soil is used as a raw material in asphalt concrete paving mixtures. The impacted soil is transported to an off-site asphalt concrete facility and can replace part of the aggregate and asphalt concrete fraction. The hot-mix process melts asphalt concrete prior to mixing with aggregate. During the cold-mix process, aggregate is mixed at ambient temperature with an asphalt concrete/water emulsion. Organics and inorganics are bound in the asphalt concrete. Some organics may volatilize in the hot-mix.	Effective for treating organics and inorganics through volatilization and/or encapsulation. Thermal pretreatment may be required to prevent leaching. Limited number of projects to support comparison of effectiveness.	Based on the nature of the fill materials at the site, the soil would need excessive processing to make it usable/acceptable for this application. Permitted facilities and demand are limited.	Moderate capital costs.	No
		Brick/Concrete Manufacture	Soil is used as a raw material in manufacture of bricks or concrete. Heating in ovens during manufacture volatilizes organics and some inorganics. Other inorganics are bound in the product.	Effective for treating organics and inorganics through volatilization and/or vitrification. A bench-scale/pilot study may be necessary to determine effectiveness.	Facilities capable of handling material are limited.	Moderate-high capital costs.	No
		Co-Burn in Utility Boiler	Soil is blended with feed coal to fire a utility boiler used to generate steam. Organics are destroyed.	Effective for treating organic constituents. Soil would be blended with coal prior to burning. Overall effectiveness of this process would need to be evaluated during a trial burn.	Permitted facilities available for burning MGP soils are limited.	Moderate capital costs.	No
	Extraction	Low-Temperature Thermal Desorption	Process by which soils containing organics with boiling point temperatures less than 800° Fahrenheit are heated and the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Would be used on materials that are determined to be characteristically hazardous based on TCLP analysis.	Effective means for pre-treatment of materials that are characteristically hazardous due to the presence of organic compounds (i.e., benzene).	Implementable. Treatment facilities are available.	Moderate capital costs.	Yes
	Thermal Destruction	Incineration	Soils are transported off-site for high temperature thermal destruction of the organic compounds present in the media. Soils are excavated and conditioned prior to incineration.	Proven process for effectively addressing organic constituents. The efficiency and effectiveness of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing.	Not implementable due to limited number of treatment facilities. Tar saturated soils cannot be treated via LTTD.	High capital and O&M costs.	No
	Disposal	Solid Waste Landfill	Disposal of impacted soil in an existing permitted non-hazardous landfill.	Proven process that, in conjunction with excavation, can effectively achieve the RAOs.	Implementable.	Moderate capital costs.	Yes
		RCRA Landfill	Disposal of impacted soil in an existing RCRA permitted landfill facility.	Proven process that, in conjunction with excavation, can effectively achieve the RAOs.	Hazardous materials would not meet New York State LDRs without pre-treatment.	Moderate capital costs.	No

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

Table 4-2
Remedial Technology Screening Evaluation for Groundwater

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
No Action	No Further Action	No Further Action	Alternative would not include any remedial action. A No Action alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a No Action alternative is required by the NCP.	Would not achieve the RAOs for groundwater in an acceptable time frame.	Implementable	Low	Yes
Institutional Controls	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted materials and/or jeopardize the integrity of a remedy. Examples of potential institutional controls include establishing land use restrictions, health and safety requirements for subsurface activities, and restrictions on groundwater use and/or extraction.	May be effective for reducing the potential for human exposure. This option would not meet the RAO for restoring, to the extent practicable, the quality of groundwater in the sand and gravel aquifer. This option may be effective when combined with other process options.	Implementable	Low	Yes
In-Situ Containment/ Control	Hydraulic Containment	Sheet Pile	Steel sheetpiles are driven into the subsurface to contain impacted soils and NAPLs. The sheet pile wall is typically keyed into a confining unit and could be permeable or impermeable to groundwater flow.	Presence of NAPL in weathered bedrock would limit the effectiveness, as sheet pile could not be installed into bedrock. Would not address the RAOs for groundwater.	Installing sheet piles to the depth necessary to contain impacted groundwater makes this technology processes technically impracticable. Potential subsurface obstructions may hinder technology use.	High capital and low O&M costs.	No
		Slurry Walls	Involves excavating a trench and adding a slurry (e.g., soil/cement-bentonite mixture) to control migration of groundwater and NAPL from an area. Slurry walls are typically keyed into a low permeability unit (e.g., an underlying silt/clay layer).	Would effectively limit the potential for future migration of NAPL. Would not meet the RAOs for groundwater. Based on preliminary groundwater modeling, slurry walls may cause groundwater mounding upgradient of the wall, and therefore could promote NAPL migration.	Potentially implementable. Underground structures and utilities would need to be removed/protected. Solidification/ stabilization materials are readily available. Underground structures would hinder technology implementability. Technology would effect the existing site hydrogeology.	High capital and low O&M costs.	No
In-Situ Treatment	Biological Treatment	Monitored Natural Attenuation	Natural biological, chemical, and physical processes that under favorable conditions, act without human intervention to reduce the mass, volume, concentration, toxicity, and mobility of chemical constituents. Long-term monitoring is required to demonstrate the reduction of COCs.	Would not achieve the RAOs for groundwater in an acceptable time frame alone, but would document reduction of COCs in the long-term. This option may be effective when combined with other process options and/or upgradient process options for the FMA.	Easily implemented. Would require monitoring to demonstrate reduction of COCs.	Low capital and O&M costs.	Yes
		Enhanced Aerobic Biodegradation	Addition of amendments (e.g., nutrients, oxygen) to the subsurface to enhance indigenous microbial populations to improve the rate of natural biodegradation of constituents.	Could be effective at improving the rate of COC degradation.	Easily implemented. Would require monitoring to demonstrate reduction of COCs.	Low capital and moderate O&M costs.	Yes
		Enhanced Anaerobic Biodegradation	Addition of amendments (e.g., nutrients, nitrate, iron) to the subsurface to enhance indigenous microbial populations to improve the rate of natural biodegradation of constituents.	Could be effective at improving the rate of COC degradation. Anaerobic degradation is not as efficient as aerobic degradation for certain constituents.	Potentially implementable. Attaining the correct nutrient balance would require extensive treatability and pilot testing.	Low capital and O&M costs.	No
	Chemical Treatment	Chemical Oxidation	Oxidizing agents are added to oxidize and reduce the concentrations of dissolved-phase organic constituents. In-situ chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate, or potassium permanganate.	Based on results of pilot testing, not an effective means to treat NAPL. May not be a cost effective means to achieve the RAOs.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available. May require special provisions for storage of process chemicals. Access to areas that would require injection wells for this process option to be effective is limited.	High capital and O&M costs.	No

Table 4-2
Remedial Technology Screening Evaluation for Groundwater

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
In-Situ Treatment (cont'd)		Permeable Reactive Barrier (PRB)	PRBs are installed in or downgradient from the flow path of a contaminant plume. The contaminants in the plume react with the media inside the barrier to either break the compound down into harmless products or immobilize contaminants by precipitation or sorption.	NAPL in subsurface would inhibit effectiveness of PRB. Could meet the RAOs when combined with source removal.	Implementable.	Moderate capital and low O&M costs.	No
	Extraction	Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO)	Steam is injected into the subsurface to mobilize contaminants and NAPLs. The mobilized contaminants are captured and constituents are recondensed, collected and treated. In addition, HPO can degrade contaminants in subsurface heated zones. In most cases, this technology requires long-term operation and maintenance of on-site injection, collection, and/or treatment systems.	This option would require a pilot scale study to determine effectiveness. Process may result in NAPL and/or dissolved plume migration. Not certain in the ability of this alternative to meet the RAOs.	Potentially implementable. Limited space for vapor recovery system and treatment. Presence of underground utilities may hinder/impede technology use.	High capital and O&M costs.	No
Removal	Hydraulic Control	Vertical Extraction Wells	Vertical wells are installed and utilized to recover groundwater for treatment/disposal and containment/migration control. Typically requires extensive design/testing to determine required hydraulic gradients and feasibility of achieving those gradients.	Could be used to effectively remove groundwater. Also would provide hydraulic containment/migration control of dissolved phase plume. Would not meet RAOs as a stand alone technology. Would likely be used in conjunction with an ex-situ treatment system (i.e., pump and treat).	Equipment and tools necessary to install and operate vertical extraction wells are readily available. Would require operation for an extended period of time.	Moderate capital and high O&M costs.	No
		Horizontal Extraction Wells	Horizontal wells are utilized to replace conventional well clusters in soil and containment/migration control.	Proven process for effectively extracting groundwater. Not likely to meet RAOs in an acceptable amount of time.	Requires specialized horizontal drilling equipment.	Moderate capital and high O&M costs.	No
	NAPL Removal	Active Removal	Process by which automated pumps are utilized to remove DNAPL from recovery wells.	May be effective in removing NAPL.	Technically implementable. Based on the viscosity of DNAPL observed during investigation activities, may have limited effectiveness. Pilot study would be needed to verify implementability.	Moderate capital and O&M costs.	Yes
		Passive Removal	NAPL is passively collected in vertical wells and periodically removed (i.e., via bottom-loading bailers, manually operated pumps, etc.).	May be effective in removing NAPL.	Technically implementable. Based on the viscosity of DNAPL observed during investigation activities, may have limited effectiveness.	Low capital and O&M costs.	Yes
Removal (cont'd)	NAPL Removal (cont'd)	Collection Trenches/Passive Barrier Wall	A zone of higher permeability material is installed within a trench hydraulically downgradient from the NAPL-impacted capture area. A perforated collection trench/pipe is placed laterally along the base of trench or permeable wall to direct NAPL to a collection sump for recovery and disposal.	May be effective in collecting NAPL. Would need pilot testing to determine technical feasibility of recovering NAPL that collects within sump/well.	Equipment and materials to construct a NAPL collection trench are readily available.	Moderate capital and high O&M costs.	Yes
		Hot Water/Steam Injection	Process involves the injection of hot water and/or steam to heat groundwater and decrease the viscosity of DNAPL to facilitate mobilization and removal. Used in conjunction with one (or more) of the above recovery technologies.	This process may facilitate uncontrolled migration of NAPL. Would not meet the RAOs as a stand-alone technology. Due to the difficulty in predicting NAPL movement, potentially enhancing NAPL movement poses significant risk.	Technically feasible.	High capital and high O&M costs.	No
Ex-Situ/On-Site Treatment	Chemical Treatment	Ultra-violet (UV) Oxidation	Oxidation by subjecting groundwater to UV light and ozone. If complete mineralization is achieved, the final products of oxidation are carbon dioxide, water, and salts.	Proven process for effectively treating organic compounds. Use of this process may effectively achieve the RAOs. A bench-scale treatability study may be required to evaluate the efficiency of this process and to make project-specific adjustments to the process.	Potentially implementable. Limited space for a full-scale treatment system. Not typically used in MGP-impacted groundwater treatment train. Not effective on NAPL.	High capital and O&M costs.	No

Table 4-2
Remedial Technology Screening Evaluation for Groundwater

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
		Chemical Oxidation	Addition of oxidizing agents to degrade organic constituents to less-toxic byproducts.	A bench-scale treatability study may be required to evaluate the efficiency of this process and to make project-specific adjustments to the process. Large amounts of oxidizing agents are needed to oxidize NAPL.	Potentially implementable. Limited space for a full-scale treatment system. Not typically used in MGP-impacted groundwater treatment train. Not effective on NAPL.	High capital and high O&M costs.	No
	Physical Treatment	Carbon Adsorption	Process by which organic constituents are adsorbed to the carbon as groundwater is passed through carbon units.	Effective at removing organic constituents. Use of this treatment process may effectively achieve the RAOs when combined with groundwater extraction.	Potentially implementable. Typically used in MGP-impacted groundwater treatment train.	High capital and O&M costs.	No
		Filtration	Extraction of groundwater and treatment using filtration. Process in which the groundwater is passed through a granular media in order to remove suspended solids by interception, straining, flocculation, and sedimentation activity within the filter.	Effective pre-treatment process to reduce suspended solids. Use of this process along with other processes (i.e., that address organic constituents) could effectively achieve the RAOs.	Potentially implementable. Typically used in MGP-impacted groundwater treatment train.	Low capital and O&M costs.	No
		Air Stripping	A process in which VOCs are removed through volatilization by increasing the contact between the groundwater and air.	This technology process would be effective at removing VOCs from water. Process would potentially be used as part of a treatment train to treat groundwater removed from excavation areas. Has potential to be used as part of a treatment system to meet the RAOs.	Potentially implementable.	High capital and O&M costs.	No
		Precipitation/ Coagulation/ Flocculation	Process which precipitates dissolved constituents into insoluble solids and improves settling characteristics through the addition of amendments to water to facilitate subsequent removal from the liquid phase by sedimentation/filtration.	Process which transforms dissolved constituents into insoluble solids by adding coagulating agents to facilitate subsequent removal from the liquid phase by sedimentation/filtration. Has potential to be used as part of a treatment system to meet the RAOs.	Potentially implementable.	Moderate capital and O&M costs.	No
		Oil/Water Separation	Process by which insoluble oils are separated from water via physical separation technologies, including gravity separation, baffled vessels, etc.	Effective at separating insoluble oil from groundwater. This process could be used as part of a groundwater treatment train to address separate-phase liquids. Has potential to be used as part of a treatment system to meet the RAOs.	Potentially implementable. Typically used in MGP-impacted groundwater treatment train.	Low capital and O&M costs.	No

Table 4-2
Remedial Technology Screening Evaluation for Groundwater

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Response Action	Remedial Technology	Technology Process	Description	Effectiveness	Implementability	Relative Cost	Retained?
Off-site Treatment/ Disposal	Groundwater Discharge	Discharge to a local Publicly-Owned Treatment Works (POTW)	Treated or untreated water is discharged to a sanitary sewer and treated at a local POTW facility.	Proven process for effectively disposing of groundwater. Could be used as a component of an overall remedy to meet the RAOs for groundwater. Note Albany County Sewer District requires pre-treatment to surface water standards.	Implementable. Equipment and materials necessary to extract, pretreat (if necessary), and discharge the water to the sewer system are readily available. Discharges to the sewer will require a POTW-issued discharge permit.	Moderate capital and O&M costs.	No
		Discharge to Surface Water via Storm Sewer	Treated or untreated water is discharged to surface water, provided that the water quality and quantity meet the allowable discharge requirements for surface waters (NYSDEC SPDES compliance).	This technology process would effectively dispose of groundwater. Impacted groundwater would require treatment to achieve water quality discharge limits. Helps in the management of treated water, but does not directly lend to achieving the RAOs for groundwater.	Discharges to surface water must meet substantive requirements of a SPDES permit. Discharge and sampling requirements may be restrictive.	Low capital and O&M costs.	No
		Discharge to a privately-owned treatment/disposal facility	Treated or untreated water is collected and transported to a privately-owned treatment facility.	Proven process for effectively disposing of groundwater. Typically requires the least amount, if any, of pretreatment because the discharged water will be subjected to additional treatment at the disposal facility. Could be used as a component of an overall remedy to meet the RAOs for	Equipment and materials to pretreat the water at the site are readily available on a commercial basis. Facilities capable of transporting and disposing of the groundwater are available. Treatment may be required prior to discharge.	Moderate capital and high O&M costs.	No

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

Table 5-1
Cost Estimate for Alternative FMA-2
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	Mobilization/Demobilization	1	LS	$300,000	$300,000
2	Utility Markout	5	Day	$1,000	$5,000
3	GPR Survey	2	Day	$2,500	$5,000
4	Temporary Site Fencing	2,000	LF	$35	$70,000
5	Material Staging Area	2	LS	$40,000	$80,000
6	Decontamination Area	1	LS	$7,500	$7,500
7	Pre-Design Investigation	1	LS	$100,000	$100,000
8	Passive Barrier Wall Pre-Excavation	220	CY	$65	$14,300
9	Passive Barrier Wall Installation	6,000	VSF	$10	$60,000
10	Passive Barrier Wall Backfill	640	CY	$25	$16,000
11	Jet Grouting	525	VLF	$75	$39,375
12	Spoils Handling	200	CY	$15	$3,000
13	Temporary Sheet Pile	27,000	SF	$40	$1,080,000
14	Excavation Enclosure	1	LS	$1,100,000	$1,100,000
15	Vapor Treatment	1	LS	$300,000	$300,000
16	Soil Excavation and Handling	17,400	CY	$45	$783,000
17	Vapor/Odor Control	30	Week	$3,000	$90,000
18	Backfill	16,000	CY	$40	$640,000
19	Surface Material Removal	9,100	CY	$30	$273,000
20	Asphalt Subbase	5,300	CY	$30	$159,000
21	Asphalt Pavement	14,100	Ton	$100	$1,410,000
22	Solid Waste Characterization	100	Each	$1,000	$100,000
23	Solid Waste Transportation and Disposal - C&D	18,600	Ton	$100	$1,860,000
24	Solid Waste Transportation and Disposal - LTTD	13,100	Ton	$85	$1,113,500
25	Solid Waste Transportation and Disposal - Nonhaz	14,100	Ton	$60	$846,000
26	DNAPL/LNAPL Collection and Monitoring Wells	22	Each	$4,000	$88,000
27	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$10,592,675
28				Administration and Engineering (10%)	$677,318
				Construction Management (10%)	$677,318
				Contingency (20%)	$2,118,535
				Total Capital Cost	$14,065,845

Table 5-1
Cost Estimate for Alternative FMA-2
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
OPERATION AND MAINTENANCE COSTS					
29	Quarterly NAPL Monitoring and Annual Reporting	1	LS	$28,000	$28,000
30	Annual Cap Inspection and Maintenance	1	LS	$15,000	$15,000
31	Verification of Institutional Controls	1	LS	$5,000	$5,000
				Subtotal O&M Cost	$48,000
				Contingency (20%)	$9,600
				Total O&M Cost	$57,600
32				30-Year Total Present Worth Cost of O&M	$885,312
				Total Estimated Cost	**$14,951,157**
				Rounded to	**$15,000,000**

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2009 dollars.

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

Assumptions:

1. Mobilization/demobilization cost estimate includes mobilization and demobilization of all equipment, materials, and labor necessary to complete the remedial activities that comprise this alternative.

2. Utility location and markout cost estimate includes labor, equipment, and materials necessary to locate, identify, and markout underground utilities at the site. Cost assumes that utility location and markout would be conducted by a private utility locating company over a period of five days at a rate of $1,000 per day.

3. GPR survey cost estimate includes all labor, equipment, and materials necessary to conduct ground-penetrating radar survey of the former manufactured gas plant area prior to implementing remedial activities. Cost estimate assumes equipment operator will require two days to complete survey

4. Temporary site fencing cost estimate includes all labor, equipment, and materials necessary to purchase, install, and remove a six-foot tall woven steel chain link fence equipped with barbed wire. Cost estimate includes up to 2,000 linear-feet of fencing used to secure excavation, working, and

5. Material staging area cost estimate includes all labor, equipment, and materials necessary to construct two 100-foot by 100-foot material staging areas consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner for staging excavated material. Separate staging areas used to segregate visually impacted material from non-visually impacted material prior to waste characterization. Maintenance includes inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting. Estimate assumes construction cost of approximately $4 per square-foot of pad.

6. Decontamination area cost estimate includes all labor, equipment, and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

7. Pre-design investigation cost estimate includes all labor, equipment, and materials necessary to conduct pre-design investigation in support of the remedial design for this alternative, including a test boring/geotechnical program.

8. Passive barrier wall pre-excavation cost estimate includes all labor, equipment, and materials necessary to pre-excavate a trench along the passive barrier wall alignment to verify presence/absence and location of underground utilities prior to installation of the passive NAPL barrier wall. Cost estimate assumes excavation activities to be completed using a backhoe and hand digging and excavation will be backfilled following mark-out/isolation/deactivation of utilities. Cost estimate assumes pre-excavation activities completed to a depth of 5 feet below grade for a wall length of 290 linear-feet.

9. Passive barrier wall installation cost estimate includes all labor, equipment, and materials necessary to install a passive barrier wall. Cost estimate includes mixing and placing slurry within the trench excavation and assumes excavation activities to be completed using a long-stick excavator. Cost estimate assumes 290 linear-feet of wall (minus 50 linear-feet to be completed via jet grouting) at an installation depth of 25 feet below grade, keyed one foot into bedrock. Unit cost based on vertical square-footage (VSF) of wall.

10. Passive barrier wall backfill cost estimate includes all labor, equipment, and materials necessary to purchase, import, and place pea-gravel stone within slurry-supported trench excavation to serve as passive barrier wall.

11. Jet grouting cost estimate includes all labor, equipment, and materials necessary to complete jet grouting around underground utilities for containment barrier wall installation. Cost estimate assumes jet grout drilling completed for 50 linear-feet of cut-off wall, drilling completed 2.5 feet on-center to a depth of 25 feet below grade, keyed one foot into bedrock. Unit cost based on vertical linear-footage (VLF) of jet grout drilling.

12. Spoils handling cost estimate includes all labor, equipment, and materials necessary to transfer jet grouting spoils to material staging area for characterization to facilitate off-site disposal. Cost estimate assumes spoils volume equal to jet grouting volume.

13. Temporary sheet pile cost estimate includes all labor, equipment, and materials necessary to install, remove, and decontaminate temporary water-tight steel sheet pile. Cost estimate assumes sheet piling (with an embedment depth of 18 feet due to the depth of weathered bedrock) is reinforced with internal bracing (struts and walers, due to the adjacent railroad). It was assumed that two layers of bracing and struts would be utilized, and the excavation south of the vehicle maintenance building would be completed in two cells spanning the length of the excavation (to provide a manageable span for struts). Final excavation support system to be determined as part of the Remedial Design.

14. Excavation enclosure cost estimate includes rental of an approximately 100-foot by 400-foot Sprung structure to enclosure excavation area east of Building #2. Cost estimate assumes a 6-month lease price of approximately $20 per square-foot and construction cost of approximately $6 per square-foot. Cost estimate assumes structure is equipped with square ends and overheard doors for truck and excavator access. Final structure construction details to be determined as part of the Remedial Design. Cost estimate based on information provided by Sprung Instant Structures, Inc.

15. Vapor treatment cost estimate includes rental of vapor treatment system to collect and treat air within the excavation enclosure. Cost estimate includes a 6-month lease of all vapor collection and treatment equipment, delivery and set-up fees, and filter media change out.

16. Soil excavation and handling cost estimate includes all labor, equipment, and materials necessary to excavate material, transfer excavated material to an on-site staging area, and load staged material for transportation off-site. Estimated quantity based on in-place volume of heavily NAPL-impacted soil east and northeast of Building #2 excavated to approximately 2 feet into the silt and clay unit. Cost estimate includes air monitoring during intrusive activities. Estimate includes an increased excavation cost due to logistical issues encountered when excavating around the internal excavation bracing (struts and

17. Vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and excavated materials staged on-site.

18. Backfill cost estimate includes all labor, equipment, and materials necessary to purchase, import, place, grade, and compact select fill within excavation areas to within one foot of the surrounding grade. Cost estimate assumes general fill placed in 12-inch lifts and compacted to 95% maximum compaction based on standard Proctor testing. Cost estimate includes survey verification and compaction testing. Cost estimate includes air monitoring during intrusive activities. Assumes the cost of excavation would be increased by 30% due to logistical issues encountered when excavating around the internal excavation bracing (struts and walers).

19. Surface material removal cost estimate includes all labor, equipment, and materials necessary to remove the top one foot of existing ground cover (i.e., asphalt pavement and subgrade) to facilitate installation of a new site cap.

20. Asphalt subbase cost estimate includes all labor, equipment, and materials necessary to purchase, import, place, grade, and compact 6 inches of gravel to serve as asphalt cap subbase for 284,000 square-feet of new cap. Cost estimate includes survey verification and compaction testing.

21. Asphalt pavement cost estimate includes all labor, equipment, and material necessary to purchase, place, and compact asphalt pavement to serve as site cap. Cost estimate assumes final asphalt cap consists of a 4-inch (compacted) binder course and 2-inch (compacted) top course (total 8 inches prior to compaction) at an assumed weight of 2 tons per cubic-yard for 284,000 square-feet of new cap.

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

23. Solid waste transportation and disposal - C&D cost estimate includes all labor, equipment, and materials necessary to transport select material off-site for disposal as construction and demolition debris. Estimated quantity based on volume of jet grout spoils and surface material removed at an assumed density of 2 tons per cubic-yard.

24. Solid waste transportation and disposal - LTTD cost estimate includes all labor, equipment, and materials necessary to transport excavated material characteristically hazardous for benzene off-site for thermal treatment via low-temperature thermal desorption. Estimated quantity based on approximately 50% of soil excavated east and northeast of Building #2. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at ESMI's LTTD facility located in Fort Edward, New York. Cost estimate includes transportation fuel charge and all applicable taxes. Cost estimate assumes treated soil will not require disposal at a solid waste landfill.

25. Solid waste transportation and disposal - nonhaz cost estimate includes all labor, equipment, and materials necessary to transport non-hazardous excavated material off-site for disposal at a solid waste landfill. Estimated quantity based on approximately 50% of soil excavated from east and northeast of Building #2 and soil excavated to facilitate installation of slurry cut-off wall. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at Seneca Meadows Landfill located in Waterloo, New York or City of Albany Landfill located in Albany, New York. Cost estimate includes transportation fuel charge and all applicable taxes.

26. DNAPL/LNAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection and monitoring wells following completion of site remedial activities. Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes PVC well construction.

27. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions to limit/prevent potential future land and groundwater use. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

28. Administration and engineering and construction management costs are based on an assumed 10% of the total capital costs, not including costs for off-site treatment/disposal of material.

29. Quarterly NAPL monitoring cost estimate includes all labor, equipment, and materials necessary to conduct quarterly NAPL monitoring and recovery (to the extent possible, if NAPL is present) from existing monitoring wells and new NAPL recovery wells. Cost estimate assumes monitoring activities to be completed in two days, four times per year. Cost estimate assumes up to two drums of PPE and disposable sampling equipment to be generated per year. Estimate also includes costs to prepare an annual report to summarize monitoring activities.

30. Annual cap inspection and maintenance cost estimate includes all labor, equipment, and materials necessary to maintain the integrity of the asphalt cap. Estimate includes costs to visually inspect cap for cracks or eroded pavement and repair up to 2,500 square-feet of asphalt pavement each year.

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

32. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2013.

Table 5-2
Cost Estimate for Alternative FMA-3
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	Mobilization/Demobilization	1	LS	$300,000	$300,000
2	Utility Markout	5	Day	$1,000	$5,000
3	GPR Survey	2	Day	$2,500	$5,000
4	Temporary Site Fencing	3,000	LF	$35	$105,000
5	Material Staging Area	2	LS	$40,000	$80,000
6	Decontamination Area	1	LS	$10,000	$10,000
7	Pre-Design Investigation	1	LS	$100,000	$100,000
8	Passive Wall Pre-Excavation	800	CY	$65	$52,000
9	Passive Barrier Wall Installation	24,300	VSF	$10	$243,000
10	Passive Barrier Wall Backfill	2,600	CY	$25	$65,000
11	Jet Grouting	1,100	VLF	$75	$82,500
12	Spoils Handling	280	CY	$15	$4,200
13	Temporary Sheet Pile	27,000	SF	$40	$1,080,000
14	Excavation Enclosure	1	LS	$1,100,000	$1,100,000
15	Vapor Treatment	1	LS	$300,000	$300,000
16	Soil Excavation and Handling	17,400	CY	$45	$783,000
17	Vapor/Odor Control	33	Week	$3,000	$99,000
18	Backfill	16,000	CY	$40	$640,000
19	Surface Material Removal	9,100	CY	$30	$273,000
20	Asphalt Subbase	5,300	CY	$30	$159,000
21	Asphalt Pavement	14,100	Ton	$100	$1,410,000
22	Solid Waste Characterization	100	Each	$1,000	$100,000
23	Solid Waste Transportation and Disposal - C&D	18,800	Ton	$100	$1,880,000
24	Solid Waste Transportation and Disposal - LTTD	13,100	Ton	$85	$1,113,500
25	Solid Waste Transportation and Disposal - Nonhaz	17,100	Ton	$60	$1,026,000
26	DNAPL/LNAPL Collection and Monitoring Wells	22	Each	$4,000	$88,000
27	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$11,153,200
28				Administration and Engineering (10%)	$713,370
				Construction Management (10%)	$713,370
				Contingency (20%)	$2,230,640
				Total Capital Cost	$14,810,580

Table 5-2
Cost Estimate for Alternative FMA-3
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
OPERATION AND MAINTENANCE COSTS					
29	Quarterly NAPL Monitoring and Annual Reporting	1	LS	$28,000	$28,000
30	Annual Cap Inspection and Maintenance	1	LS	$15,000	$15,000
31	Verification of Institutional Controls	1	LS	$5,000	$5,000
				Subtotal O&M Cost	$48,000
				Contingency (20%)	$9,600
				Total O&M Cost	$57,600
32				30-Year Total Present Worth Cost of O&M	$885,312
				Total Estimated Cost	**$15,695,892**
				Rounded to	**$15,700,000**

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2009 dollars.

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

Assumptions:

1. Mobilization/demobilization cost estimate includes mobilization and demobilization of all equipment, materials, and labor necessary to complete the remedial activities that comprise this alternative.

2. Utility location and markout cost estimate includes labor, equipment, and materials necessary to locate, identify, and markout underground utilities at the site. Cost assumes that utility location and markout would be conducted by a private utility locating company over a period of five days at a rate of $1,000 per day.

3. GPR survey cost estimate includes all labor, equipment, and materials necessary to conduct ground-penetrating radar survey of the former manufactured gas plant area prior to implementing remedial activities. Cost estimate assumes equipment operator will require two days to complete survey

4. Temporary site fencing cost estimate includes all labor, equipment, and materials necessary to purchase, install, and remove a six-foot tall woven steel chain link fence equipped with barbed wire. Cost estimate includes up to 3,000 linear-feet of fencing used to secure excavation, working, and staging areas.

Table 5-2
Cost Estimate for Alternative FMA-3
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

5. Material staging area cost estimate includes all labor, equipment, and materials necessary to construct two 100-foot by 100-foot material staging areas consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner for staging excavated material. Separate staging areas used to segregate visually impacted material from non-visually impacted material prior to waste characterization. Maintenance includes inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting. Estimate assumes construction cost of approximately $4 per square-foot of pad.

6. Decontamination area cost estimate includes all labor, equipment, and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

7. Pre-design investigation cost estimate includes all labor, equipment, and materials necessary to conduct pre-design investigation in support of the remedial design for this alternative, including a test boring/geotechnical program.

8. Passive wall pre-excavation cost estimate includes all labor, equipment, and materials necessary to pre-excavate a trench along the passive wall alignments to verify presence/absence and location of underground utilities prior to installation of containment barrier and passive walls. Cost estimate assumes excavation activities to be completed using a backhoe and hand digging and excavation will be backfilled following mark-out/isolation/deactivation of utilities. Cost estimate assumes pre-excavation activities completed to a depth of 5 feet below grade for a wall length of 290 linear-feet in the northwest corner of the site and 780 linear-feet in along the eastern portion of the site.

9. Passive barrier wall installation cost estimate includes all labor, equipment, and materials necessary to install a passive barrier wall. Cost estimate includes mixing and placing slurry within the trench excavation and assumes excavation activities to be completed using a long-stick excavator. Cost estimate assumes 290 linear-feet (minus 50 linear feet to be completed via jet grouting) and 780 linear-feet of wall (minus 50 linear-feet to be completed via jet grouting) at an installation depth of 25 feet below grade, keyed one foot into bedrock. Unit cost based on vertical square-footage (VSF) of wall.

10. Passive barrier wall backfill cost estimate includes all labor, equipment, and materials necessary to purchase, import, and place pea-gravel stone within slurry-supported trench excavation to serve as passive barrier wall.

11. Jet grouting cost estimate includes all labor, equipment, and materials necessary to complete jet grouting around underground utilities for passive barrier walls installation. Cost estimate assumes jet grout drilling completed for two 50 linear-feet sections of cut-off wall, drilling completed 2.5 feet on-center to a depth of 25 feet below grade. Unit cost based on vertical linear-footage (VLF) of jet grout drilling.

Table 5-2
Cost Estimate for Alternative FMA-3
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

12. Spoils handling cost estimate includes all labor, equipment, and materials necessary to transfer jet grouting spoils to material staging area for characterization to facilitate off-site disposal. Cost estimate assumes spoils volume equal to jet grouting volume.

13. Temporary sheet pile cost estimate includes all labor, equipment, and materials necessary to install, remove, and decontaminate temporary water-tight steel sheet pile. Cost estimate assumes sheet piling (with an embedment depth of 18 feet due to the depth of weathered bedrock) is reinforced with internal bracing (struts and walers, due to the adjacent railroad). It was assumed that two layers of bracing and struts would be utilized, and the excavation south of the vehicle maintenance building would be completed in two cells spanning the length of the excavation (to provide a manageable span for struts). Final excavation support system to be determined as part of the Remedial Design.

14. Excavation enclosure cost estimate includes rental of an approximately 100-foot by 400-foot Sprung structure to enclosure excavation area east of Building #2. Cost estimate assumes a 6-month lease price of approximately $20 per square-foot and construction cost of approximately $6 per square-foot. Cost estimate assumes structure is equipped with square ends and overheard doors for truck and excavator access. Final structure construction details to be determined as part of the Remedial Design. Cost estimate based on information provided by Sprung Instant Structures, Inc.

15. Vapor treatment cost estimate includes rental of vapor treatment system to collect and treat air within the excavation enclosure. Cost estimate includes a 6-month lease of all vapor collection and treatment equipment, delivery and set-up fees, and filter media change out.

16. Soil excavation and handling cost estimate includes all labor, equipment, and materials necessary to excavate material, transfer excavated material to an on-site staging area, and load staged material for transportation off-site. Estimated quantity based on in-place volume of heavily NAPL-impacted soil east and northeast of Building #2 excavated to approximately 2 feet into the silt and clay unit. Cost estimate includes air monitoring during intrusive activities. Estimate includes an increased excavation cost due to logistical issues encountered when excavating around the internal excavation bracing (struts and walers).

17. Vapor/odor control cost estimate includes all labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and excavated materials staged on-site.

18. Backfill cost estimate includes all labor, equipment, and materials necessary to purchase, import, place, grade, and compact select fill within excavation areas to within one foot of the surrounding grade. Cost estimate assumes general fill placed in 12-inch lifts and compacted to 95% maximum compaction based on standard Proctor testing. Cost estimate includes survey verification and compaction testing. Cost estimate includes air monitoring during intrusive activities. Assumes the cost of excavation would be increased by 30% due to logistical issues encountered when excavating around the internal excavation bracing (struts and walers).

19. Surface material removal cost estimate includes all labor, equipment, and materials necessary to remove the top one foot of existing ground cover (i.e., asphalt pavement and subgrade) to facilitate installation of a new site cap.

20. Asphalt subbase cost estimate includes all labor, equipment, and materials necessary to purchase, import, place, grade, and compact 6 inches of gravel to serve as asphalt cap subbase for 284,000 square-feet of new cap. Cost estimate includes survey verification and compaction testing.

21. Asphalt pavement cost estimate includes all labor, equipment, and material necessary to purchase, place, and compact asphalt pavement to serve as site cap. Cost estimate assumes final asphalt cap consists of a 4-inch (compacted) binder course and 2-inch (compacted) top course (total 8 inches prior to compaction) at an assumed weight of 2 tons per cubic-yard for 284,000 square-feet of new cap.

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

23. Solid waste transportation and disposal - C&D cost estimate includes all labor, equipment, and materials necessary to transport select material off-site for disposal as construction and demolition debris. Estimated quantity based on volume of jet grout spoils and surface material removed at an assumed density of 2 tons per cubic-yard.

24. Solid waste transportation and disposal - LTTD cost estimate includes all labor, equipment, and materials necessary to transport excavated material characteristically hazardous for benzene off-site for thermal treatment via low-temperature thermal desorption. Estimated quantity based on approximately 50% of soil excavated east and northeast of Building #2. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at ESMI's LTTD facility located in Fort Edward, New York. Cost estimate includes transportation fuel charge and all applicable taxes. Cost estimate assumes treated soil will not require disposal at a solid waste landfill.

25. Solid waste transportation and disposal - nonhaz cost estimate includes all labor, equipment, and materials necessary to transport non-hazardous excavated material off-site for disposal at a solid waste landfill. Estimated quantity based on approximately 50% of soil excavated from east and northeast of Building #2 and soil excavated to facilitate installation of slurry cut-off and passive barrier walls. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at Seneca Meadows Landfill located in Waterloo, New York or City of Albany Landfill located in Albany, New York. Cost estimate includes transportation fuel charge and all applicable taxes.

26. DNAPL/LNAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection and monitoring wells following completion of site remedial activities. Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes PVC well construction.

Table 5-2
Cost Estimate for Alternative FMA-3
Limited Soil Removal, Capping, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

27. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions to limit/prevent potential future land and groundwater use. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

28. Administration and engineering and construction management costs are based on an assumed 10% of the total capital costs, not including costs for off-site treatment/disposal of material.

29. Quarterly NAPL monitoring cost estimate includes all labor, equipment, and materials necessary to conduct quarterly NAPL monitoring and recovery (to the extent possible, if NAPL is present) from existing monitoring wells and new NAPL recovery wells. Cost estimate assumes monitoring activities to be completed in two days, four times per year. Cost estimate assumes up to two drums of PPE and disposable sampling equipment to be generated per year. Estimate also includes costs to prepare an annual report to summarize monitoring activities.

30. Annual cap inspection and maintenance cost estimate includes all labor, equipment, and materials necessary to maintain the integrity of the asphalt cap. Estimate includes costs to visually inspect cap for cracks or eroded pavement and repair up to 2,500 square-feet of asphalt pavement each year.

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

32. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2013.

Table 5-3
Cost Estimate for Alternative FMA-4
ISS, Limited Soil Removal, Capping, Containment, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	Pre-Design Investigation	1	LS	$100,000	$100,000
2	Mobilization/Demobilization	3	LS	$170,000	$510,000
3	Utility Markout	5	Day	$1,000	$5,000
4	GPR Survey	2	Day	$2,500	$5,000
5	Subsurface Utility Relocation	1	LS	$500,000	$500,000
6	Temporary Site Fencing	3,000	LF	$35	$105,000
7	Material Staging Area	3	LS	$40,000	$120,000
8	Decontamination Area	3	LS	$10,000	$30,000
9	ISS Pre-Excavation	12,600	CY	$50	$630,000
10	ISS Treatment	36,200	CY	$75	$2,715,000
11	Post-ISS QA/QC Testing	37	Each	$400	$14,800
12	Post-ISS QA/QC Coring	14	Each	$1,500	$21,000
13	Passive Walls Pre-Excavation	800	CY	$65	$52,000
14	Passive Barrier Wall Installation	24,300	VSF	$10	$243,000
15	Passive Barrier Wall Backfill	2,600	CY	$25	$65,000
16	Jet Grouting - Passive Barrier Walls	4,200	VLF	$75	$315,000
17	Spoils Handling - Barrier Wall Jet Grouting	560	CY	$15	$8,400
18	Temporary Sheet Pile	27,000	SF	$40	$1,080,000
19	Excavation Enclosure	1	LS	$1,100,000	$1,100,000
20	Vapor Treatment	1	LS	$300,000	$300,000
21	Soil Excavation and Handling	17,400	CY	$45	$783,000
22	Vapor/Odor Control	83	Week	$3,000	$249,000
23	Backfill	22,300	CY	$40	$892,000
24	Surface Material Removal	6,600	CY	$30	$198,000
25	Asphalt Subbase	5,300	CY	$30	$159,000
26	Asphalt Pavement	14,100	Ton	$100	$1,410,000
27	Solid Waste Characterization	140	Each	$1,000	$140,000
28	Solid Waste Transportation and Disposal - C&D	21,200	Ton	$100	$2,120,000
29	Solid Waste Transportation and Disposal - LTTD	13,100	Ton	$85	$1,113,500
30	Solid Waste Transportation and Disposal - Nonhaz	30,900	Ton	$60	$1,854,000
31	DNAPL/LNAPL Collection and Monitoring Wells	22	Each	$4,000	$88,000
32	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$16,975,700
33				Administration and Engineering (10%)	$1,188,820
				Construction Management (10%)	$1,188,820
				Contingency (20%)	$3,395,140
				Total Capital Cost	$22,748,480

Table 5-3
Cost Estimate for Alternative FMA-4
ISS, Limited Soil Removal, Capping, Containment, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
OPERATION AND MAINTENANCE COSTS					
34	Quarterly NAPL Monitoring and Annual Reporting	1	LS	$28,000	$28,000
35	Annual Cap Inspection and Maintenance	1	LS	$15,000	$15,000
36	Verification of Institutional Controls	1	LS	$5,000	$5,000
				Subtotal O&M Cost	$48,000
				Contingency (20%)	$9,600
				Total O&M Cost	$57,600
				30-Year Total Present Worth Cost of O&M	$885,312
				Total Estimated Cost	**$23,633,792**
				Rounded to	**$23,600,000**

General Notes:

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

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

Assumptions:

1. Pre-design investigation cost estimate includes labor, equipment, and materials necessary to conduct pre-design investigation in support of the remedial design for this alternative, including a test boring/geotechnical program.

2. Mobilization/demobilization cost estimate includes mobilization and demobilization of all equipment, materials, and labor necessary to complete the remedial activities that comprise this alternative.

3. Utility location and markout cost estimate includes labor, equipment, and materials necessary to locate, identify, and markout underground utilities at the site. Cost assumes that utility location and markout would be conducted by a private utility locating company over a period of five days at a rate of $1,000 per day.

4. GPR survey cost estimate includes labor, equipment, and materials necessary to conduct ground-penetrating radar survey of the former manufactured gas plant area prior to implementing remedial activities. Cost estimate assumes equipment operator will require two days to complete survey activities.

5. Subsurface utility relocation cost estimate includes labor, equipment, and materials necessary to relocate subsurface gas lines, electrical lines, and telephone lines in the northern portion of the FMA to facilitate ISS treatment activities. Estimate assumes subsurface utilities are relocated further north on National Grid property.

6. Temporary site fencing cost estimate includes labor, equipment, and materials necessary to purchase, install, and remove a six-foot tall woven steel chain link fence equipped with barbed wire. Cost estimate includes up to 3,000 linear-feet of fencing used to secure excavation, working, and staging areas.

7. Material staging area cost estimate includes labor, equipment, and materials necessary to construct two 100-foot by 100-foot material staging areas consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner for staging excavated material. Separate staging areas used to segregate visually impacted material from non-visually impacted material prior to waste characterization. Maintenance includes inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting. Estimate assumes construction cost of approximately $4 per square-foot of pad.

8. Decontamination area cost estimate includes labor, equipment, and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

9. ISS pre-excavation cost estimate includes labor, equipment, and materials necessary to pre-excavate ISS treatment area to verify presence/absence and location of underground utilities prior to conducting ISS treatment activities and to allow for expansion of site soil during ISS treatment. Cost estimate assumes excavation activities to be completed using a backhoe and hand digging. Cost estimate assumes pre-excavation activities completed to a depth of 5 feet below grade.

10. ISS treatment cost estimate includes labor, equipment, and materials necessary to conduct in-situ soil stabilization to the top of weathered bedrock via large diameter auger mixing methods in the targeted area west of the Vehicle Maintenance Building. Volume estimate based on in-place soil volume.

11. Post-ISS QA/QC testing cost estimate includes labor, equipment, and materials necessary to perform quality assurance/quality control testing of stabilized material to verify performance criteria have been achieved. Cost estimate assumes QA/QC samples will be collected from a soil boring completed for every 1,000 square-feet of stabilized material. Cost estimate assumes up to eight borings completed per day and includes cost for a geologist, drill rig and crew, and laboratory analysis of samples for unconfined compressive strength and permeability.

12. Passive walls pre-excavation cost estimate includes labor, equipment, and materials necessary to pre-excavate a trench along the passive barrier wall alignments to verify presence/absence and location of underground utilities prior to installation of passive walls. Cost estimate assumes excavation activities to be completed using a backhoe and hand digging and excavation will be backfilled following mark-out/isolation/ deactivation of utilities. Cost estimate assumes pre-excavation activities completed to a depth of 5 feet below grade for a wall lengths of 290 linear-feet and 780 linear-feet.

13. Passive barrier wall installation cost estimate includes labor, equipment, and materials necessary to install a passive barrier wall. Cost estimate includes mixing and placing slurry within the trench excavation and assumes excavation activities to be completed using a long-stick excavator. Cost estimate assumes 780 linear-feet of wall (minus 50 linear-feet to be completed via jet grouting) and 290 linear-feet of wall (minus 50 linear-feet to be completed by jet grouting) at an installation depth of 25 feet below grade, keyed one foot into bedrock.

14. Passive barrier wall backfill cost estimate includes labor, equipment, and materials necessary to purchase, import, and place pea-gravel stone within slurry-supported trench excavation to serve as passive barrier wall.

15. Jet grouting - passive barrier walls cost estimate includes labor, equipment, and materials necessary to complete jet grouting around underground utilities for passive barrier wall installation. Cost estimate assumes jet grout drilling completed for two 50 linear-feet sections of each wall, drilling completed 2.5 feet on-center to a depth of 25 feet below grade. Unit cost based on vertical linear-footage (VLF) of jet grout drilling.

16. Spoils handling - barrier wall jet grouting cost estimate includes labor, equipment, and materials necessary to transfer jet grouting spoils to material staging area for characterization to facilitate off-site disposal. Cost estimate assumes spoils volume equal to jet grouting volume.

17. Temporary sheet pile cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary water-tight steel sheet pile. Cost estimate assumes sheet piling (with an embedment depth of 18 feet due to the depth of weathered bedrock) is reinforced with internal bracing (struts and walers, due to the adjacent railroad). It was assumed that two layers of bracing and struts would be utilized, and the excavation south of the vehicle maintenance building would be completed in two cells spanning the length of the excavation (to provide a manageable span for struts). Final excavation support system to be determined as part of the Remedial Design.

18. Excavation enclosure cost estimate includes rental of an approximately 100-foot by 400-foot Sprung structure to enclosure excavation area east of Building #2. Cost estimate assumes a 6-month lease price of approximately $20 per square-foot and construction cost of approximately $6 per square-foot. Cost estimate assumes structure is equipped with square ends and overheard doors for truck and excavator access. Final structure construction details to be determined as part of the Remedial Design. Cost estimate based on information provided by Sprung Instant Structures, Inc.

19. Vapor treatment cost estimate includes rental of vapor treatment system to collect and treat air within the excavation enclosure. Cost estimate includes a 6-month lease of all vapor collection and treatment equipment, delivery and set-up fees, and filter media change out.

Table 5-3
Cost Estimate for Alternative FMA-4
ISS, Limited Soil Removal, Capping, Containment, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

20. Soil excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate material, transfer excavated material to an on-site staging area, and load staged material for transportation off-site. Estimated quantity based on in-place volume of heavily NAPL-impacted soil east and northeast of Building #2 excavated to approximately 2 feet into the silt and clay unit. Cost estimate includes air monitoring during intrusive activities. Estimate includes an increased excavation cost due to logistical issues encountered when excavating around the internal excavation bracing (struts and walers).

21. Vapor/odor control cost estimate includes labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and excavated materials staged on-site.

22. Backfill cost estimate includes labor, equipment, and materials necessary to purchase, import, place, grade, and compact select fill within excavation areas to within one foot of the surrounding grade. Cost estimate assumes general fill placed in 12-inch lifts and compacted to 95% maximum compaction based on standard Proctor testing. Cost estimate includes survey verification and compaction testing. Cost estimate includes air monitoring during intrusive activities. Assumes the cost of excavation would be increased by 30% due to logistical issues encountered when excavating and backfilling around the internal excavation bracing (struts and walers).

23. Surface material removal cost estimate includes labor, equipment, and materials necessary to remove the top one foot of existing ground cover (i.e., asphalt pavement and subgrade) to facilitate installation of a new site cap.

24. Asphalt subbase cost estimate includes labor, equipment, and materials necessary to purchase, import, place, grade, and compact 6 inches of gravel to serve as asphalt cap subbase for 284,000 square-feet of new cap. Cost estimate includes survey verification and compaction testing.

25. Asphalt pavement cost estimate includes labor, equipment, and material necessary to purchase, place, and compact asphalt pavement to serve as site cap. Cost estimate assumes final asphalt cap consists of a 4-inch (compacted) binder course and 2-inch (compacted) top course (total 8 inches prior to compaction) at an assumed weight of 2 tons per cubic-yard for 284,000 square-feet of new cap.

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

27. Solid waste transportation and disposal - C&D cost estimate includes labor, equipment, and materials necessary to transport select material off-site for disposal as construction and demolition debris. Estimated quantity based on volume of surface material removed at an assumed density of 2 tons per cubic-yard.

Table 5-3
Cost Estimate for Alternative FMA-4
ISS, Limited Soil Removal, Capping, Containment, Passive NAPL Recovery via Wells and Barrier Walls, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

28. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport excavated material characteristically hazardous for benzene off-site for thermal treatment via low-temperature thermal desorption. Estimated quantity based on approximately 50% of soil excavated east and northeast of Building #2. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at ESMI's LTTD facility located in Fort Edward, New York. Cost estimate includes transportation fuel charge and all applicable taxes. Cost estimate assumes treated soil will not require disposal at a solid waste landfill.

29. Solid waste transportation and disposal - nonhaz cost estimate includes labor, equipment, and materials necessary to transport non-hazardous excavated material off-site for disposal at a solid waste landfill. Estimated quantity based on approximately 50% of soil excavated from east and northeast of Building #2 and soil excavated to facilitate installation of passive barrier walls. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at Seneca Meadows Landfill located in Waterloo, New York or City of Albany Landfill located in Albany, New York. Cost estimate includes transportation fuel charge and all applicable taxes.

30. DNAPL/LNAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection and monitoring wells following completion of site remedial activities. Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes PVC well construction.

31. Institutional controls cost estimate includes legal expenses to institute environmental easements and deed restrictions to limit/prevent potential future land and groundwater use. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

32. Administration and engineering and construction management costs are based on an assumed 10% of the total capital costs, not including costs for off-site treatment/disposal of material.

33. Quarterly NAPL monitoring cost estimate includes labor, equipment, and materials necessary to conduct quarterly NAPL monitoring and recovery (to the extent possible, if NAPL is present) from existing monitoring wells and new NAPL recovery wells. Cost estimate assumes monitoring activities to be completed in two days, four times per year. Cost estimate assumes up to two drums of PPE and disposable sampling equipment to be generated per year. Estimate also includes costs to prepare an annual report to summarize monitoring activities.

34. Annual cap inspection and maintenance cost estimate includes labor, equipment, and materials necessary to maintain the integrity of the asphalt cap. Estimate includes costs to visually inspect cap for cracks or eroded pavement and repair up to 2,500 square-feet of asphalt pavement each year.

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

Table 5-4
Cost Estimate for Alternative FMA-5
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	Relocate GRS and Electrical Substation	1	LS	$10,000,000	$10,000,000
2	Mobilization/Demobilization	1	LS	$400,000	$400,000
3	Building Characterization, Demolition and Disposal	1	LS	$7,500,000	$7,500,000
4	Utility Markout	5	Day	$1,000	$5,000
5	GPR Survey	2	Day	$2,500	$5,000
6	Temporary Site Fencing	5,000	LF	$35	$175,000
7	Material Staging Area	2	LS	$90,000	$180,000
8	Decontamination Area	2	LS	$7,500	$15,000
9	Surface Material Removal	11,000	CY	$30	$330,000
10	Pre-Design Investigation	1	LS	$200,000	$200,000
11	Excavation Enclosure	1	LS	$1,100,000	$1,100,000
12	Vapor Treatment	1	LS	$300,000	$300,000
13	Temporary Sheet Pile	166,000	SF	$50	$8,300,000
14	Excavation Area Dewatering and Water Treatment	110	Month	$50,000	$5,500,000
15	Soil Excavation and Handling	244,300	CY	$35	$8,550,500
16	Soil Amendment	18,400	Ton	$125	$2,300,000
17	Vapor/Odor Control	490	Week	$3,000	$1,470,000
18	Backfill	233,300	CY	$30	$6,999,000
19	Storm Sewer System	1	LS	$400,000	$400,000
20	Gravel Surface Cover	11,000	CY	$30	$330,000
21	Liquid Waste Characterization	860	Each	$1,000	$860,000
22	Solid Waste Characterization	820	Each	$1,000	$820,000
23	Solid Waste Transportation and Disposal - C&D	22,000	Ton	$100	$2,200,000
24	Solid Waste Transportation and Disposal - LTTD	192,500	Ton	$85	$16,362,500
25	Solid Waste Transportation and Disposal - Nonhaz	192,500	Ton	$60	$11,550,000
				Subtotal Capital Cost	$85,852,000
26				Administration and Engineering (10%)	$4,573,950
				Construction Management (10%)	$4,573,950
				Contingency (20%)	$17,170,400
				Total Estimated Cost	**$112,170,300**
				Rounded to	**$112,000,000**

Table 5-4

Cost Estimate for Alternative FMA-5
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Notes:

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

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

Assumptions:

1. Relocate GRS and electrical substation cost estimate includes labor, equipment, and materials necessary to deactivate, demolish, remove, and rebuilt the gas regulator station and Genesee Street Substation and associated infrastructure to facilitate excavation of soil in this area of the site.

2. Mobilization/demobilization cost estimate includes mobilization and demobilization of equipment, materials, and labor necessary to complete the remedial activities that comprise this alternative.

3. Building characterization, demolition, and disposal cost estimate includes labor, equipment, and materials necessary to remove Building #2 and the Vehicle Maintenance Building prior to conducting excavation activities. Estimate includes costs to conduct characterization sampling, removal of liquids and equipment from the buildings prior to demolition, removal of asbestos containing materials (ACM) including roof structure, demolition of existing structures, air monitoring during demolition activities, and transportation of demolition debris at a C&D landfill, TSCA landfill, ACM landfill. Estimate assumes no salvage value.

4. Utility location and markout cost estimate includes labor, equipment, and materials necessary to locate, identify, and markout underground utilities at the site. Cost assumes that utility location and markout would be conducted by a private utility locating company over a period of five days at a rate of $1,000 per day.

5. GPR survey cost estimate includes labor, equipment, and materials necessary to conduct ground-penetrating radar survey of the former manufactured gas plant area prior to implementing remedial activities. Cost estimate assumes equipment operator will require two days to complete survey activities.

6. Temporary site fencing cost estimate includes labor, equipment, and materials necessary to purchase, install, and remove a six-foot tall woven steel chain link fence equipped with barbed wire. Cost estimate includes up to 5,000 linear-feet of fencing used to secure excavation, working, and staging areas.

7. Material staging area cost estimate includes labor, equipment, and materials necessary to construct two 150-foot by 150-foot material staging areas consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner for staging excavated material. Separate staging areas used to segregate visually impacted material from non-visually impacted material prior to waste characterization. Maintenance includes inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting. Estimate assumes construction cost of approximately $4 per square-foot of pad.

Table 5-4

Cost Estimate for Alternative FMA-5
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

8. Decontamination area cost estimate includes labor, equipment, and materials necessary to construct and remove two 60-foot by 30-foot decontamination pads and appurtenances. The decontamination pads would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

9. Surface material removal cost estimate includes labor, equipment, and materials necessary to remove the top one foot of existing ground cover (i.e., asphalt pavement and subgrade) to facilitate excavation of site soil.

10. Pre-design investigation cost estimate includes labor, equipment, and materials necessary to conduct pre-design investigation in support of the remedial design for this alternative, including a test boring/geotechnical program.

11. Excavation enclosure cost estimate includes rental of an approximately 100-foot by 400-foot Sprung structure to enclosure excavation area east of Building #2. Cost estimate assumes a 6-month lease price of approximately $20 per square-foot and construction cost of approximately $6 per square-foot. Cost estimate assumes structure is equipped with square ends and overheard doors for truck and excavator access. Final structure construction details to be determined as part of the Remedial Design. Cost estimate based on information provided by Sprung Instant Structures, Inc.

12. Vapor treatment cost estimate includes rental of vapor treatment system to collect and treat air within the excavation enclosure. Cost estimate includes a 6-month lease of all vapor collection and treatment equipment, delivery and set-up fees, and filter media change out.

13. Temporary sheet pile cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary water-tight steel sheet pile secured and anchored with rock pins and/or tie-backs and reinforced with internal bracing. Final excavation support system to be determined as part of the Remedial Design.

14. Excavation area dewatering and water treatment cost estimate includes installation of sumps within excavation areas and rental of a portal water treatment system capable of operating at 50 gallons-per-minute. Cost estimate assumes water treatment system includes pumps, influent piping and hoses, frac tanks, carbon filters, bag filters, discharge piping and hoses, and flow meter. Cost estimate assumes bag filters will require change out approximately once per day of operation. Estimate assumes treated water would be discharge to local storm sewer and subsequently the Hudson River at no additional cost.

15. Soil excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate material, transfer excavated material to an on-site staging area, and load staged material for transportation off-site. Estimated quantity based on in-place volume of soil containing constituents at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives. Cost estimate includes air monitoring during intrusive activities.

16. Soil amendment cost estimate includes labor, equipment, and materials necessary to purchase and import stabilizing agent (e.g., Portland cement) to amend approximately 50% of excavated soil. Estimated quantity based on an assumed 10% of excavated soil (by weight) to be amended at 1.5 tons per cubic-yard.

Table 5-4

Cost Estimate for Alternative FMA-5
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

17. Vapor/odor control cost estimate includes labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and excavated materials staged on-site.

18. Backfill cost estimate includes all labor, equipment, and materials necessary to purchase, import, place, grade, and compact select fill within excavation areas to within one foot of the surrounding grade. Cost estimate assumes general fill placed in 12-inch lifts and compacted to 95% maximum compaction based on standard Proctor testing. Cost estimate includes survey verification and compaction testing.

19. Storm sewer system cost estimate includes labor, equipment, and materials necessary to install a new storm sewer system in the FMA following excavation and backfilling activities. Cost estimate includes piping, manholes, and catch basins and assumes new storm sewer system will connect to the existing storm sewer system that conveys stormwater to Manhole MH-3 located in the Yard Storage Area.

20. Gravel surface cover cost estimate includes labor, equipment, and materials necessary to purchase, import, place, grade, and compact 12 inches of gravel to serve as final site cover. Cost estimate includes survey verification and compaction testing.

21. Liquid waste characterization cost estimate includes the analysis of wastewater sample for PCBs, VOCs, SVOCs, metals, and pesticides. Liquid waste characterization to be conducted in accordance with the requirements provided by disposal facility. Cost estimate assumes one liquid waste characterization to be collected for every 50,000 gallons of treated water. More than an estimated 43,000,000 gallons of water are anticipated to generated during soil excavation activities.

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

23. Solid waste transportation and disposal - C&D cost estimate includes labor, equipment, and materials necessary to transport select material off-site for disposal at as construction and demolition debris. Estimated quantity based on volume of surface material removed at an assumed density of 2 tons per cubic-yard.

24. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport excavated material characteristically hazardous for benzene off-site for thermal treatment via low-temperature thermal desorption. Estimated quantity based on approximately 50% of excavated soil. Cost estimate assumes a material density of 1.5 tons per cubic-yard and an additional 10% by weight for the addition of a soil amendment. Cost estimate assumes soil would be managed at ESMI's LTTD facility located in Fort Edward, New York. Cost estimate includes transportation fuel charge and all applicable taxes. Cost estimate assumes treated soil will not require disposal at a solid waste landfill.

25. Solid waste transportation and disposal - nonhaz cost estimate includes labor, equipment, and materials necessary to transport non-hazardous excavated material off-site for disposal at a solid waste landfill. Estimated quantity based on approximately 50% of excavated soil. Cost estimate assumes a material density of 1.5 tons per cubic-yard and an additional 10% by weight for the addition of a soil amendment. Cost estimate assumes soil would be managed at Seneca Meadows Landfill located in Waterloo, New York or City of Albany Landfill located in Albany, New York. Cost estimate includes transportation fuel charge and all applicable taxes.

Table 5-4

Cost Estimate for Alternative FMA-5
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

26. Administration and engineering and construction management costs are based on an assumed 10% of the total capital costs, not including costs for the relocation of the GRS and electrical substation or for off-site treatment/disposal of material.

Table 5-5
Cost Estimate for Alternative ODSA-2
Passive NAPL Recovery, Groundwater Monitoring, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	DNAPL Collection Wells	8	Each	$4,000	$32,000
2	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$82,000
				Contingency (20%)	$16,400
				Total Capital Cost	$98,400
OPERATION AND MAINTENANCE COSTS					
3	Quarterly DNAPL Monitoring	3	LS	$2,500	$7,500
4	Annual Groundwater and Quarterly DNAPL Monitoring	1	LS	$15,000	$15,000
5	Laboratory Analysis	19	Each	$400	$7,600
6	Waste Disposal	4	Each	$250	$1,000
7	Annual Reporting	1	LS	$10,000	$10,000
8	Verification of Institutional Controls	1	LS	$5,000	$5,000
				Subtotal O&M Cost	$46,100
				Contingency (20%)	$9,220
				Total O&M Cost	$55,320
9				30-Year Total Present Worth Cost of O&M	$850,268
				Total Estimated Cost	**$948,668**
				Rounded to	**$950,000**

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2009 dollars.

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

Assumptions:

1. DNAPL collection wells cost estimate includes all labor, equipment, and materials necessary to install NAPL collection wells following completion of site remedial activities. Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes PVC well construction.

2. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions to limit/prevent potential future groundwater use. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

3. Quarterly DNAPL monitoring cost estimate includes all labor, equipment, and materials necessary to conduct quarterly NAPL monitoring and recovery (to the extent possible, if NAPL is present) from new NAPL recovery wells. Cost estimate assumes monitoring activities to be completed in one day, three times per year. Fourth quarterly DNAPL monitoring event to be conducted with annual groundwater monitoring. See Note 4.

4. Annual groundwater and quarterly DNAPL monitoring includes all labor, equipment, and materials necessary to conduct annual groundwater monitoring and one round of quarterly DNAPL monitoring as part of the annual groundwater monitoring activities. Cost estimate assumes groundwater samples collected from up to 15 existing groundwater monitoring wells using low-flow sampling procedures. Cost estimate assumes two workers will require 6 days to complete monitoring activities. Estimate includes rental of vehicle and equipment.

5. Laboratory analysis cost estimate includes the analysis of groundwater samples for BTEX and PAHs. Estimate assumes laboratory analysis of groundwater samples from up to 15 existing groundwater monitoring wells and up to 4 QA/QC samples.

6. Waste disposal cost estimate includes off-site disposal of drummed PPE, disposable sampling equipment, purge water, and NAPL generated/collected during quarterly DNAPL monitoring and annual groundwater monitoring activities.

7. Annual reporting cost estimate includes all labor necessary to prepare an annual report summarizing quarterly DNAPL and annual groundwater monitoring activities and results. Annual report to be submitted to NYSDEC.

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

9. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2013.

Table 5-6
Cost Estimate for Alternative OSDA-3
Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	DNAPL Collection Wells	8	Each	$4,000	$32,000
2	ORC Application Wells	40	Each	$3,000	$120,000
3	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$202,000
				Contingency (20%)	$40,400
				Total Capital Cost	$242,400
OPERATION AND MAINTENANCE COSTS - Annual					
4	Quarterly DNAPL Monitoring	3	LS	$2,500	$7,500
5	Semi-Annual ORC Application	80	Each	$200	$16,000
6	Annual Groundwater and Quarterly DNAPL Monitoring	1	LS	$15,000	$15,000
7	Laboratory Analysis	19	Each	$400	$7,600
8	Waste Disposal	8	Each	$250	$2,000
9	Annual Reporting	1	LS	$15,000	$15,000
10	Verification of Institutional Controls	1	LS	$5,000	$5,000
				Subtotal O&M Cost	$68,100
				Contingency (20%)	$13,620
				Subtotal O&M Cost	$81,720
11				30-Year Total Present Worth Cost of O&M	$1,256,036
OPERATION AND MAINTENANCE COSTS - 10-year well replacement					
12	Replace ORC Application Wells	40	Each	$5,000	$200,000
				Subtotal O&M Cost	$200,000
				Contingency (20%)	$40,000
				Subtotal O&M Cost	$240,000
13				10-Year Total Present Worth Cost of O&M	$147,339
OPERATION AND MAINTENANCE COSTS - 20-year well replacement					
14	Replace ORC Application Wells	40	Each	$5,000	$200,000
				Subtotal O&M Cost	$200,000
				Contingency (20%)	$40,000
				Subtotal O&M Cost	$240,000
15				20-Year Total Present Worth Cost of O&M	$90,453
				Total O&M Cost	$1,493,829
				Total Estimated Cost	**$1,736,229**
				Rounded to	**$1,740,000**

Table 5-6
Cost Estimate for Alternative OSDA-3
Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Notes:

1. Cost estimate is based on ARCADIS' past experience and vendor estimates using 2009 dollars.

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

Assumptions:

1. DNAPL collection wells cost estimate includes all labor, equipment, and materials necessary to install NAPL collection wells following completion of site remedial activities. Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes PVC well construction.

2. ORC application wells cost estimate includes all labor, equipment, and materials necessary to install ORC application wells following completion of site remedial activities. Cost estimate assumes application wells to be installed approximately 20 feet on center for the length of the hydraulically upgradient portion of the off-site/downgradient area (780 linear-feet). Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes 2-inch diameter PVC well construction and drilling into bedrock is not required. Cost estimate includes installation of canisters and cables to

3. Institutional controls cost estimate includes all legal expenses to institute environmental easements and deed restrictions to limit/prevent potential future groundwater use. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

4. Quarterly DNAPL monitoring cost estimate includes all labor, equipment, and materials necessary to conduct quarterly NAPL monitoring and recovery (to the extent possible, if NAPL is present) from new NAPL recovery wells. Cost estimate assumes monitoring activities to be completed in one day, three times per year. Fourth quarterly DNAPL monitoring event to be conducted with annual groundwater

5. Semi-annual ORC application cost estimate includes cost to purchase ORC compound for two semi-annual applications. Cost estimate assumes ORC will be applied via ORC "socks" placed within canisters suspended in application wells. Cost estimate assumes one sock per well. Cost estimate assumes change out of socks to be conducted semi-annually during NAPL monitoring events.

6. Annual groundwater and quarterly DNAPL monitoring includes all labor, equipment, and materials necessary to conduct annual groundwater monitoring and one round of quarterly DNAPL monitoring as part of the annual groundwater monitoring activities. Cost estimate assumes groundwater samples collected from up to 15 existing groundwater monitoring wells using low-flow sampling procedures. Cost estimate assumes two workers will require 6 days to complete monitoring activities. Estimate includes rental of vehicle and equipment.

Table 5-6
Cost Estimate for Alternative OSDA-3
Passive NAPL Recovery, Enhanced Biodegradation, Groundwater Monitoring, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

7. Laboratory analysis cost estimate includes the analysis of groundwater samples for BTEX and PAHs. Estimate assumes laboratory analysis of groundwater samples from up to 15 existing groundwater monitoring wells and up to 4 QA/QC samples.

8. Waste disposal cost estimate includes off-site disposal of drummed PPE, disposable sampling equipment, purge water, and NAPL generated/collected during quarterly DNAPL monitoring and annual groundwater monitoring activities.

9. Annual reporting cost estimate includes all labor necessary to prepare an annual report summarizing quarterly DNAPL and annual groundwater monitoring activities and results, as well as semi-annual ORC application activities. Annual report to be submitted to NYSDEC.

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

11. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2009.

12. Replace ORC application wells cost estimate includes all labor, equipment, and materials necessary to abandon existing and install new ORC application wells 10 years after completion of site remedial activities. Cost estimate assumes application wells to be installed approximately 20 feet on center for the length of the hydraulically upgradient portion of the off-site/downgradient area (780 linear-feet). Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes 2-inch diameter PVC well construction and drilling into bedrock is not required.

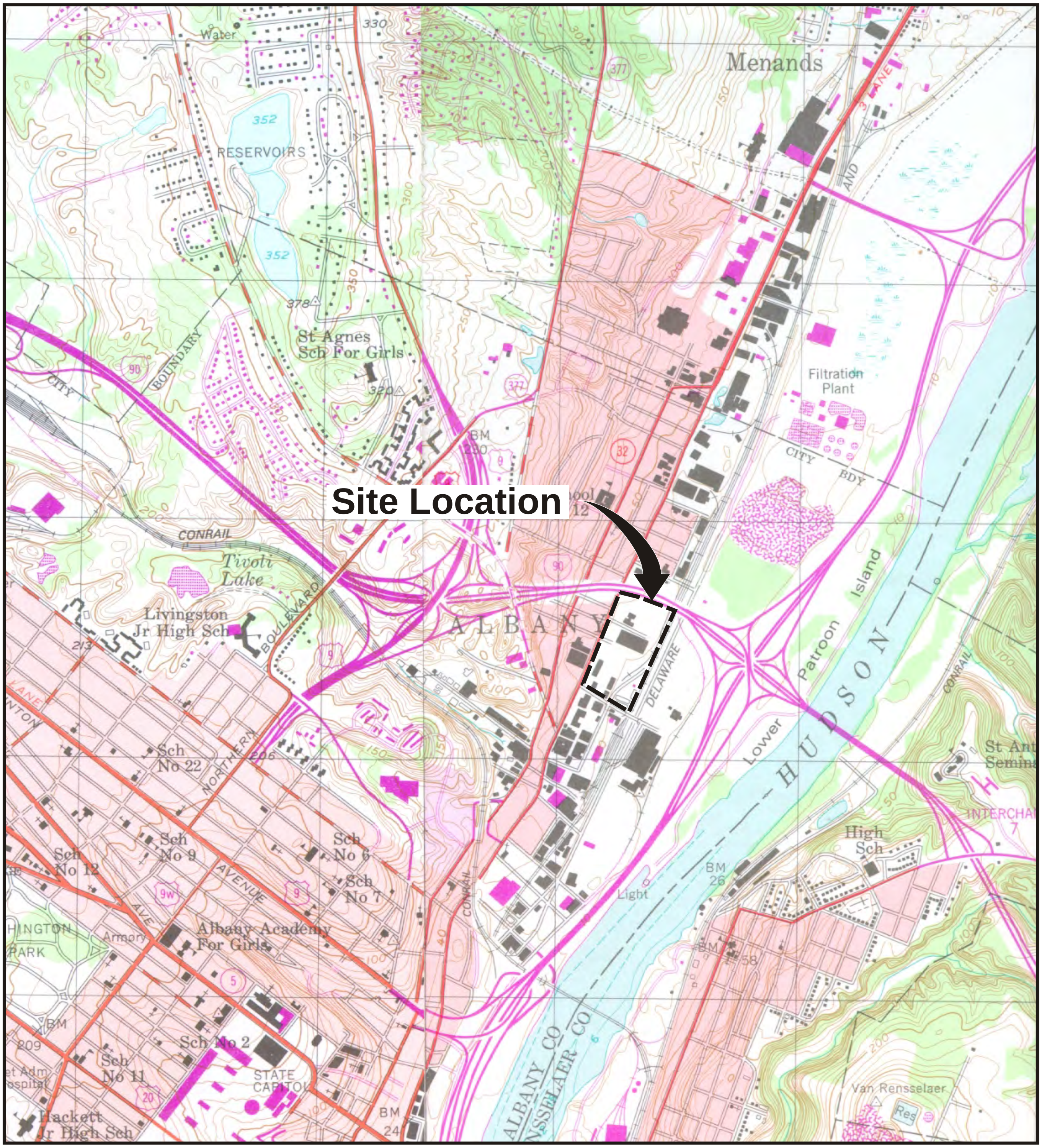
13. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2009.

14. Replace ORC application wells cost estimate includes all labor, equipment, and materials necessary to abandon existing and install new ORC application wells 20 years after completion of site remedial activities. Cost estimate assumes application wells to be installed approximately 20 feet on center for the length of the hydraulically upgradient portion of the off-site/downgradient area (780 linear-feet). Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes 2-inch diameter PVC well construction and drilling into bedrock is not required.

15. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2013.

ARCADIS

Figures



REFERENCE: Base Map USGS Quads., Albany, New York, 1980 and Troy South, New York, 1980.

2000'   0   2000'

Approximate Scale: 1" = 2000'

Area Location

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK

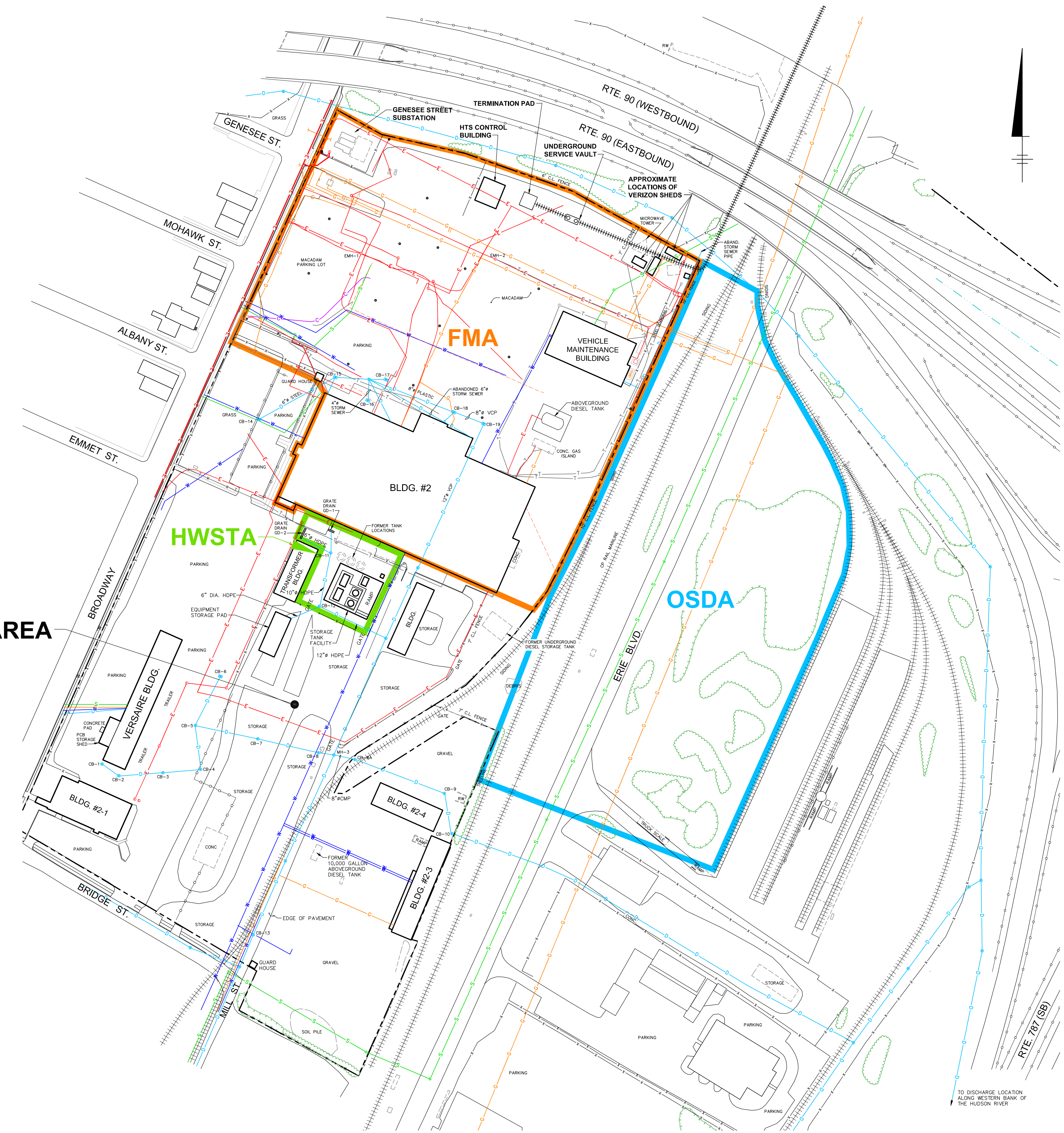
FEASIBILITY STUDY REPORT

SITE LOCATION MAP

ARCADIS

FIGURE
1-1

02/25/09 SYRACUSE-NY-ENV141-DJH
B0036648/0000/00021/CDR/36648N01.CDR



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- FORMER MGP AREA
- OFF-SITE DOWNGRADIENT AREA
- HAZARDOUS WASTE STORAGE TANK AREA

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON-SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D-29734-E, FILE INDEX NO. 20.3-A1.1-B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATION OF UNDERGROUND TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, AND CABLE LINES WERE UPDATED BASED ON ELECTROMAGNETIC UTILITY SURVEY CONDUCTED BY UNDERGROUND SERVICES, INC. DURING OCTOBER 2012. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES MUST BE DETERMINED/CONFIRMED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. FMA = FORMER MANUFACTURED GAS (MGP) PLANT AREA.
6. OSDA = OFF-SITE DOWNGRADIENT AREA.
7. HWSTA = HAZARDOUS WASTE STORAGE TANK AREA.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

SITE PLAN

ARCADIS

FIGURE
1-2

CITY: SYRACUSE NY DIV/GROUP: ENV/IM-DV DB: LJP, R. BASSETT, E. KRAHMER, R. ALLEN LD:(Opt) PIC: T. YOUNG PM: M. JONES TM: M.JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF* PLOTTED: 12/28/2015 11:08 AM BY: ALLEN, ROYCE
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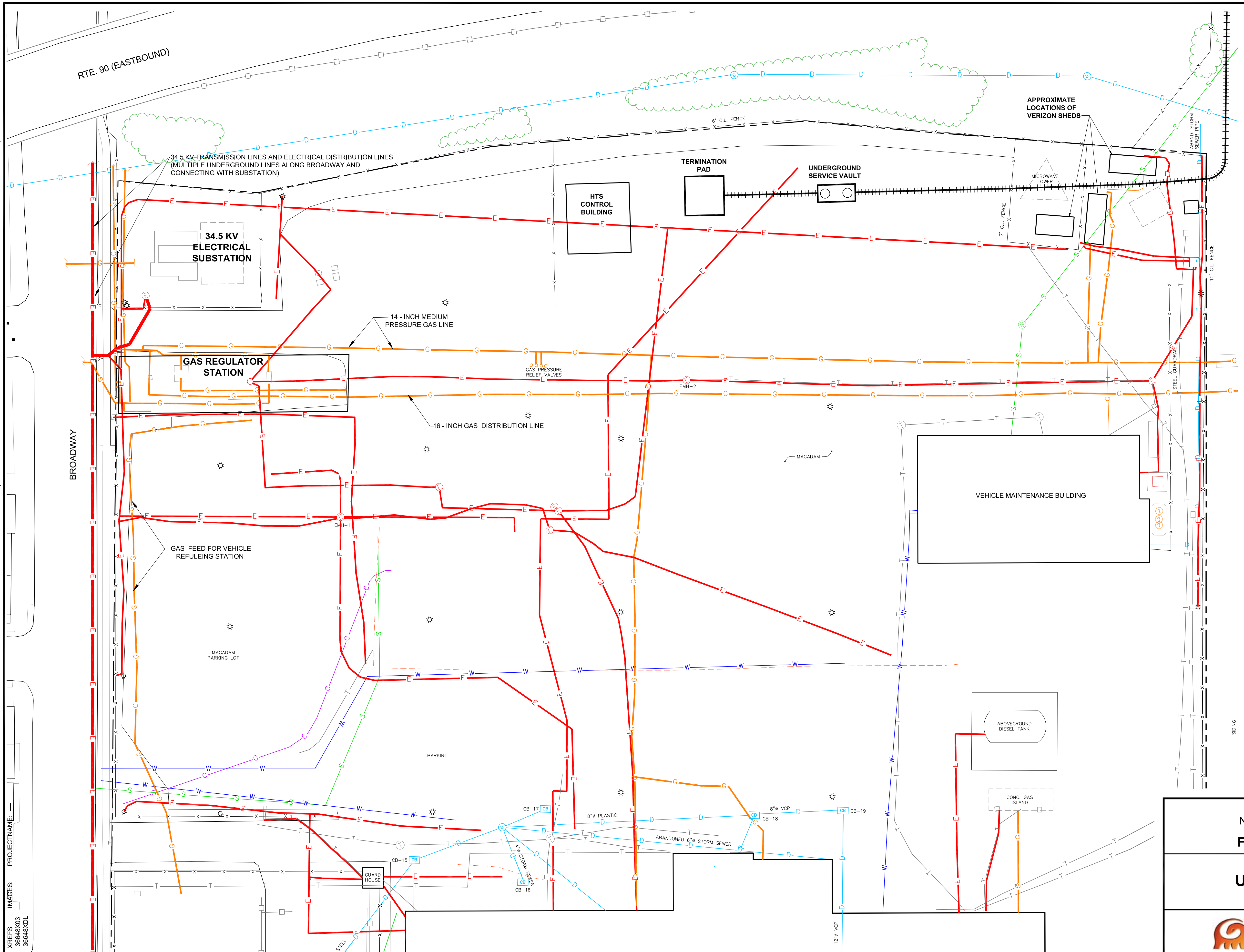

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- CB EXISTING CATCH BASIN
- D EXISTING STORM SEWER MANHOLE
- S EXISTING SANITARY MANHOLE
- E EXISTING ELECTRICAL MANHOLE
- T EXISTING TELEPHONE MANHOLE
- ? EXISTING UNKNOWN UTILITY MANHOLE
- D STORM SEWER
- S SANITARY SEWER
- T TELEPHONE LINE
- E ELECTRICAL LINE
- E UNDERGROUND 34.5 KV ELECTRICAL TRANSMISSION LINE
- G GAS LINE
- W WATER LINE
- C CABLE LINE
- UNKNOWN UTILITY

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.

0 30' 60'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

UTILITY LOCATION MAP

ARCADIS

FIGURE
1-3

CITY: SYRACUSE NY DIV/GROUP: ENV/IM-DV DB: R BASSETT, R. ALLEN LD:(Opt) PIC: T, YOUNG PM: M. JONES TM: M. JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF* G:\ENVCAD\SYRACUSE\ACT\B0036648\1401\00002\DWG\FS-REPORT\36648B26.DWG LAYOUT: 1-3 SAVED: 12/28/2015 11:19 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/28/2015 11:19 AM BY: ALLEN, ROYCE
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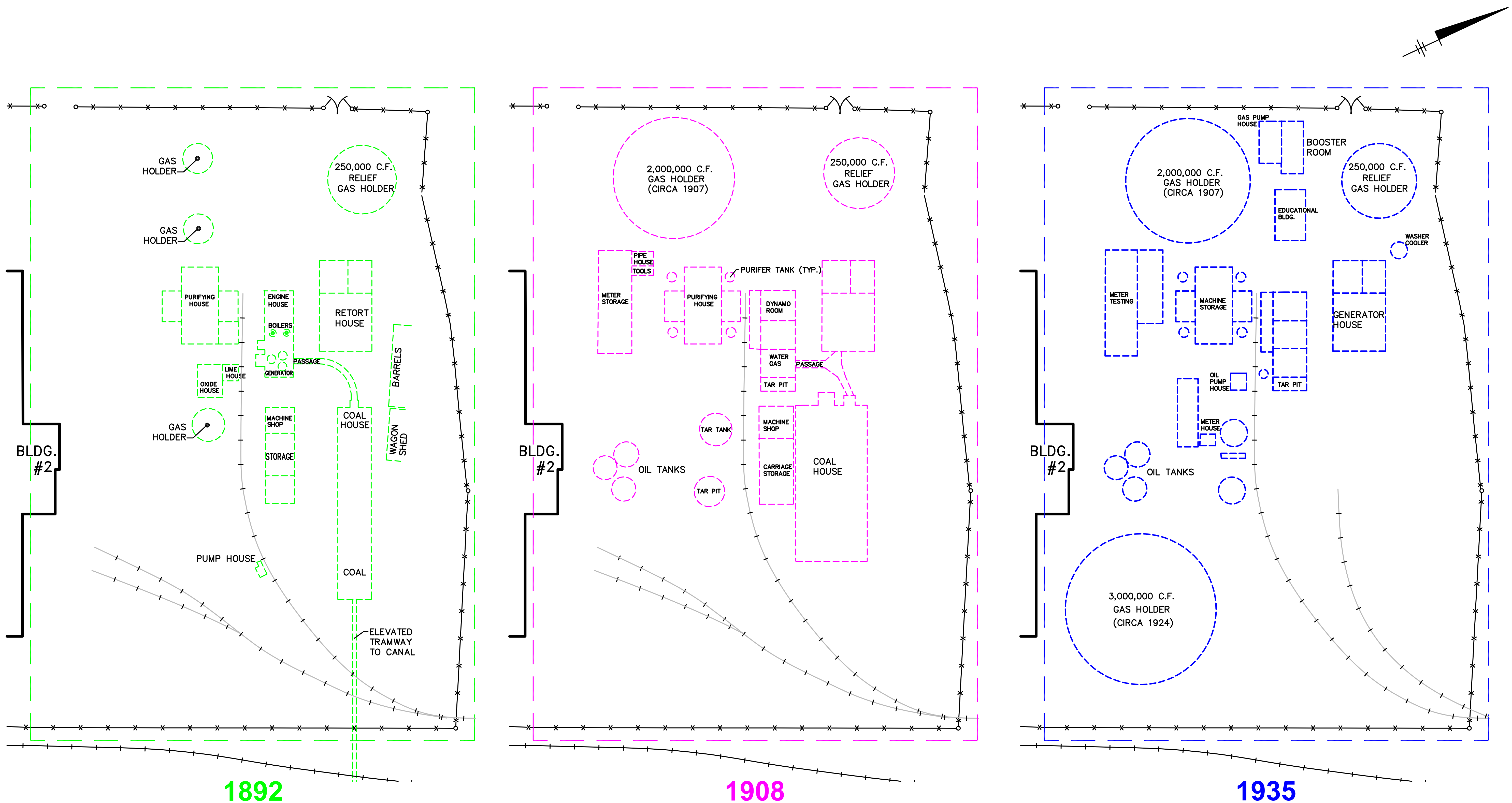


LEGEND:

- EXISTING FENCE
- EXISTING RAILROAD
- FORMER RAILROAD

NOTES:

1. BUILDING 2 AND EXISTING FENCE LOCATION DIGITIZED FROM NIAGARA MOHAWK POWER CORPORATION DRAWING NO. D–24687–E, FILE NO. INDEX 20.3–A1.1–B2, DATED 10/29/85.
2. HISTORIC STRUCTURE LOCATIONS ARE BASED ON ENGINEERING–SCIENCE FIGURE NO. 3.2, "MGP SITE PLAN" AND HISTORICAL MAPS INCLUDING SANBORN FIRE INSURANCE MAPS. SITE FEATURE LOCATIONS ARE APPROXIMATE.
3. C.F. = CUBIC FEET

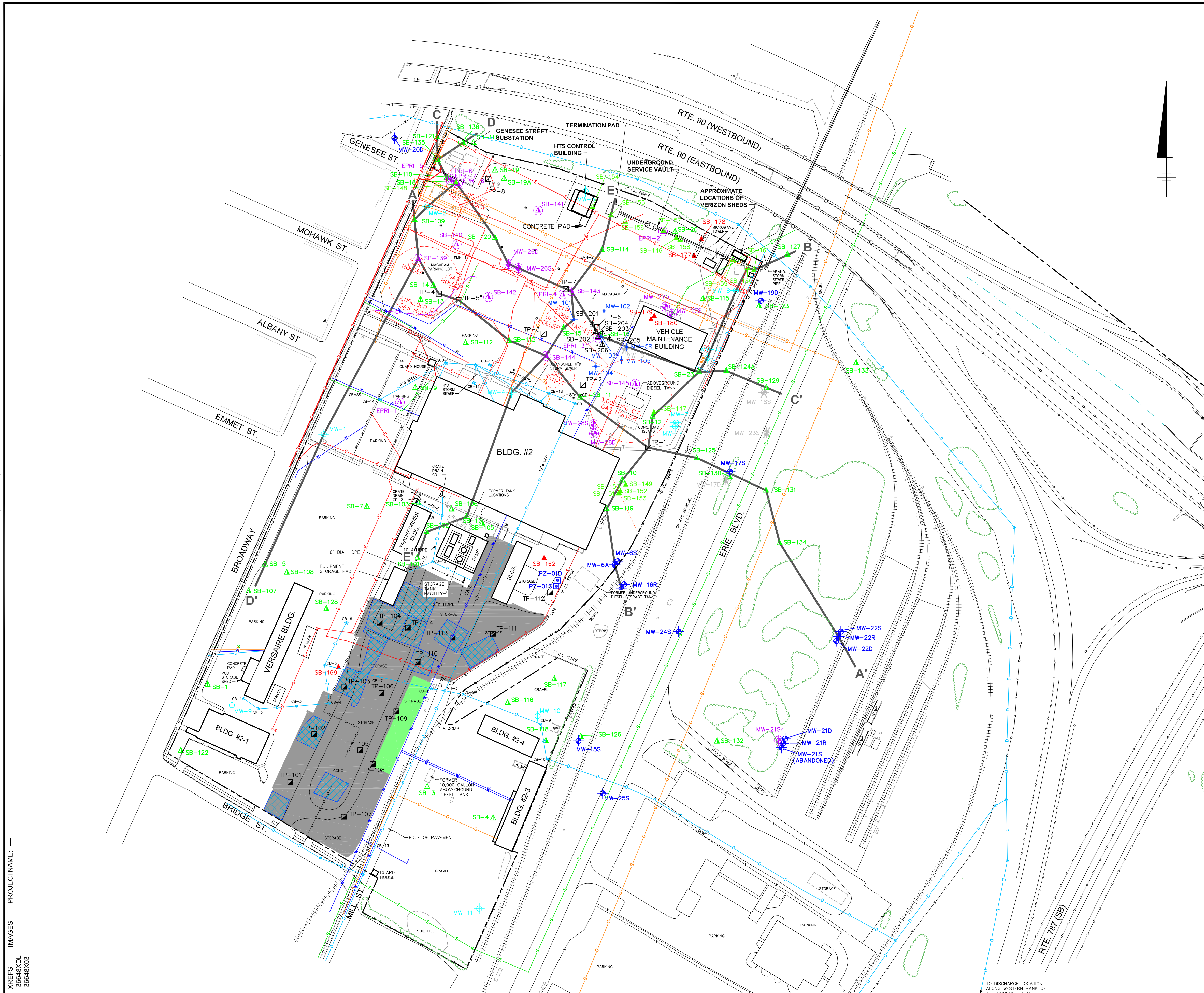
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

HISTORICAL SITE FEATURES

ARCADIS

FIGURE
1-4



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- HISTORICAL SITE FEATURE
- APPROXIMATE PROPERTY LINE
- MW-105 PILOT-TEST MONITORING WELL LOCATION
- SB-205 PILOT-TEST BASELINE SOIL BORING LOCATION
- SB-147 TREATABILITY STUDY SOIL BORING LOCATION
- SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- SB-126 MGP/RCRA SOIL BORING LOCATION
- TP-105 MGP/RCRA TEST PIT LOCATION
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- SB-4 PSA/IRM SOIL BORING LOCATION
- TP-3 PSA/IRM TEST PIT LOCATION
- SB-156 HTS PROJECT SOIL BORING LOCATION
- SB-162 SUPPLEMENTAL INVESTIGATION SOIL BORING LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE LIMITS OF ASPHALT CAP
- APPROXIMATE LIMITS OF SPCC AREA
- APPROXIMATE SOIL EXCAVATION AREA BOUNDARY
- A—A' TRANSECT LOCATION

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LOCATIONS OF SOIL BORINGS SB-179 AND SB-180 WERE MEASURED IN THE FIELD AND ARE APPROXIMATE.
6. MGP = MANUFACTURED GAS PLANT.
7. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
8. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
9. HTS = HIGH TEMPERATURE SUPERCONDUCTIVE.
10. SPCC = SPILL PREVENTION, CONTROL, AND COUNTERMEASURE.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

SAMPLE LOCATION MAP

ARCADIS

FIGURE
1-5

CITY:SYRACUSE, N.Y. DIV/GROUP:ENV/IM-DV DB:RCB WLL R.ALLEN LD: PIC: PM:M.JONES TM: LYR:ON=*;OFF=*REF* ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/28/2015 1:12 PM BY: ALLEN, ROYCE
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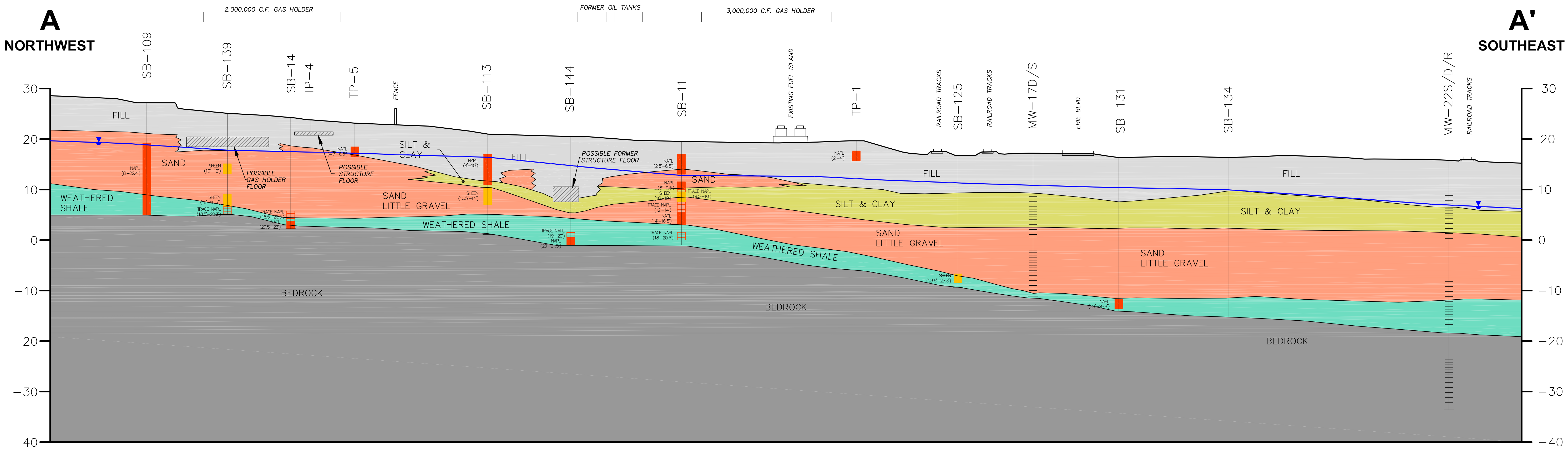


LEGEND:

- MW-2 — WELL/BORING ID
- GROUND SURFACE
- APPROXIMATE GROUNDWATER LEVEL (1997)
- LITHOLOGICAL CONTACT
- NAPL OBSERVED (SEE NOTE 4)
- TRACE NAPL OBSERVED (SEE NOTE 4)
- SHEEN OBSERVED (SEE NOTE 4)
- SCREEN
- BOTTOM OF BORING

- FILL
- SAND, LITTLE GRAVEL
- SILT & CLAY
- WEATHERED SHALE
- BEDROCK

NOTES:

1. COORDINATES ARE BASED ON THE NORTH AMERICAN DATUM OF 1983, NEW YORK EAST ZONE.
2. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. ALL LOCATION ARE APPROXIMATE.
4. SOIL/NAPL OBSERVATIONS MADE DURING DRILLING OR EXCAVATION.

0 10' 20'
VERTICAL SCALE

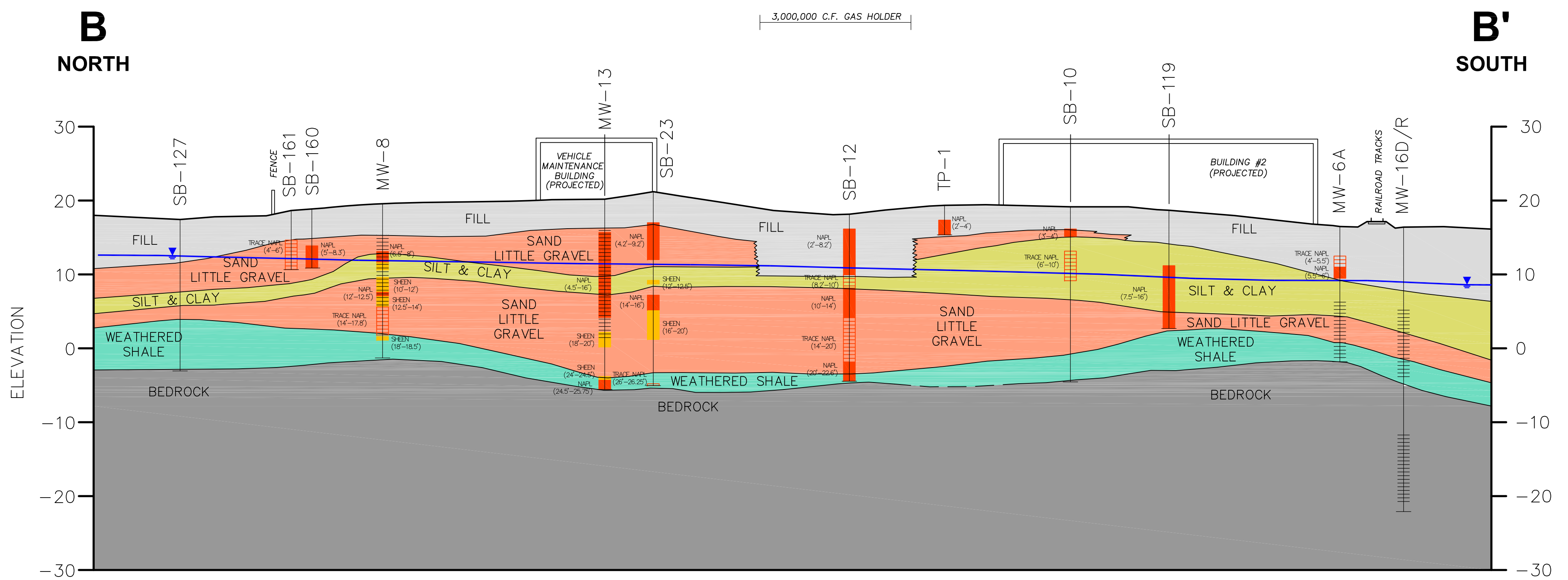
0 50' 100'
HORIZONTAL SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

GEOLOGIC CROSS SECTION A-A'

ARCADIS

FIGURE
1-6



LEGEND:

MW-8 WELL/BORING ID

GROUND SURFACE

APPROXIMATE GROUNDWATER LEVEL (JUNE 1997)

LITHOLOGICAL CONTACT

NAPL OBSERVED (SEE NOTE 4)

TRACE NAPL OBSERVED (SEE NOTE 4)

SHEEN OBSERVED (SEE NOTE 4)

SCREEN

BOTTOM OF BORING

FILL

SAND, LITTLE GRAVEL

SILT & CLAY

WEATHERED SHALE

BEDROCK

NOTES:

1. COORDINATES ARE BASED ON THE NORTH AMERICAN DATUM OF 1983, NEW YORK EAST ZONE.
2. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. ALL LOCATION ARE APPROXIMATE.
4. SOIL/NAPL OBSERVATIONS MADE DURING DRILLING OR EXCAVATION.

0 10' 20'
VERTICAL SCALE

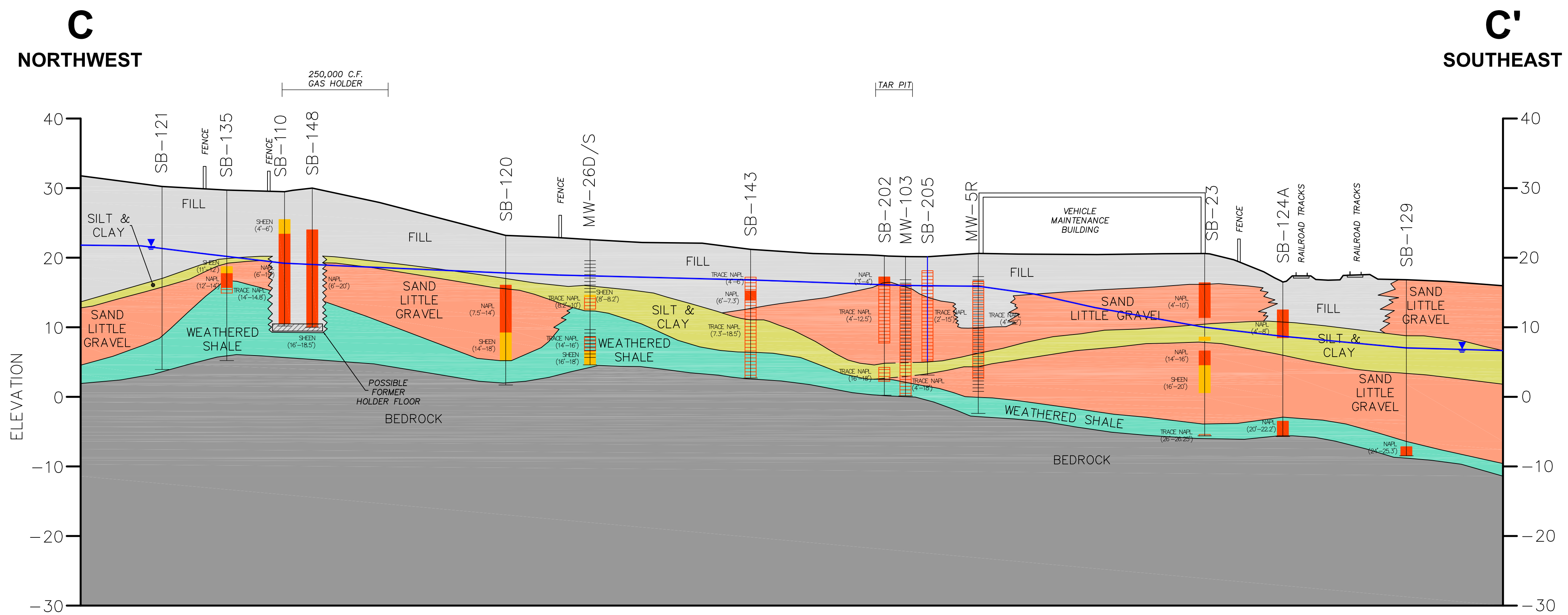
0 50' 100'
HORIZONTAL SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

GEOLOGIC CROSS SECTION B-B'

ARCADIS

FIGURE
1-7



LEGEND:

MW-26D/S	WELL/BORING ID
	GROUND SURFACE
	APPROXIMATE GROUNDWATER LEVEL (JUNE 1997)
	LITHOLOGICAL CONTACT
	NAPL OBSERVED (SEE NOTE 4)
	TRACE NAPL OBSERVED (SEE NOTE 4)
	SHEEN OBSERVED (SEE NOTE 4)
	SCREEN
	BOTTOM OF BORING

- FILL
- SAND, LITTLE GRAVEL
- SILT & CLAY
- WEATHERED SHALE
- BEDROCK

NOTES:

1. COORDINATES ARE BASED ON THE NORTH AMERICAN DATUM OF 1983, NEW YORK EAST ZONE.
2. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. ALL LOCATION ARE APPROXIMATE.
4. SOIL/NAPL OBSERVATIONS MADE DURING DRILLING OR EXCAVATION.

0 10' 20'
VERTICAL SCALE

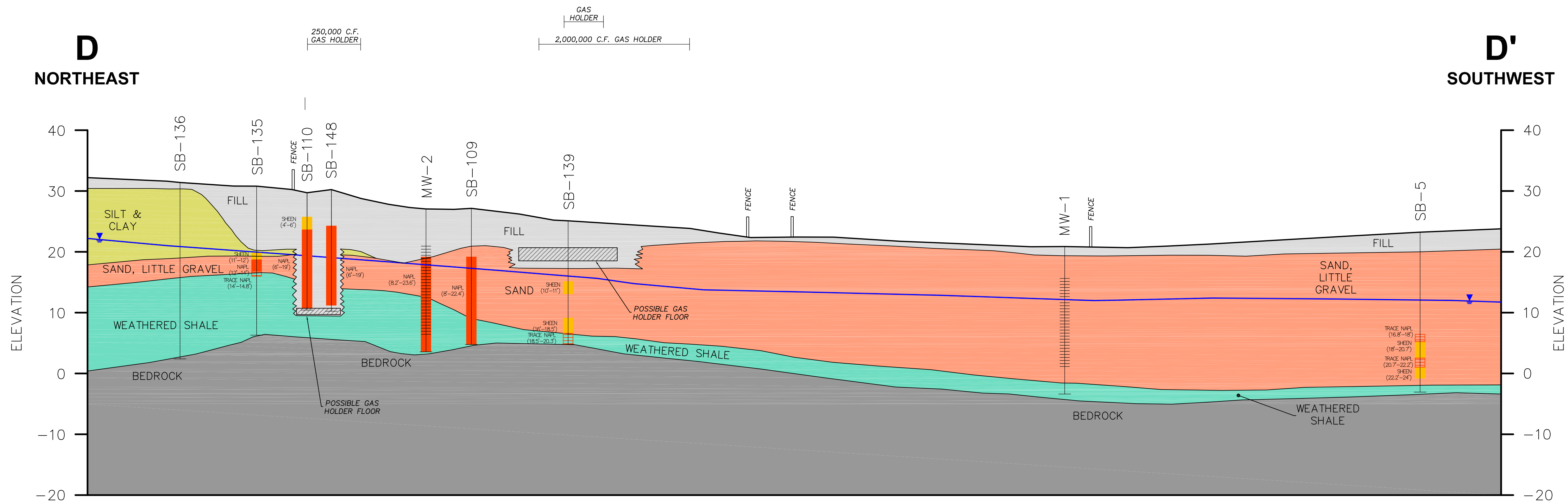
0 50' 100'
HORIZONTAL SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

GEOLOGIC CROSS SECTION C-C'

ARCADIS

FIGURE
1-8



MW−2

LEGEND:

- WELL/BORING ID
- GROUND SURFACE
- APPROXIMATE GROUNDWATER LEVEL (JUNE 1997)
- LITHOLOGICAL CONTACT
- NAPL OBSERVED (SEE NOTE 4)
- TRACE NAPL OBSERVED (SEE NOTE 4)
- SHEEN OBSERVED (SEE NOTE 4)
- SCREEN
- BOTTOM OF BORING

- FILL
- SAND, LITTLE GRAVEL
- SILT & CLAY
- WEATHERED SHALE
- BEDROCK

NOTES:

1. COORDINATES ARE BASED ON THE NORTH AMERICAN DATUM OF 1983, NEW YORK EAST ZONE.
2. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. ALL LOCATION ARE APPROXIMATE.
4. SOIL/NAPL OBSERVATIONS MADE DURING DRILLING OR EXCAVATION.

0 10' 20'
VERTICAL SCALE

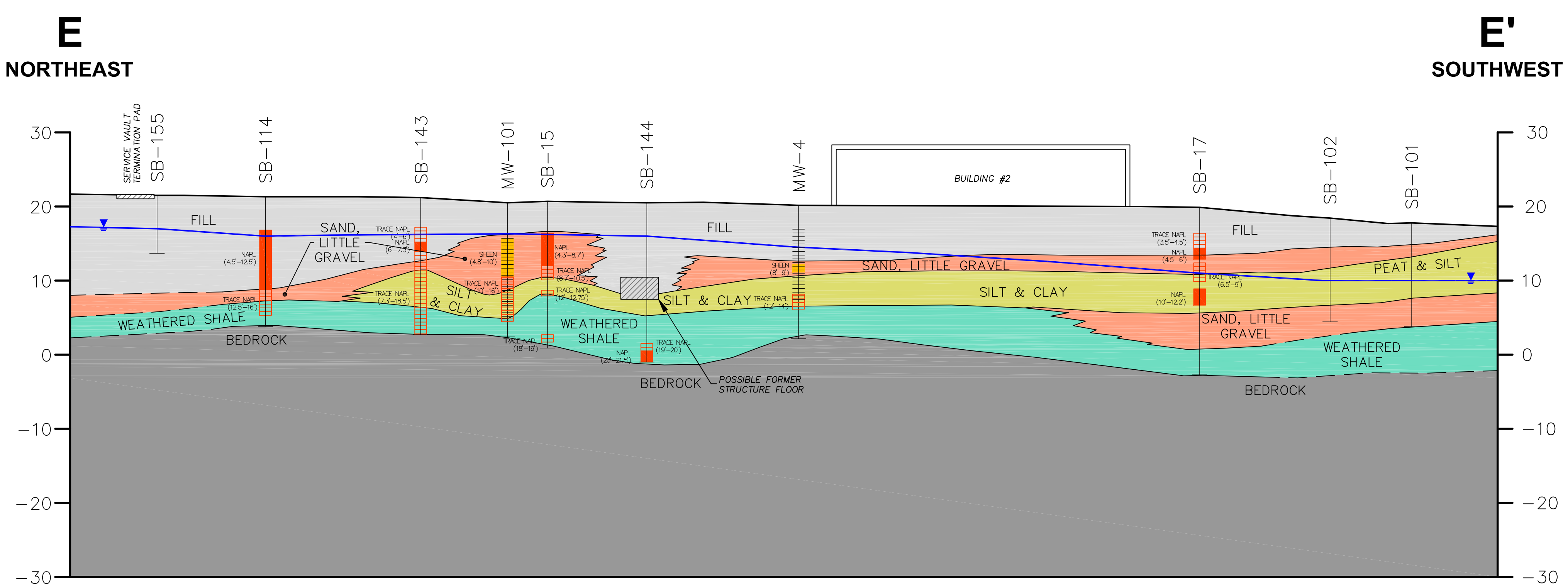
0 50' 100'
HORIZONTAL SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

GEOLOGIC CROSS SECTION D-D'

ARCADIS

FIGURE
1-9



LEGEND:

MW-4 — WELL/BORING ID

GROUND SURFACE

APPROXIMATE GROUNDWATER LEVEL (JUNE 1997)

LITHOLOGICAL CONTACT

NAPL OBSERVED (SEE NOTE 4)

TRACE NAPL OBSERVED (SEE NOTE 4)

SHEEN OBSERVED (SEE NOTE 4)

SCREEN

BOTTOM OF BORING

FILL

SAND, LITTLE GRAVEL

SILT & CLAY

WEATHERED SHALE

BEDROCK

NOTES:

1. COORDINATES ARE BASED ON THE NORTH AMERICAN DATUM OF 1983, NEW YORK EAST ZONE.
2. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. ALL LOCATION ARE APPROXIMATE.
4. SOIL/NAPL OBSERVATIONS MADE DURING DRILLING OR EXCAVATION.

0 10' 20'
VERTICAL SCALE

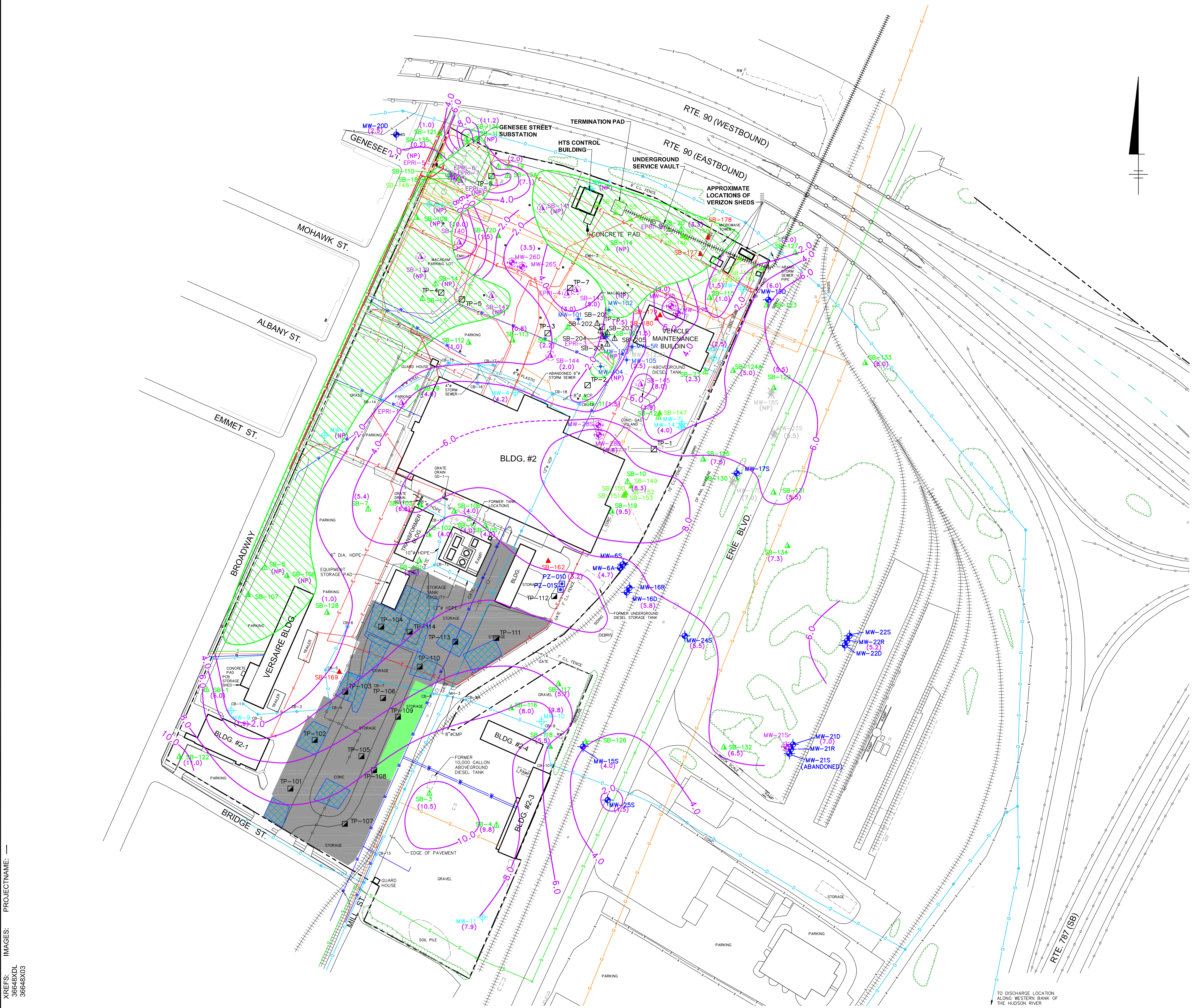
0 50' 100'
HORIZONTAL SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

GEOLOGIC CROSS SECTION E-E'

ARCADIS

FIGURE
1-10



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- HISTORICAL SITE FEATURE
- APPROXIMATE PROPERTY LINE
- MW-105 PILOT-TEST MONITORING WELL LOCATION
- SB-205 PILOT-TEST BASELINE SOIL BORING LOCATION
- SB-147 TREATABILITY STUDY SOIL BORING LOCATION
- SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- SB-126 MGP/RCRA SOIL BORING LOCATION
- TP-105 MGP/RCRA TEST PIT LOCATION
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- SB-4 PSA/IRM SOIL BORING LOCATION
- TP-3 PSA/IRM TEST PIT LOCATION
- SB-156 HTS PROJECT SOIL BORING LOCATION
- SB-162 SUPPLEMENTAL INVESTIGATION SOIL BORING LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE LIMITS OF ASPHALT CAP
- APPROXIMATE LIMITS OF SPCC AREA
- APPROXIMATE SOIL EXCAVATION AREA BOUNDARY
- APPROXIMATE SILT & CLAY UNIT NOT PRESENT (NP)
- (5.2) OBSERVED THICKNESS (FEET)
- 6.0 ISOPACH CONTOUR LINE (FEET) (DASHED WHERE INFERRED

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON-SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D-29734-E, FILE INDEX NO. 20.3-A1.1-B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATION OF UNDERGROUND TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, AND CABLE LINES WERE UPDATED BASED ON ELECTROMAGNETIC UTILITY SURVEY CONDUCTED BY UNDERGROUND SERVICES, INC. DURING OCTOBER 2012. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES MUST BE DETERMINED/CONFIRMED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LOCATIONS OF SOIL BORINGS SB-179 AND SB-180 WERE MEASURED IN THE FIELD AND ARE APPROXIMATE.
6. MGP = MANUFACTURED GAS PLANT.
7. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
8. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
9. HTS = HIGH TEMPERATURE SUPERCONDUCTIVE.
10. SPCC = SPILL PREVENTION, CONTROL, AND COUNTERMEASURE.

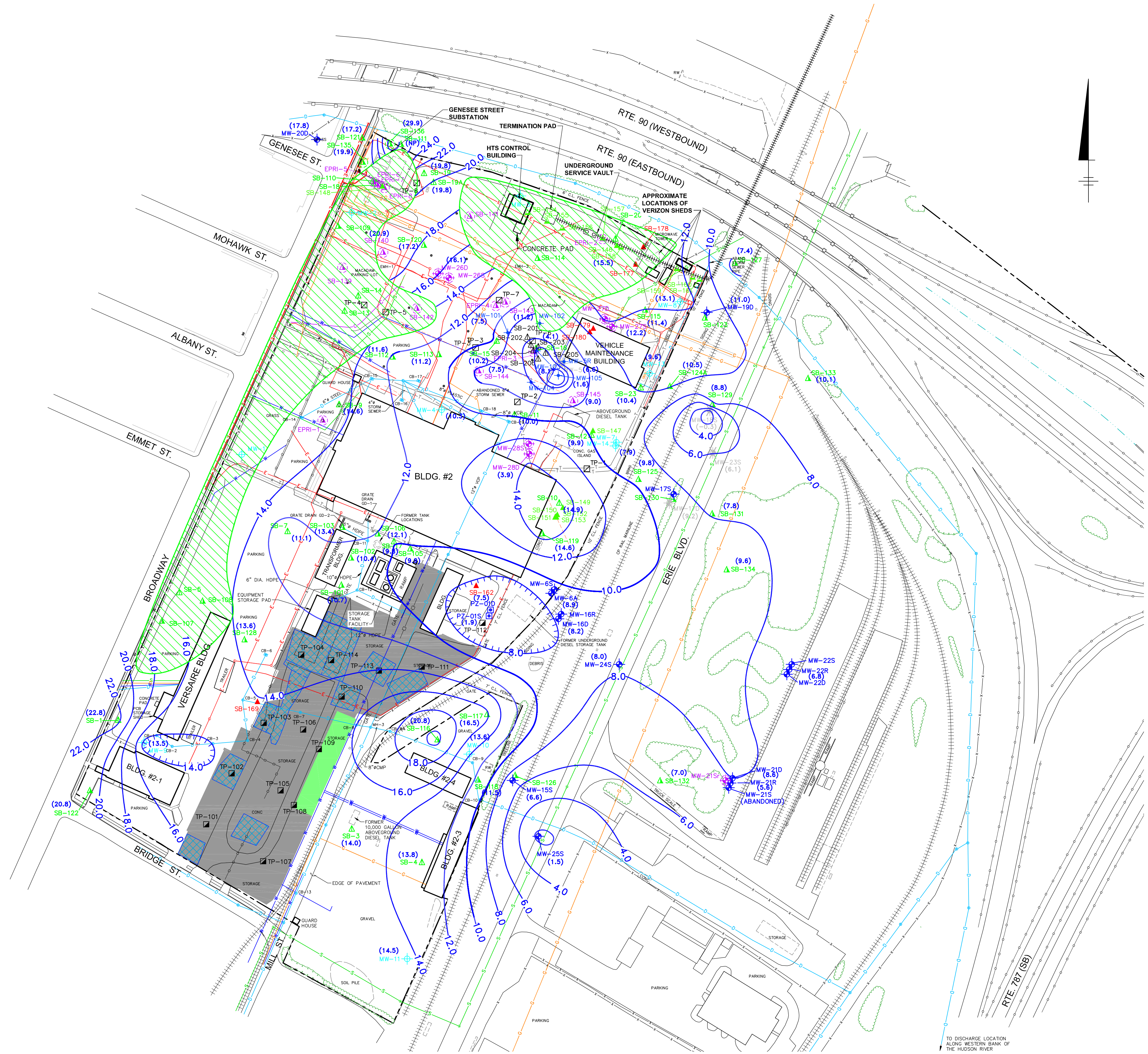
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ISOPACH OF SILT & CLAY UNIT

ARCADIS

FIGURE
1-11



LEGEND:

APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
GUARD RAIL
FENCE
EXISTING RAILROAD
APPROXIMATE PROPERTY LINE
MW-105 PILOT-TEST MONITORING WELL LOCATION
SB-205 PILOT-TEST BASELINE SOIL BORING LOCATION
SB-147 TREATABILITY STUDY SOIL BORING LOCATION
SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
PZ-01S MGP/RCRA PIEZOMETER
SB-126 MGP/RCRA SOIL BORING LOCATION
MW-11 MGP/RCRA TEST PIT LOCATION
TP-105 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
SB-4 PSA/IRM SOIL BORING LOCATION
TP-3 PSA/IRM TEST PIT LOCATION
SB-156 HTS PROJECT SOIL BORING LOCATION
SB-162 SUPPLEMENTAL INVESTIGATION SOIL BORING LOCATION
MW-18S DESTROYED GROUNDWATER MONITORING WELL
UTILITY POLE
EXISTING CATCH BASIN
EXISTING STORM SEWER MANHOLE
EXISTING SANITARY MANHOLE
EXISTING ELECTRICAL MANHOLE
EXISTING TELEPHONE MANHOLE
EXISTING UNKNOWN UTILITY MANHOLE
STORM SEWER
SANITARY SEWER
TELEPHONE LINE
ELECTRICAL LINE
GAS LINE
WATER LINE
CABLE LINE
UNKNOWN UTILITY
APPROXIMATE LIMITS OF ASPHALT CAP
APPROXIMATE LIMITS OF SPCC AREA
APPROXIMATE SOIL EXCAVATION AREA BOUNDARY
APPROXIMATE SILT & CLAY UNIT NOT PRESENT
(5.2) TOP OF SILT & CLAY UNIT (FEET AMSL)
6.0 GENERALIZED TOP OF SILT & CLAY UNIT (FEET AMSL)

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LOCATIONS OF SOIL BORINGS SB-179 AND SB-180 WERE MEASURED IN THE FIELD AND ARE APPROXIMATE.
6. MGP = MANUFACTURED GAS PLANT.
7. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
8. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
9. HTS = HIGH TEMPERATURE SUPERCONDUCTIVE.
10. SPCC = SPILL PREVENTION, CONTROL, AND COUNTERMEASURE.
11. AMSL = ABOVE MEAN SEA LEVEL.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

TOP OF SILT & CLAY UNIT

ARCADIS

FIGURE
1-12

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- SB-126 MGP/RCRA SOIL BORING LOCATION
- TP-105 MGP/RCRA TEST PIT LOCATION
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- SB-4 PSA/IRM SOIL BORING LOCATION
- TP-3 PSA/IRM TEST PIT LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- CB EXISTING CATCH BASIN
- D EXISTING STORM SEWER MANHOLE
- S EXISTING SANITARY MANHOLE
- E EXISTING ELECTRICAL MANHOLE
- T EXISTING TELEPHONE MANHOLE
- ? EXISTING UNKNOWN UTILITY MANHOLE
- D STORM SEWER
- S SANITARY SEWER
- T TELEPHONE LINE
- E ELECTRICAL LINE
- G GAS LINE
- W WATER LINE
- C CABLE LINE
- UNKNOWN UTILITY
- (-11.10) TOP OF BEDROCK SURFACE ELEVATION (FEET, MSL)
- -10 TOP OF BEDROCK SURFACE ELEVATION CONTOUR LINE (FEET, MSL)

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. TOP OF BEDROCK SURFACE ELEVATIONS ARE BASED ON VISUAL OBSERVATIONS DURING SOIL BORING ACTIVITIES AND THE FINDINGS OF A GROUND PENETRATING RADAR (GPR) SURVEY CONDUCTED AT THE SITE DURING FEBRUARY 1997.
6. MGP = MANUFACTURED GAS PLANT.
7. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
8. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
9. HTS = HIGH TEMPERATURE SUPERCONDUCTIVE.
10. SPCC = SPILL PREVENTION, CONTROL, AND COUNTERMEASURE.
11. MSL = MEAN SEA LEVEL.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

TOP OF WEATHERED BEDROCK SURFACE MAP

ARCADIS

FIGURE
1-13

CITY: SYRACUSE, N.Y. DIV/GROUP: ENV CAD/IM-DV DB: LJP R. BASSETT, R.ALLEN LD:(Opt) PIC:(Opt) PM: M.JONES TM: J.HORSTMAN LYR:(Opt)ON=*;OFF=*REF*
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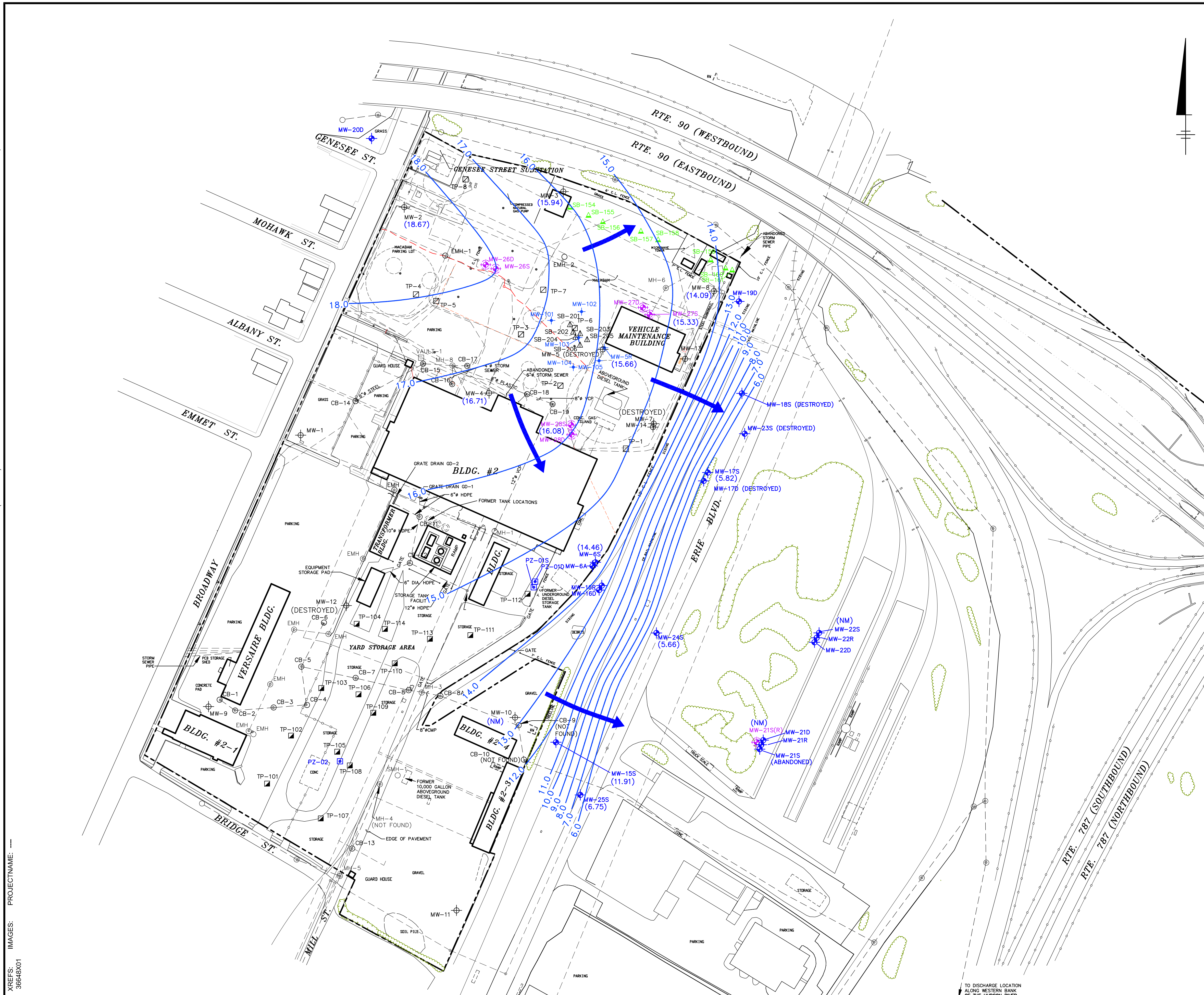

LEGEND:

- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- MW-105 PILOT-TEST MONITORING WELL LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- (NM) NOT MEASURED
- (4.6) GROUNDWATER ELEVATION (FT., AMSL)
- [10.6] GROUNDWATER ELEVATION (FT., AMSL; SEE NOTE 5)
- 6.0 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)(FT., AMSL)
- GENERALIZED GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NATIONAL GRID DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. GROUNDWATER ELEVATION DATA OBTAINED FROM MONITORING WELLS MW-1, MW-7, MW-11, MW-12, MW-14, MW-21SR AND PZ-02 WERE NOT INCLUDED WHEN CREATING THIS CONTOUR MAP.
6. MGP = MANUFACTURED GAS PLANT.
7. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
8. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
9. AMSL = ABOVE MEAN SEA LEVEL.

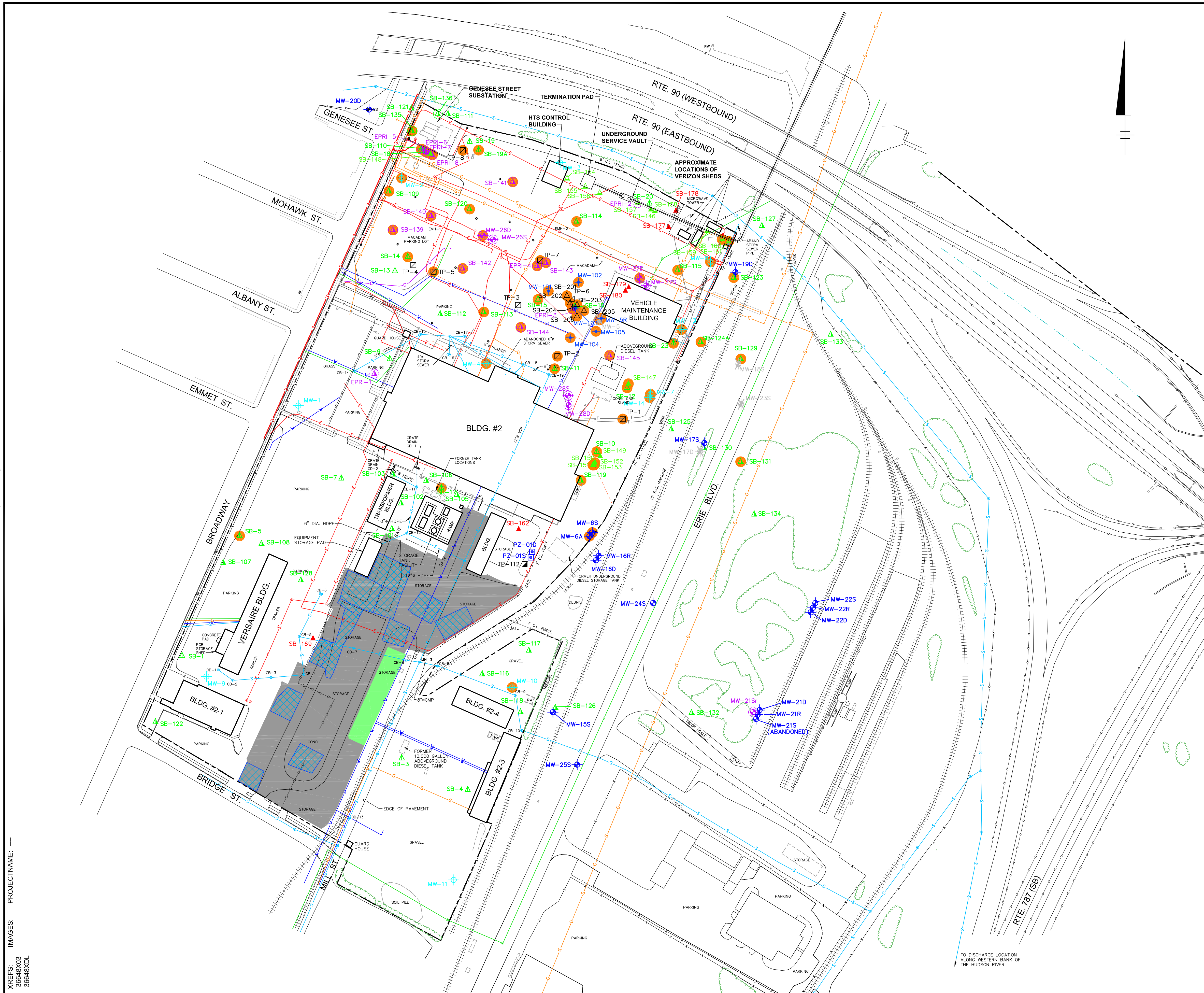
NATIONAL GRID
NORTH ALBANY SERVICE CENTER
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

WATER TABLE ELEVATION MAP (DECEMBER 2011)

ARCADIS

FIGURE
1-14

CITY: SYRACUSE, N.Y. DIV/GROUP: ENV/IM-DV DB: LJP R.BASSETT, R.ALLEN LD:(Opt) PIC:(Opt) PM: M.JONES TM: J.HORSTMAN LYR:(Opt)ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/28/2015 4:00 PM BY: ALLEN, ROYCE
G:\ENVCAD\SYRACUSE\ACT\B0036648\1401\00002\DWG\FS-REPORT\36648C01.DWG LAYOUT: 1-15 SAVED: 12/28/2015 4:00 PM ACADVER: 19.1S (LMS TECH)
XREFS: 36648X03 36648XDL IMAGES: PROJECTNAME: ----



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- MW-105 PILOT-TEST MONITORING WELL LOCATION
- SB-205 PILOT-TEST BASELINE SOIL BORING LOCATION
- SB-147 TREATABILITY STUDY SOIL BORING LOCATION
- SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- SB-126 MGP/RCRA SOIL BORING LOCATION
- TP-105 MGP/RCRA TEST PIT LOCATION
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- SB-4 PSA/IRM SOIL BORING LOCATION
- TP-3 PSA/IRM TEST PIT LOCATION
- SB-156 HTS PROJECT SOIL BORING LOCATION
- SB-162 SUPPLEMENTAL INVESTIGATION SOIL BORING LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- D STORM SEWER
- S SANITARY SEWER
- T TELEPHONE LINE
- E ELECTRICAL LINE
- G GAS LINE
- W WATER LINE
- C CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE SOIL EXCAVATION AREA BOUNDARY
- APPROXIMATE LIMITS OF ASPHALT CAP
- APPROXIMATE LIMITS OF SPCC AREA
- INVESTIGATION LOCATION OBSERVED TO CONTAIN MGP- AND/OR PETROLEUM-RELATED MATERIAL

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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6. MGP = MANUFACTURED GAS PLANT.
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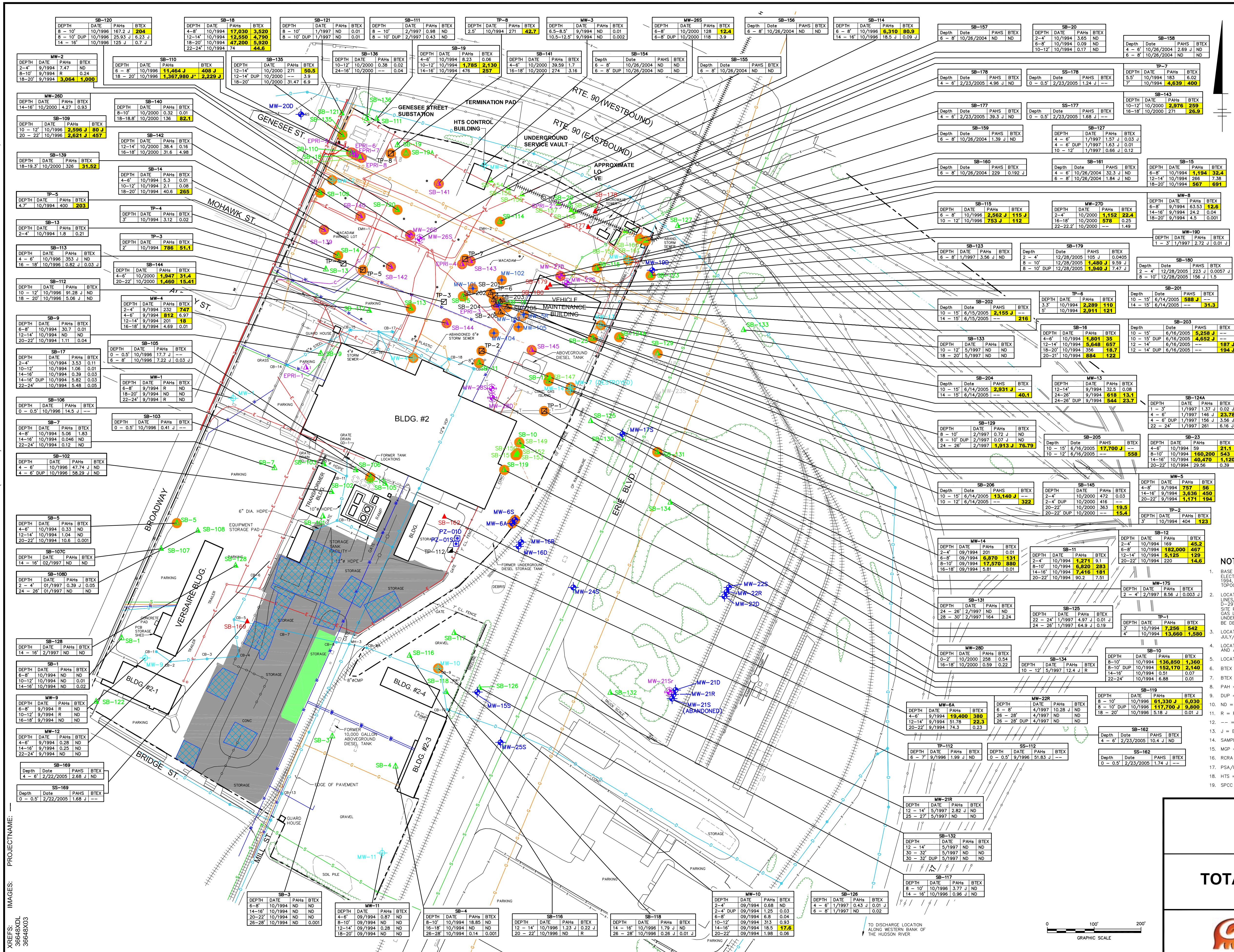
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

VISUAL EXTENT OF MGP- AND/OR PETROLEUM-RELATED MATERIALS

ARCADIS

FIGURE
1-15



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- MW-105 PILOT-TEST MONITORING WELL LOCATION
- SB-205 PILOT-TEST BASELINE SOIL BORING LOCATION
- SB-147 TREATABILITY STUDY SOIL BORING LOCATION
- SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- SB-126 MGP/RCRA SOIL BORING LOCATION
- TP-105 MGP/RCRA TEST PIT LOCATION
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- SB-4 PSA/IRM SOIL BORING LOCATION
- TP-3 PSA/IRM TEST PIT LOCATION
- SB-156 HTS PROJECT SOIL BORING LOCATION
- SB-162 SUPPLEMENTAL INVESTIGATION SOIL BORING LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- TOTAL PAHs DETECTED AT A CONCENTRATION GREATER THAN 500 PPM OR BTEX DETECTED AT CONCENTRATION GREATER THAN 10 PPM.
- APPROXIMATE SOIL EXCAVATION AREA BOUNDARY
- APPROXIMATE LIMITS OF ASPHALT CAP
- APPROXIMATE LIMITS OF SPCC AREA
- INVESTIGATION LOCATION OBSERVED TO CONTAIN MGP- AND/OR PETROLEUM-RELATED MATERIALS

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012..
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LOCATIONS OF SOIL BORINGS SB-179 AND SB-180 WERE MEASURED IN THE FIELD AND ARE APPROXIMATE.
6. BTEX AND PAH CONCENTRATIONS REPORTED IN PARTS PER MILLION (PPM).
7. BTEX = BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES (TOTAL).
8. PAH = POLYNUCLEAR AROMATIC HYDROCARBONS.
9. DUP = DUPLICATE SAMPLE.
10. ND = NOT DETECTED AT CONCENTRATION EXCEEDING LABORATORY DETECTION LIMITS.
11. R = REJECTED SAMPLE RESULT.
12. -- = PARAMETER NOT ANALYZED.
13. J = ESTIMATED SAMPLE RESULT.
14. SAMPLE RESULTS FOR SOIL REMOVED BY EXCAVATION ARE NOT SHOWN.
15. MGP = MANUFACTURED GAS PLANT.
16. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
17. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
18. HTS = HIGH TEMPERATURE SUPERCONDUCTIVE.
19. SPCC = SPILL PREVENTION, CONTROL, AND COUNTERMEASURE.

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

TOTAL BTEX/PAHs IN SOIL (PPM)

ARCADIS

FIGURE
1-16

CITY: SYRACUSE, N.Y. DIV/GROUP: ENV/IM-DV DB: LJP, R BASSETT, R.ALLEN LD:(Opt) PIC:(Opt) PM:M.JONES TM:J.HORSTMAN LYR:(Opt)ON=*;OFF=*REF*
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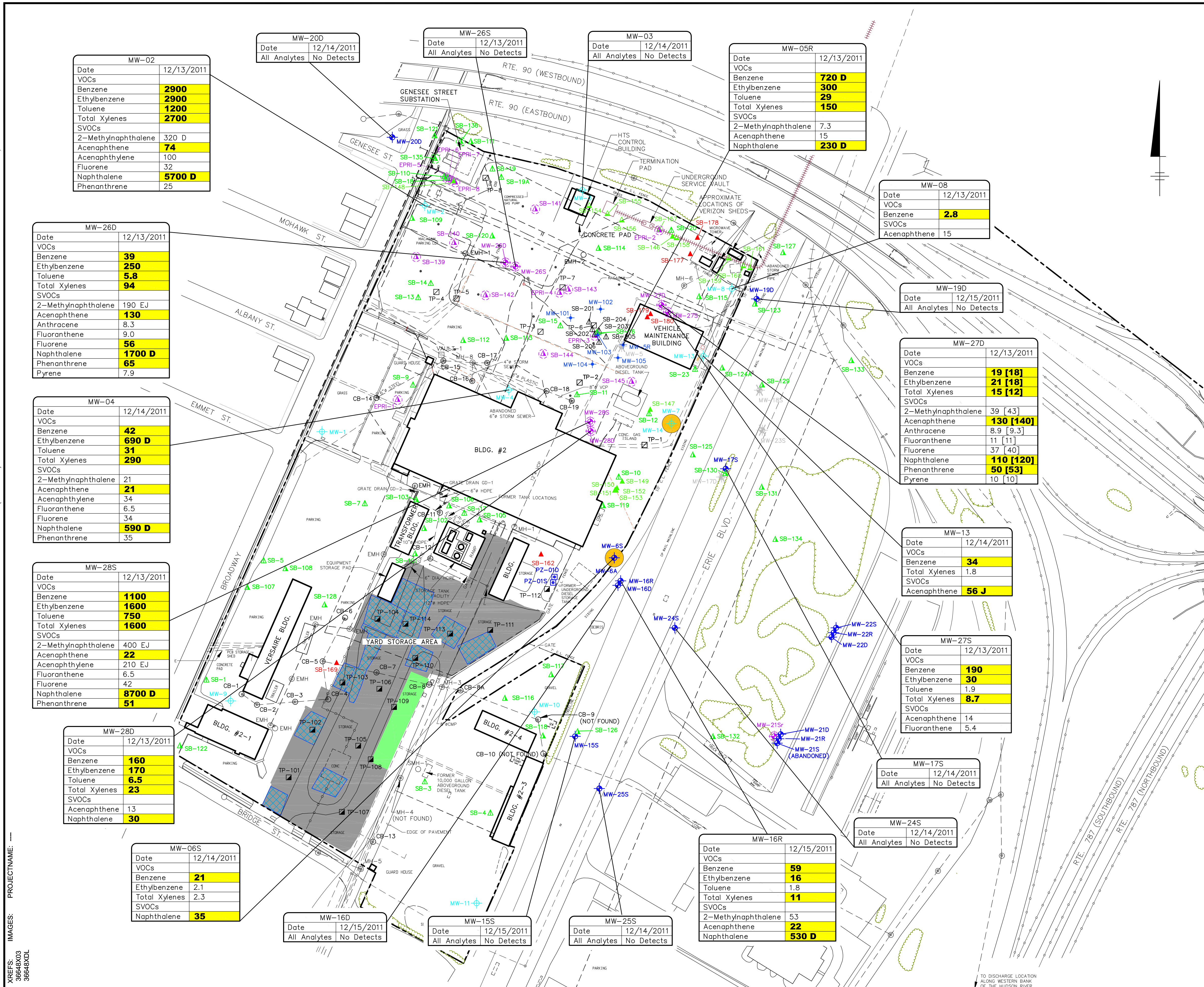

MW-02	
Date	12/13/2011
VOCs	
Benzene	2900
Ethylbenzene	2900
Toluene	1200
Total Xylenes	2700
SVOCs	
2-Methylnaphthalene	320 D
Acenaphthene	74
Acenaphthylene	100
Fluorene	32
Naphthalene	5700 D
Phenanthrene	25

MW-20D	
Date	12/14/2011
All Analytes	No Detects

MW-26S	
Date	12/13/2011
All Analytes	No Detects

MW-03	
Date	12/14/2011
All Analytes	No Detects

MW-05R	
Date	12/13/2011
VOCs	
Benzene	720 D
Ethylbenzene	300
Toluene	29
Total Xylenes	150
SVOCs	
2-Methylnaphthalene	7.3
Acenaphthene	15
Naphthalene	230 D

MW-08	
Date	12/13/2011
VOCs	
Benzene	2.8
SVOCs	
Acenaphthene	15

MW-26D	
Date	12/13/2011
VOCs	
Benzene	39
Ethylbenzene	250
Toluene	5.8
Total Xylenes	94
SVOCs	
2-Methylnaphthalene	190 EJ
Acenaphthene	130
Anthracene	8.3
Fluoranthene	9.0
Fluorene	56
Naphthalene	1700 D
Phenanthrene	65
Pyrene	7.9

MW-19D	
Date	12/15/2011
All Analytes	No Detects

MW-27D	
Date	12/13/2011
VOCs	
Benzene	19 [18]
Ethylbenzene	21 [18]
Total Xylenes	15 [12]
SVOCs	
2-Methylnaphthalene	39 [43]
Acenaphthene	130 [140]
Anthracene	8.9 [9.3]
Fluoranthene	11 [11]
Fluorene	37 [40]
Naphthalene	110 [120]
Phenanthrene	50 [53]
Pyrene	10 [10]

MW-04	
Date	12/14/2011
VOCs	
Benzene	42
Ethylbenzene	690 D
Toluene	31
Total Xylenes	290
SVOCs	
2-Methylnaphthalene	21
Acenaphthene	21
Acenaphthylene	34
Fluoranthene	6.5
Fluorene	34
Naphthalene	590 D
Phenanthrene	35

MW-13	
Date	12/14/2011
VOCs	
Benzene	34
Total Xylenes	1.8
SVOCs	
Acenaphthene	56 J

MW-28S	
Date	12/13/2011
VOCs	
Benzene	1100
Ethylbenzene	1600
Toluene	750
Total Xylenes	1600
SVOCs	
2-Methylnaphthalene	400 EJ
Acenaphthene	22
Acenaphthylene	210 EJ
Fluoranthene	6.5
Fluorene	42
Naphthalene	8700 D
Phenanthrene	51

MW-27S	
Date	12/13/2011
VOCs	
Benzene	190
Ethylbenzene	30
Toluene	1.9
Total Xylenes	8.7
SVOCs	
Acenaphthene	14
Fluoranthene	5.4

MW-28D	
Date	12/13/2011
VOCs	
Benzene	160
Ethylbenzene	170
Toluene	6.5
Total Xylenes	23
SVOCs	
Acenaphthene	13
Naphthalene	30

MW-17S	
Date	12/14/2011
All Analytes	No Detects

MW-24S	
Date	12/14/2011
All Analytes	No Detects

MW-06S	
Date	12/14/2011
VOCs	
Benzene	21
Ethylbenzene	2.1
Total Xylenes	2.3
SVOCs	
Naphthalene	35

MW-16R	
Date	12/15/2011
VOCs	
Benzene	59
Ethylbenzene	16
Toluene	1.8
Total Xylenes	11
SVOCs	
2-Methylnaphthalene	53
Acenaphthene	22
Naphthalene	530 D

MW-16D	
Date	12/15/2011
All Analytes	No Detects

MW-15S	
Date	12/15/2011
All Analytes	No Detects

MW-25S	
Date	12/14/2011
All Analytes	No Detects

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- MW-105 PILOT-TEST MONITORING WELL LOCATION
- SB-205 PILOT-TEST BASELINE SOIL BORING LOCATION
- SB-147 TREATABILITY STUDY SOIL BORING LOCATION
- SB-141 PRE-DESIGN INVESTIGATION SOIL BORING LOCATION
- MW-28S ADDITIONAL GROUNDWATER INVESTIGATION GROUNDWATER MONITORING WELL LOCATION
- MW-15S MGP/RCRA GROUNDWATER MONITORING WELL LOCATION
- PZ-01S MGP/RCRA PIEZOMETER
- SB-126 MGP/RCRA SOIL BORING LOCATION
- TP-105 MGP/RCRA TEST PIT LOCATION
- MW-11 PSA/IRM GROUNDWATER MONITORING WELL LOCATION
- SB-4 PSA/IRM SOIL BORING LOCATION
- TP-3 PSA/IRM TEST PIT LOCATION
- SB-156 HTS PROJECT SOIL BORING LOCATION
- SB-162 SUPPLEMENTAL INVESTIGATION SOIL BORING LOCATION
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- D STORM SEWER
- S SANITARY SEWER
- T TELEPHONE LINE
- E ELECTRICAL LINE
- G GAS LINE
- W WATER LINE
- C CABLE LINE
- UNKNOWN UTILITY
- CONSTITUENT DETECTED AT CONCENTRATION EXCEEDING NYSDEC STANDARDS/GUIDANCE VALUES PRESENTED IN TOGS 1.1.1.
- APPROXIMATE SOIL EXCAVATION AREA BOUNDARY
- APPROXIMATE LIMITS OF ASPHALT CAP
- APPROXIMATE LIMITS OF SPCC AREA
- DNAPL OBSERVED IN WELL DURING 12/2007 GROUNDWATER SAMPLING EVENT AND SUBSEQUENT QUARTERLY NAPL GAUGING EVENTS IN 2008
- LNAPL OBSERVED IN WELL DURING 12/2007 GROUNDWATER SAMPLING EVENT AND SUBSEQUENT QUARTERLY NAPL GAUGING EVENTS IN 2008

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND PSA/IRM SAMPLING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON-SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D-29734-E, FILE INDEX NO. 20.3-A1.1-B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATION OF UNDERGROUND TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, AND CABLE LINES WERE UPDATED BASED ON ELECTROMAGNETIC UTILITY SURVEY CONDUCTED BY UNDERGROUND SERVICES, INC. DURING OCTOBER 2012. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES MUST BE DETERMINED/CONFIRMED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LOCATIONS OF PRE-DESIGN INVESTIGATION SOIL BORINGS AND ADDITIONAL GROUNDWATER INVESTIGATION MONITORING WELLS WERE OBTAINED FROM A SURVEY CONDUCTED BY NMPC DURING NOVEMBER 2000.
6. ALL CONCENTRATIONS ARE IN PARTS PER BILLION (ppb).
7. B = INDICATES A VALUE WHICH IS LESS THAN THE CONTRACT REQUIRED DETECTION LIMIT, BUT GREATER THAN OR EQUAL TO THE INSTRUMENT DETECTION LIMIT.
8. J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.
9. ANALYTICAL RESULTS SHOWN ARE FROM THE MOST RECENT SAMPLING EVENT AT EACH MONITORING WELL LOCATION.
10. MONITORING WELLS MW-6S AND MW-7 WERE INSTALLED BUT HAVE NOT BEEN SAMPLED DUE TO PRESENCE OF DNAPL.
11. LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID.
12. DNAPL = DENSE NON-AQUEOUS PHASE LIQUID.
13. MGP = MANUFACTURED GAS PLANT.
14. RCRA = RESOURCE CONSERVATION RECOVERY ACT.
15. PSA/IRM = PRELIMINARY SITE ASSESSMENT/INTERIM REMEDIAL MEASURE.
16. HTS = HIGH TEMPERATURE SUPERCONDUCTIVE.
17. SPCC = SPILL PREVENTION, CONTROL, AND COUNTERMEASURE.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

GROUNDWATER ANALYTICAL RESULTS (DECEMBER 2011) DETECTED VOCs AND SVOCs (ppb)

ARCADIS

FIGURE
1-17

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE LOCATION OF PASSIVE NAPL BARRIER WALL
- APPROXIMATE SOIL EXCAVATION AREA
- APPROXIMATE CAP LIMITS
- APPROXIMATE LOCATION OF LNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF DNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF NAPL MONITORING WELL

NOTES:

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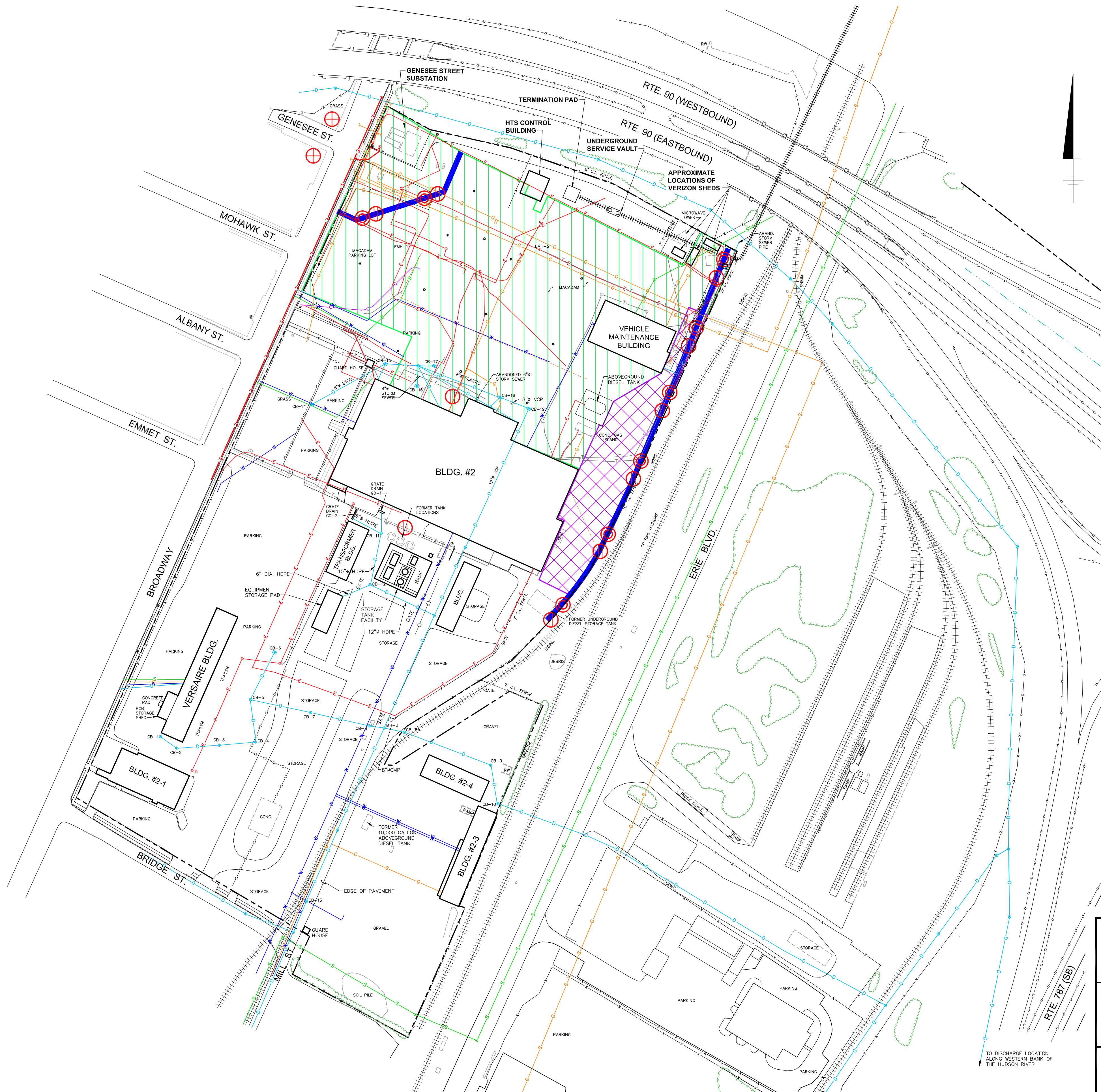
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LNAPL = LIGHT NON–AQUEOUS PHASE LIQUID.
6. DNAPL = DENSE NON–AQUEOUS PHASE LIQUID.

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE FMA-2

ARCADIS

FIGURE
5-1



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE LOCATION OF PASSIVE NAPL BARRIER WALL
- APPROXIMATE SOIL EXCAVATION AREA
- APPROXIMATE CAP LIMITS
- APROXIMATE LOCATION OF LNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF DNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF NAPL MONITORING WELL

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON–SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D–29734–E, FILE INDEX NO. 20.3–A1.1–B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATION OF UNDERGROUND TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, AND CABLE LINES WERE UPDATED BASED ON ELECTROMAGNETIC UTILITY SURVEY CONDUCTED BY UNDERGROUND SERVICES, INC. DURING OCTOBER 2012. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES MUST BE DETERMINED/CONFIRMED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
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4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. NAPL = NON–AQUEOUS PHASE LIQUID.
6. LNAPL = LIGHT NON–AQUEOUS PHASE LIQUID.
7. DNAPL = DENSE NON–AQUEOUS PDHASE LIQUID.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE FMA-3

ARCADIS

FIGURE
5-2

CITY: SYRACUSE, N.Y. DIV/GROUP: ENV/IM-DV DB: LJP, R.BASSETT, R.ALLEN LD:(Opt) PIC:(Opt) PM:M. JONES TM:J.HORSTMAN LYR:(Opt)ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/29/2015 2:45 PM BY: ALLEN, ROYCE
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36648X03

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- CB EXISTING CATCH BASIN
- D EXISTING STORM SEWER MANHOLE
- S EXISTING SANITARY MANHOLE
- E EXISTING ELECTRICAL MANHOLE
- T EXISTING TELEPHONE MANHOLE
- ? EXISTING UNKNOWN UTILITY MANHOLE
- D STORM SEWER
- S SANITARY SEWER
- T TELEPHONE LINE
- E ELECTRICAL LINE
- G GAS LINE
- W WATER LINE
- C CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE LOCATION OF PASSIVE NAPL BARRIER WALL
- APPROXIMATE SOIL EXCAVATION AREA
- APPROXIMATE CAP LIMITS
- APPROXIMATE ISS AREAS (SUBJECT TO ACCESS)(TO BE CAPPED)
- APROXIMATE LOCATION OF LNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF DNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF NAPL MONITORING WELL

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE FMA-4

ARCADIS

FIGURE
5-3

CITY: SYRACUSE NY DIV/GROUP: ENV/IM-DV DB: R.BASSETT, E. KRAHMER, R. ALLEN LD:(Opt) PIC: T. YOUNG PM: M. JONES TM: M.JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF*
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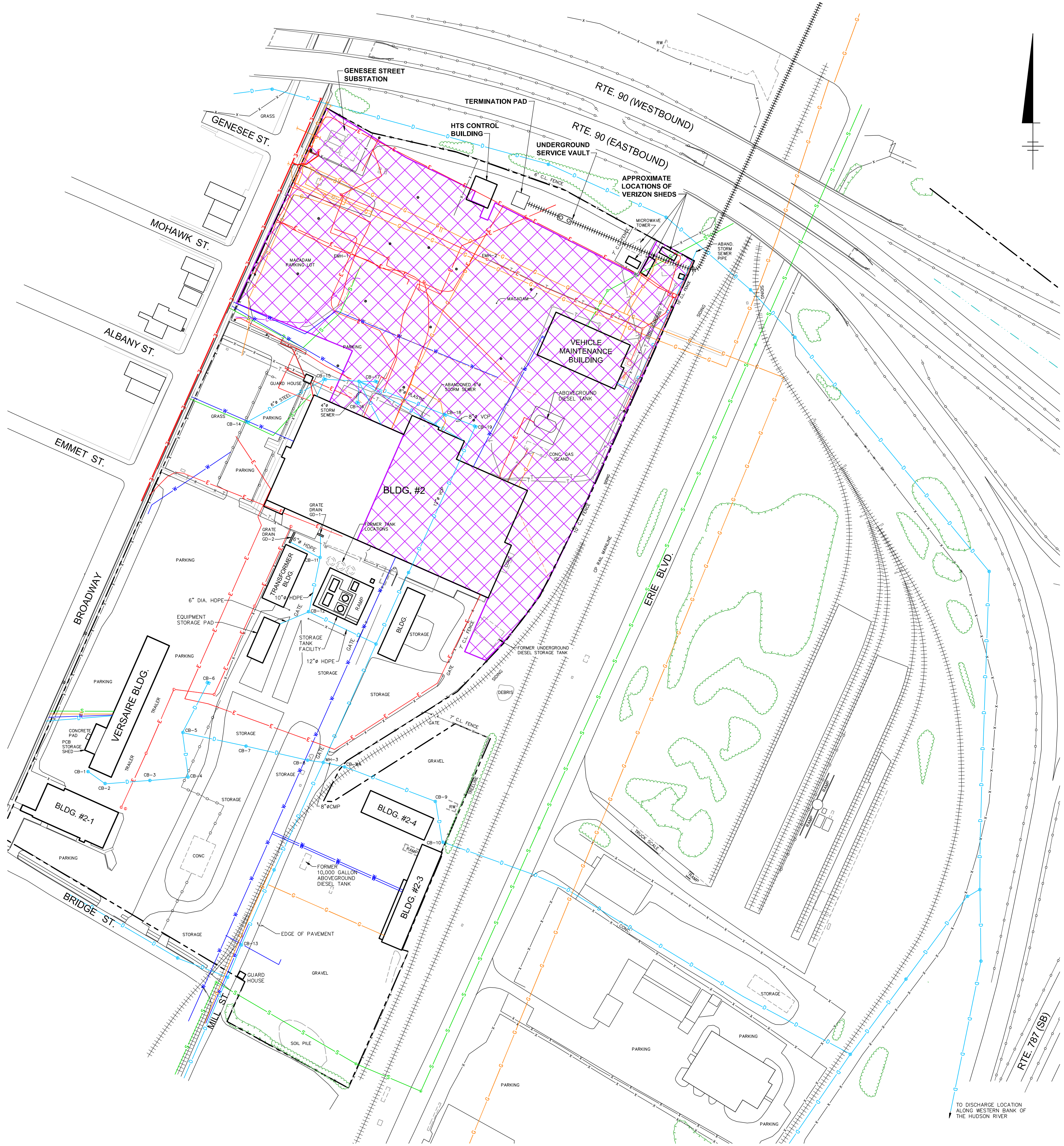

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE SOIL EXCAVATION AREA

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON-SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D-29734-E, FILE INDEX NO. 20.3-A1.1-B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATION OF UNDERGROUND TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, AND CABLE LINES WERE UPDATED BASED ON ELECTROMAGNETIC UTILITY SURVEY CONDUCTED BY UNDERGROUND SERVICES, INC. DURING OCTOBER 2012. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES MUST BE DETERMINED/CONFIRMED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
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4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID.
6. DNAPL = DENSE NON-AQUEOUS PHASE LIQUID.

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE FMA-5

ARCADIS

FIGURE
5-4

CITY: SYRACUSE NY DIV/GROUP: ENV/IM-DV DB: LJP, R. BASSETT, E. KRAHMER, R. ALLEN LD:(Opt) PIC: T. YOUNG PM: M. JONES TM: M.JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF*
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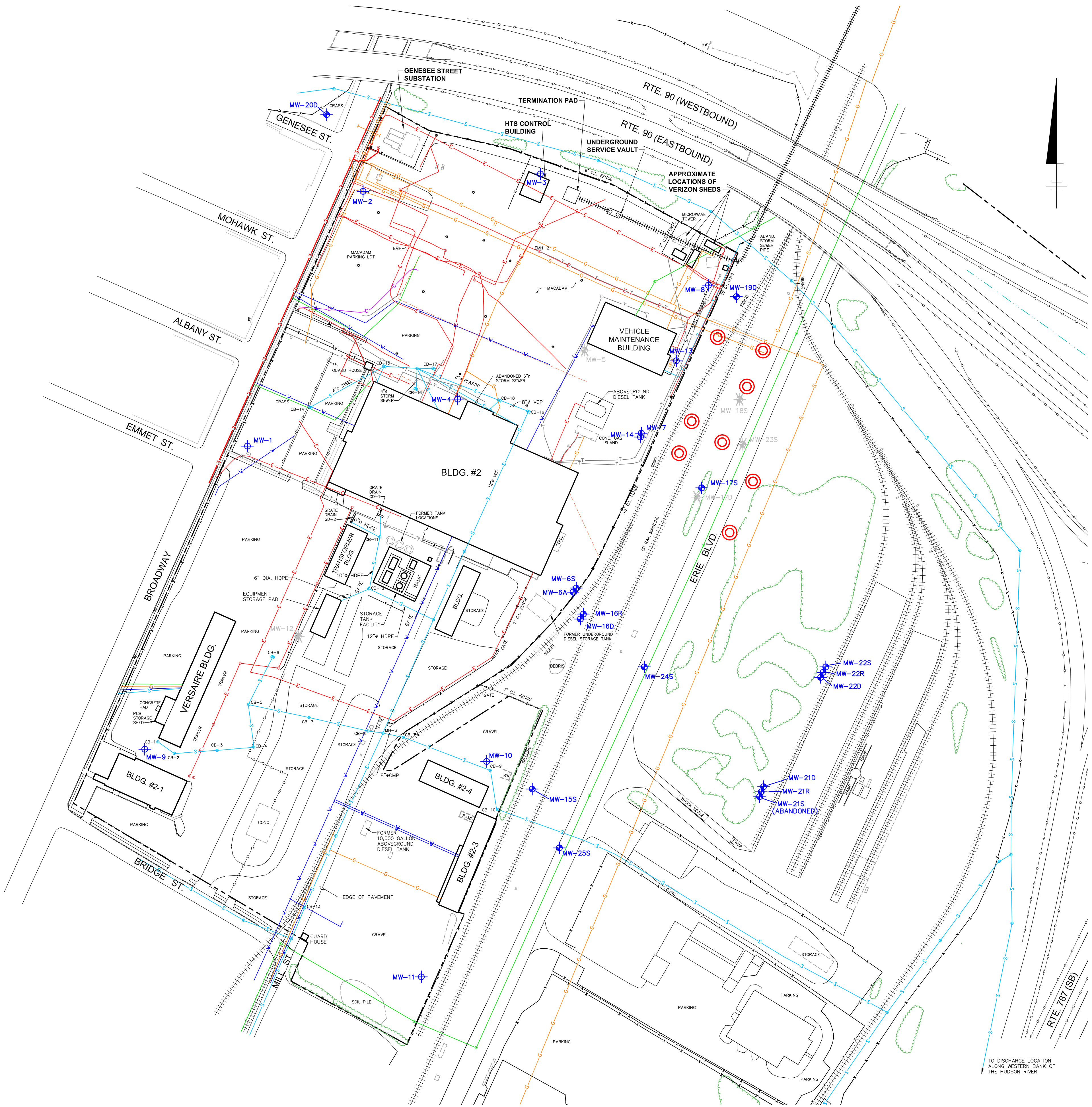

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- MW-15S EXISTING GROUNDWATER MONITORING WELL
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- APPROXIMATE LOCATION OF DNAPL COLLECTION WELL

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND GROUNDWATER MONITORING WELLS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON-SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D-29734-E, FILE INDEX NO. 20.3-A1.1-B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATION OF UNDERGROUND TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, AND CABLE LINES WERE UPDATED BASED ON ELECTROMAGNETIC UTILITY SURVEY CONDUCTED BY UNDERGROUND SERVICES, INC. DURING OCTOBER 2012. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES MUST BE DETERMINED/CONFIRMED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES..
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. DNAPL = DENSE NON-AQUEOUS PHASE LIQUID.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE OSDA-2

ARCADIS

FIGURE
5-5

CITY: SYRACUSE, N.Y. DIV/GROUP: ENV/IM-DV DB: LJP, R. BASSETT, R. ALLEN LD:(Opt) PIC:(Opt) PM: M.JONES TM: J.HORSTMAN LYR:(Opt)ON=*;OFF=*REF* PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/29/2015 3:07 PM BY: ALLEN, ROYCE
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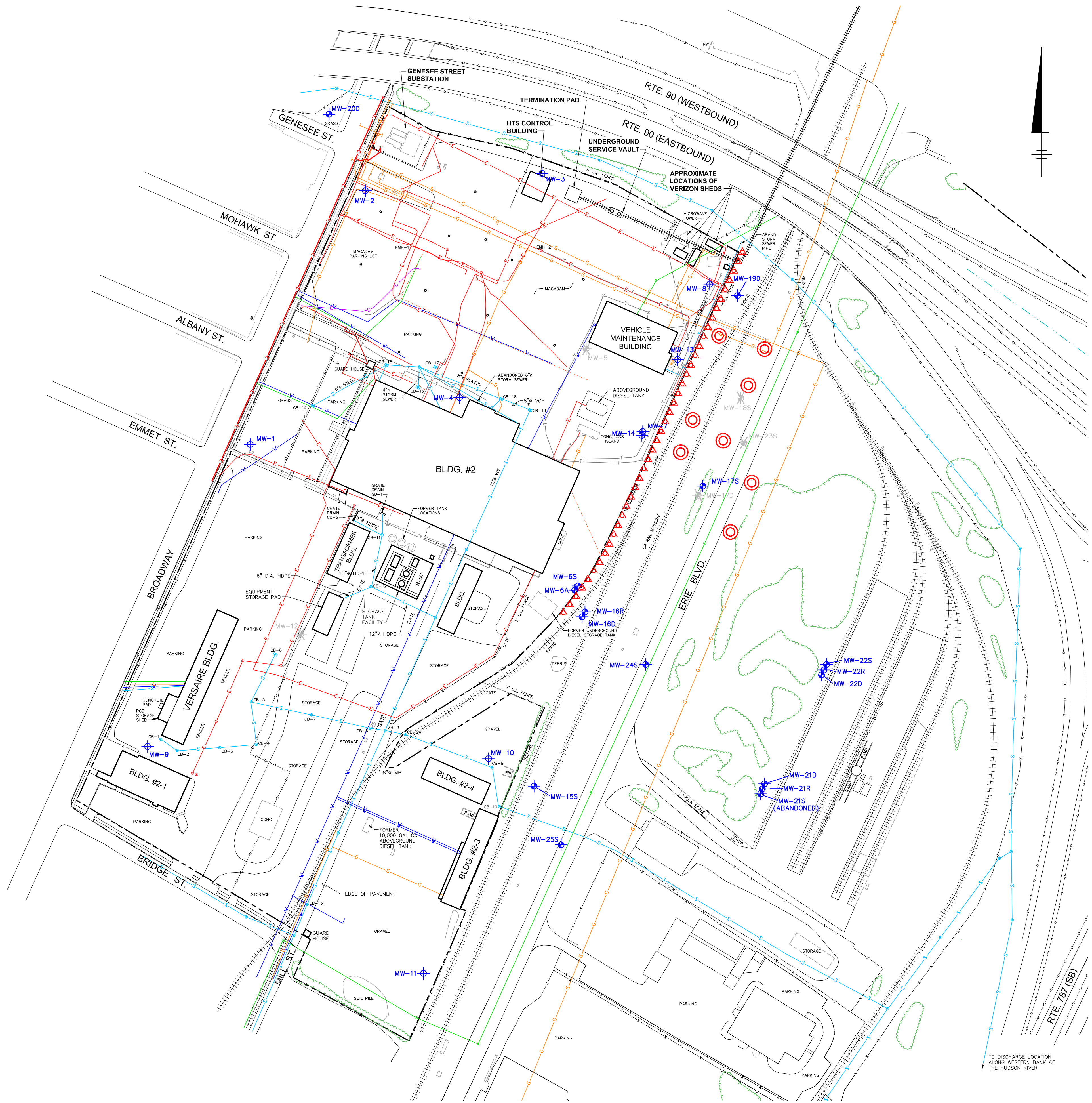

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
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- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- MW-15S EXISTING GROUNDWATER MONITORING WELL
- MW-18S DESTROYED GROUNDWATER MONITORING WELL
- APPROXIMATE LOCATION OF DNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF GROUNDWATER AMENDMENT APPLICATION WELL

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS AND GROUNDWATER MONITORING WELLS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. DNAPL = DENSE NON–AQUEOUS PHASE LIQUID.

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE OSDA-3

ARCADIS

FIGURE
5-6

ARCADIS

Appendix A

March 6, 2013 Memorandum

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MEMO

To:
Douglas K. MacNeal, P.E.
Bureau of Western Remedial Action
Division of Environmental Remediation
NYSDEC
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Copies:
George Heitzman, P.E., NYSDEC
Bridget Callaghan, NYSDOH
James Morgan, National Grid
Brian Stearns, P.E., National Grid
Terry W. Young, P.E., ARCADIS
Jason Brien, P.E., ARCADIS

From:
Michael Jones, ARCADIS

Date:
March 6, 2013

ARCADIS Project No.:
B0036648.0000

Subject:
National Grid North Albany Former MGP Site
Revised FS Remedial Alternatives

This memorandum presents revised remedial alternatives that are proposed for inclusion in a *Revised Draft Feasibility Study Report* (Revised Draft FS Report) for the National Grid North Albany Former Manufactured Gas Plant (MGP) Site (the site). The site location and site layout are shown on Figures 1 and 2, respectively.

Remedial alternatives for the site were originally presented in the *Draft Feasibility Study Report* (Draft FS Report) prepared by ARCADIS (December, 2009). The New York State Department of Environmental Conservation (NYSDEC) provided verbal comments on the Draft FS Report during an April 2012 conference call with personnel from National Grid and ARCADIS. The NYSDEC subsequently submitted an April 30, 2012 email to National Grid which indicated that the alternatives presented in the Draft FS Report were not acceptable to the NYSDEC and requested that National Grid develop and evaluate additional remedial alternatives to address MGP-related residual materials at the site. In response to the April 30, 2012 e-mail, National Grid agreed to propose revised remedial alternatives for the former MGP area (FMA) at the site in a June 26, 2012 letter to the NYSDEC. The NYSDEC did not provide comments on the proposed remedial alternatives for the offsite downgradient area (OSDA) that were presented in the Draft FS Report. Accordingly, National Grid does not propose to incorporate any revisions for the OSDA remedial alternatives to be presented in the Revised Draft FS Report.

In support of developing revised remedial alternatives, personnel from the NYSDEC, National Grid, and ARCADIS met in Albany, New York on November 29, 2012. The objectives of this meeting were to summarize site characterization information, review the rationale used to develop the remedial alternatives presented in the Draft FS Report, and discuss NYSDEC comments/concerns regarding the proposed remedial alternatives. Based on discussions during the meeting, National Grid has developed the proposed revised FMA remedial alternatives which are presented in this memorandum.

Concurrent with developing the proposed revised remedial alternatives, National Grid has also implemented the following additional ongoing activities to support the evaluation of remedial alternatives in the Revised Draft FS Report:

- Conducting bench-scale in-situ stabilization (ISS) treatability testing to evaluate the feasibility of implementing ISS to treat MGP-related residuals in soil at the site.

- Conducting a utility survey to map underground utilities and related infrastructure located in the FMA.

- Conducting a geophysical survey of specific areas in the FMA to evaluate the presence of subsurface foundations and other obstructions that may potentially interfere with proposed remedial efforts.

- Completing additional groundwater flow simulations using the existing hydrogeologic model for the site.

The additional activities that were conducted to support the development of revised remedial alternatives are summarized below, followed by a summary of the remedial alternatives presented in the Draft FS Report, NYSDEC comments on the Draft FS Report, and an overview of the revised remedial alternatives that are proposed for inclusion in the Draft Revised FS Report.

FS Support Activities

The FS support activities consisted of the following:

- *Bench-scale ISS treatability testing* – was conducted by ARCADIS to evaluate and identify potential mix designs that could be used to stabilize soil containing MGP-related residual materials. Treatability testing samples were collected for bench-scale testing from both the purifier waste area located east of Building 2 and the NAPL-impacted area in the central portion of the FMA located to the west and north of the Vehicle Maintenance Building. Treatability testing has been completed and the results indicate that ISS can be used to successfully treat waste from both the purifier waste area east of Building 2 and the central portion of the FMA located west and north of the Vehicle Maintenance Building.

- *Utility survey* – was conducted by a private utility locating company (Underground Services, Inc.). The utility survey identified both known and previously unknown storm sewer, sanitary sewer, telephone, electrical, gas, water, and cable lines throughout the site. The updated utility survey information for the former MGP area is included on the Site Plan presented as Figure 2.

- *Geophysical survey* – was conducted by ARCADIS using ground-penetrating radar (GPR) to evaluate subsurface obstructions (former MGP building and holder foundations) that would potentially be encountered in the parking lot area south of the Genesee Substation and the gas regulator station (GRS) during intrusive remedial construction activities.

- *Hydrogeologic modeling* – was conducted by ARCADIS to further evaluate (i.e., in addition to the hydraulic modeling scenarios previously evaluated in support of the Draft FS Report) the potential effects of conducting ISS activities and installing low-permeability barriers on site hydrogeology. In general, the modeling evaluated potential changes to local water table elevation, vertical hydraulic gradients, and groundwater flow paths.

Results for the bench-scale ISS treatability testing will be provided to the NYSDEC under separate cover. Information obtained during the utility and GPR surveys and the results for the updated hydrogeologic modeling effort will be incorporated in the Revised Draft FS Report.

FMA Remedial Alternatives Included in Draft FS Report

The following remedial alternatives for addressing site-related impacts in the FMA were presented in the December 2009 Draft FS Report:

- *Alternative FMA-1*– Under this alternative, no remedial activities would be completed (used for comparison with existing baseline conditions in the FMA).

- *Alternative FMA-2*– This alternative utilized a combination of soil removal, containment, passive NAPL recovery, and capping to address MGP- and non-MGP-related impacts in the former MGP area. This alternative includes the excavation of approximately 17,400 cubic-yards (cy) of purifier waste (consisting of heavily NAPL-impacted soil and NAPL-coated woodchips) encountered east and northeast of Building 2 to a depth of approximately two feet into an underlying silt and clay unit (i.e., approximately 12 feet below ground surface [bgs]). Alternative FMA-2 also included containment of heavily NAPL-impacted soil in the northwest corner of the site near the Genesee Street Substation to prevent potential migration of NAPL from this area. Although technically feasible, removal or in-situ treatment of impacted soil in the northwest corner of the site is not practical due to the presence of existing infrastructure (i.e., an active electrical substation and the GRS). Containment of this area would reduce the potential for migration of residual MGP-related material located beneath the Genesee Street Substation and near the GRS. If at some point in the future, the Genesee Street Substation is de-energized or relocated, National Grid would evaluate remedial measures to address the NAPL and impacted soils that are currently not accessible due to the presence of the substation.

Remaining on-site soil that contains MGP- and non-MGP-related impacts would be addressed by passive removal of NAPL via collection wells, construction of an asphalt cap, and implementation of institutional controls to prevent groundwater use, restrict the property for industrial use, and notify future owners of the presence of remaining impacted material.

- *Alternative FMA-3*(recommended alternative in Draft FS Report) – This alternative was similar to Alternative FMA-2; however, it included installation of a passive NAPL barrier wall along the eastern property boundary to enhance collection of the potentially mobile fraction of NAPL (relative to collection wells alone as included in Alternative FMA-2). The passive barrier wall would reduce the potential for further offsite migration of LNAPL and DNAPL both in the saturated and unsaturated zones beyond the FMA and facilitate the collection of potentially mobile NAPLs. This alternative included the same components of containment, removal, capping, and institutional controls as Alternative FMA-2.

- *Alternative FMA-4*– Alternative FMA-4 included the same removal, containment, capping, institutional control, and passive NAPL barrier wall and NAPL recovery components as Alternative FMA-3. This alternative also included ISS of saturated and unsaturated soil to the west and north of the Vehicle Maintenance Building that contains significant visual evidence of NAPL (i.e., soils saturated with NAPL, not including staining, sheens, or blebs) and/or PAHs at concentrations greater than 1,000 milligrams per kilogram (mg/kg). As part of this alternative, approximately 5,700 cy of soil would be pre-excavated to a depth of approximately 4 feet bgs to facilitate ISS of approximately 26,200 cy of site soils to the top of weathered bedrock.

- *Alternative FMA-5*–This alternative consisted of excavating approximately 219,800 cy of soil containing COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives and transporting the excavated material for offsite treatment/disposal. As part of Alternative FMA-5, the Genesee Street Substation, the GRS, and the Vehicle Maintenance Building would be removed to facilitate soil excavation activities in this portion of the site. This alternative also included the installation of NAPL collection wells and implementation of institutional controls.

NYSDEC Comments

NYSDEC comments on the Draft FS Report were discussed during an April 2012 conference call between personnel from the NYSDEC, National Grid, and ARCADIS. NYSDEC verbal comments on the draft FS Report are paraphrased below (each NYSDEC comment has been numbered for reference in discussing the proposed modifications to the FMA alternatives):

- *Comment 1– The recommended alternative does not include enough work in the central portion of the site (in area where the Chemical Oxidation Study was conducted). There is quite a bit of coal tar in this area that is not addressed by the alternatives.*

- *Comment 2 - Why is National Grid proposing to remove the purifier waste to the east of Building 2? Since that area is upgradient from the cutoff wall, any backfill material that is placed in this area will become re-contaminated.*

- *Comment 3 - Why is there no removal/treatment for soil located along the western property boundary (in the vicinity of soil boring SB-109 and monitoring well MW-9 in the parking lot area immediately south of the Genesee Street Substation and gas regulator station)?*

- *Comment 4 - Why is the cutoff wall around the substation placed where it is - National Grid should consider adjusting the alignment of the cutoff wall to facilitate removal/treatment of material in the parking lot area south of the substation/gas regulator station (note that this comment is closely related to comment 3).*

- *Comment 5 –The department is encouraging the more liberal use of ISS – especially where excavation and removal is not practical.*

- *Comment 6 - Alternative FMA-5 should include costs for removal of Building 2 to facilitate removal/treatment of impacted materials.*

The NYSDEC comments on the draft FS Report were reviewed during the November 29, 2012 meeting between NYSDEC, National Grid, and ARCADIS personnel. Based on the verbal NYSDEC comments and discussions during the meeting, proposed modifications to the FMA remedial alternatives to be presented in the Revised Draft FS Report are presented below.

FMA Remedial Alternatives to be Included in Revised Draft FS Report

As discussed above, National Grid does not propose to incorporate any changes to the proposed remedial alternatives for the OSDA located east of the FMA in the Revised Draft FS Report. None of the FMA remedial alternatives (for either the December 2009 Draft FS Report or the revised alternatives to be included in the Revised Draft FS Report) incorporate active groundwater remedial efforts. BTEX and PAH concentrations in groundwater samples collected from monitoring wells within the FMA over the course of consecutive annual groundwater sampling events appear to be stable. With the exception of the no action alternative (FMA-1), the FMA remedial alternatives will either immobilize or remove MGP-related residual material and COCs in soil. Following implementation of remedial activities, it is expected that natural attenuation processes (e.g., biodegradation, dispersion, dilution, volatilization, etc.) will act to reduce the extent of residual dissolved-phase groundwater impacts in the FMA. Continued monitoring of groundwater downgradient of the FMA will be included as part of the selected OSDA remedial alternative.

Proposed modifications to the FMA remedial alternatives to be presented in the Revised Draft FS Report (as compared to the alternatives originally presented in the December 2009 Draft FS Report) are summarized below.

Remedial Alternative FMA -1

No changes to alternative FMA-1 (No Action) are proposed. This alternative will continue to act as a baseline for comparison of the remaining FMA remedial alternatives against existing site conditions.

Remedial Alternatives FMA-2 and FMA-3

National Grid proposes to modify remedial alternatives FMA-2 and FMA-3 by replacing the low permeability barrier wall in the northwest corner of the site (downgradient of the Genesee Street Substation) with a permeable NAPL barrier wall. No other changes to these alternatives are proposed from the December 2009 Draft FS Report.

Alternatives FMA-2 and FMA-3 previously included construction of a low-permeability containment barrier wall in the northwest corner of the site to reduce migration of potentially mobile NAPL below the Genesee Street Substation and GRS. The wall was assumed to be constructed using a cement-bentonite (CB) slurry. As indicated in the Draft FS Report, removal or in-situ treatment of impacted soil in this area of the site is not practical due to the presence of an existing active electrical substation and the GRS. The placement/alignment of the wall was selected to contain a contiguous area of lower viscosity NAPL (i.e., relative to other coal tar) identified in the northwest corner of the site. Addressing a portion of this area (i.e. via excavation, ISS, or other remedial technology) was not considered effective based on site operations, current exposure potential, and the contiguous nature of coal tar impacts in this area. The alignment of the proposed wall in this area of the site would be further refined based on the results of a pre-design investigation (PDI), as appropriate.

Based on the results for the additional hydrogeologic modeling recently conducted, construction of a low-permeability wall that is tied into competent bedrock (i.e., through the weathered bedrock) may produce an undesirable increase in water table elevation and downward vertical hydraulic gradient behind (i.e., upgradient of) the wall. Any increase in the groundwater table elevation could further add to existing drainage problems at the site and an increased downward vertical hydraulic gradient could have an impact on NAPL migration. Therefore, National Grid proposes to replace the low-permeability barrier wall for the northwest corner of the site with a permeable NAPL barrier wall, which would be used to facilitate the collection of potentially mobile NAPL. A long-stick excavator would be used to remove soil and biopolymer slurry would serve as a stabilizing fluid to support the open trench excavation. The excavation would be completed to an average depth of approximately 25 feet below grade and keyed into bedrock. Pea gravel (or other appropriate granular material) would then be placed within the slurry-supported trench and the biopolymer slurry would be degraded to promote free flow of groundwater through the wall. DNAPL recovery wells would be installed within the permeable barrier wall and LNAPL migration would be mitigated by installing a low-permeability "curtain" within the upper portion of the wall that would extend below the annual low water table elevation. At locations where subsurface utilities cross the alignment of the permeable barrier wall, jet grouting would be utilized to create a localized continuous low permeable NAPL barrier to prevent NAPL migration in the area immediately beneath the utility feature. The technical descriptions and associated detailed evaluations for Alternatives FMA-2 and FMA-3 that were included in the December 2009 Draft FS Report will be revised as appropriate and incorporated in the Revised Draft FS Report.

Remedial Alternative FMA-4

Revisions which are proposed for to the Alternative FMA-4 (as originally presented in the Draft FS Report) consist of the following:

- Conducting ISS treatment for an additional 7,500 cy of soil containing MGP-related residual materials in the central portion of the FMA. The additional ISS activities will address NYSDEC's verbal comment #1 as paraphrased above. The expanded ISS treatment area will address visual impacts and elevated concentrations of total PAHs at soil borings SB-113 and SB-115, respectively. The revised ISS treatment limits are intended to address soil containing significant visual evidence of NAPL (i.e., soils saturated with NAPL, not including staining, sheens, or blebs) and/or PAHs at concentrations greater than 1,000 mg/kg in the central portion of the FMA. National Grid is currently evaluating the feasibility of relocating the two gas pipelines that traverse the ISS area further north along National Grid's existing property to facilitate treatment of soil beneath and in the immediate vicinity of the pipelines.

- Replacing the low permeability barrier wall in the northwest corner of the site (downgradient of the Genesee Street Substation) with a permeable NAPL barrier wall as discussed above for alternatives FMA-2 and FMA-3.

Alternative FMA-4 would address the majority of the most heavily-impacted site soils through a combination of ISS and excavation for offsite treatment/disposal. Permeable barrier walls would be utilized to mitigate migration of remaining residual MGP-related materials that are not immobilized or removed and future exposure to remaining MGP-related materials will be addressed though engineering and institutional controls. Major remedial components of Alternative FMA-4 to be proposed in the Revised Draft FS Report are shown on Figure 3 and include:

- Treating approximately 33,100 cy of soil in the central portion of the FMA via ISS.

- Excavating approximately 17,400 cy of soil in the purifier waste area east and northeast of Building 2 for offsite transport and treatment/disposal.

- Constructing a permeable NAPL barrier wall in the northwest corner of the site.
- Constructing a permeable NAPL barrier wall along the eastern property boundary.
- Installing NAPL collection wells.
- Constructing an asphalt cap over site soil.
- Establishing institutional controls.

Approximately 33,100 cy of saturated and unsaturated soil would be treated via ISS to the top of weathered bedrock in the area shown on Figure 3. The ISS process involves mixing Portland cement (and other pozzolanic materials) with impacted site soil to reduce the leachability and mobility of COCs and NAPL. The resulting mixture is generally a homogeneous mixture of soil and grout that hardens to become a weakly-cemented material. The ISS process would stabilize NAPL-impacted soil into a solid mass (micro-encapsulation), as well as soil surrounding NAPL-impacted soil (macro-encapsulation), thereby preventing migration of COCs and NAPL beyond the stabilized mass.

Prior to conducting the ISS activities, the ISS treatment area (shown on Figure 3) would be over-excavated to a depth of approximately 4 feet bgs to account for material bulking caused by the ISS treatment and to verify the locations of subsurface obstructions (i.e., utilities and former foundations and structures). Approximately 10,100 cy of surface material (asphalt and soil to a depth of 1 foot) and subsurface soil would be generated by the pre-ISS excavation activities. For the purpose of developing a cost estimate, it has been assumed that surface material would be disposed of as C&D debris and shallow soil removed during pre-ISS excavation would be disposed of as a non-hazardous waste. Based on the proposed extent and depth of the ISS treatment activities, ISS would most-likely be completed using excavator bucket mixing techniques or small-diameter augers. Post-ISS quality assurance/quality control (QA/QC) sampling would consist of sampling stabilized material to verify that performance criteria (e.g., unconfined compressive strength [UCS], permeability, etc.) are met. If performance criteria are not achieved, soil re-mixing could be required at specific locations.

As shown on Figure 3, multiple natural gas distribution and electrical transmission lines transect the ISS treatment area. The most problematic utilities are two gas pipelines (reportedly 14-inch and 16-inch medium pressure gas mains) that extend across the ISS treatment area to the north of the Vehicle Maintenance Building. National Grid is currently evaluating the feasibility of relocating there gas pipelines (and other utilities) further to the north along National Grid’s existing property in order to facilitate completion of the ISS activities. If it is not feasible to relocate these pipelines outside of the ISS area, then it may be technically impracticable to treat soil located beneath or in close proximity to these utilities.

Alternative FMA-4 would also include the excavation of 17,400 cy of accessible soil in the purifier waste area east and northeast of Building 2. Approximate removal limits are shown on Figure 3. Excavation would be completed approximately two feet into the silt and clay confining layer (the top of which varies from approximately 10 to 12 feet below grade). The NYSDEC previously expressed concerns regarding the potential re-contamination of backfill placed in this excavation area (see verbal comment #2 above). However, the conceptual site model suggests that MGP-related residual materials have generally migrated downward from its point of origin and then laterally along the top of and/or within weathered bedrock. Therefore, National Grid does not expect that clean fill used to backfill the purifier waste removal area (placed at depths up to 12 feet bgs) would be re-impacted by potential migration of MGP-related material.

Similar to Alternative FMA-2 and FMA-3, Alternative FMA-4 would also include construction of permeable NAPL barrier walls in the northwest corner of the site and along the eastern site boundary (as Shown on Figure 3) to mitigate potential downgradient migration and enhance the collection of potentially mobile NAPL in these areas. A long-stick excavator would be used to remove soil and biopolymer slurry would serve as a stabilizing fluid to support the open trench excavation. The excavation would be completed to an average depth of approximately 25 feet below grade and keyed into bedrock. Pea gravel (or other appropriate granular material) would then be placed within the slurry-supported trench and the biopolymer slurry would be degraded to promote free flow of groundwater through the wall. DNAPL recovery wells would be installed within the permeable barrier wall and LNAPL migration would be mitigated by installing a low-permeability “curtain” within the upper portion of the wall that would extend below the annual low water table elevation. As shown on Figure 3, recovery wells would be installed within the permeable barrier wall and in other areas of the site to facilitate NAPL monitoring/recovery. The final number and layout of NAPL collection wells would be determined during the remedial design.

Following completion of ISS and soil excavation activities, an asphalt cap would be established to the approximate limits shown on Figure 3 to mitigate potential exposure to remaining MGP-related residual material in the FMA.

Alternative FMA-4 would include institutional controls in the form of environmental easements (i.e., ELURs) and deed restrictions to prohibit the use of site groundwater and limit the future development and use of the property. Additionally, this alternative would include preparation of a Site Management Plan (SMP) which will require an annual site inspection and certification to document that engineering and institutional controls for the site remain in place and function as intended.

Estimated costs for Alternative FMA-4 are presented in Table 1. The total estimated 30-year present worth cost for this alternative is approximately $21,800,000. The estimated capital cost (including costs for ISS treatment; soil excavation and offsite disposal; and installation of permeable barrier walls, NAPL collection wells, and an asphalt cap) is approximately $20,900,000. The estimated 30-year present worth cost of

O&M activities associated with this alternative, including conducting quarterly NAPL monitoring and annual inspection and maintenance of the asphalt cap, is approximately $900,000.

Remedial Alternative FMA-5

Alternative FMA-5 will be revised to address NYSDEC verbal comment #6 as paraphrased above. Proposed revisions to Alternative FMA-5 (as originally presented in the Draft FS Report) consist of the following:

- Demolition and disposal of Building 2 to facilitate excavation of potentially impacted soil below the building.
- Excavation and offsite treatment/disposal of an assumed additional 24,000 cy of soil beneath Building 2 that contains COCs at concentrations greater than 6 NYCRR Part 375-6 unrestricted use SCOs.
- Removal of the LNAPL and DNAPL collection wells which were previously proposed near the southeast corner of the FMA (these wells are would no longer be required because no impacted soil would remain beneath Building 2 under the revised alternative).

Major remedial components of Alternative FMA-5 to be proposed in the Revised Draft FS Report are shown on Figure 4 and include:

- Removing the Genesee Street Substation and GRS, as well as other supporting infrastructure present at the site.
- Removing Building 2 and the Vehicle Maintenance Building.
- Excavating approximately 244,000 cy of soil containing MGP-related residual materials and COCs at concentrations greater than 6NYCRR Part 375-6 unrestricted use SCOs.

The approximately limits of soil removal activities under this alternative are shown on Figure 4. Soil excavation activities would include the removal of surface material and unsaturated and saturated soil and weathered bedrock to the top of the competent bedrock surface. Implementation of this alternative requires the removal and relocation of the Genesee Street Substation and GRS, as well as the subsurface components associated with the utilities (i.e., natural gas distribution and electrical transmission lines). Additionally, Building 2 and the Vehicle Maintenance Building would be demolished and removed as part of this alternative. For the purpose of establishing a cost estimate, it has been assumed that approximately 50% of the soil located below the footprint of Building 2 would require removal.

Excavation activities would be conducted using conventional construction equipment. Given the extent and depth of the removal areas (depths ranging from 18 to 26 feet below grade), excavation support would be required as part of this alternative. For the purpose of developing a cost estimate, it has been assumed that excavation support would consist of water-tight steel sheet piles equipped with tie backs and rock pins. Dead and live loads associated with Interstate 90 along the northern portion of the FMA, the railroad located immediately east of the FMA, and Broadway located immediately west of the FMA, would be evaluated to determine requirements for the excavation support system(s). It has been assumed that multiple smaller excavation cells would be required based on these loading conditions. The final excavation plan would be developed as part of the remedial design. The remedial design would include development of a storm water pollution prevention plan (SWPPP) and erosion controls (e.g., silt fencing, hay bales) would be placed around excavation and material staging areas to reduce soil erosion. Excavation areas would be backfilled with clean imported fill and a new storm sewer system would be constructed north of Building 2, which would tie into the existing storm sewer system that conveys storm water toward existing manhole MH-3 located in the Yard Storage Area. Surface restoration would consist of a one-foot-thick gravel cover. Costs to rebuild Building 2 and the Vehicle Maintenance Building have not been included as part of this alternative.

Water generated during excavation area dewatering and soil staging activities would be collected and treated on-site via a temporary water treatment system. The system would be anticipated to consist of solids removal, oil-water separation, and carbon filtration. Treated water would be discharged to a local storm sewer which subsequently discharges to Hudson River. More than 43,000,000 gallons of water are anticipated to require treatment and disposal under this alternative. Residual dissolved-phase groundwater impacts (if any) not removed during excavation area dewatering activities would not be addressed through active treatment and would be allowed to degrade over time via natural processes.

Excavated material would be segregated based on the presence/absence of visual impacts (i.e., NAPL, sheens) and staged to facilitate waste characterization and evaluation of treatment and disposal requirements. Multiple material staging areas would be required based on the volume of soil to be excavated under this alternative. Excavated soil from the saturated zone is anticipated to require stabilization through the addition of Portland cement (or other soil amendments). For the purpose of developing a cost estimate for this alternative, it has been assumed that approximately 50% of excavated soil would require thermal treatment/disposal via LTTD and the remaining 50% of excavated material would be disposed of as a non-hazardous waste at a solid waste landfill.

Estimated costs for Alternative FMA-5 are presented in Table 2. The total estimated cost for this alternative is approximately $112,000,000. The estimated capital cost includes removal of the electrical substation, the GRS, Building 2, and the Vehicle Maintenance Building; soil excavation and offsite disposal; and backfilling of excavated areas.

Path Forward

Following NYSDEC review and approval of the revised alternatives presented herein, National Grid will prepare and submit a Revised Draft FS Report that includes the modifications to the FMA remedial alternatives as detailed in this memorandum along with detailed and comparative evaluations of the alternatives. Following NYSDEC review and approval of the Revised Daft FS Report, National Grid will submit a Final FS report.

Please contact National Grid's Project Manager, Mr. James Morgan, at 315.428.3101 if you have any questions or comments.

Table 1
Cost Estimate for Alternative FMA-4 (REVISED)
ISS, Limited Soil Removal, Capping, Containment, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	Pre-Design Investigation	1	LS	$100,000	$100,000
2	Mobilization/Demobilization	1	LS	$500,000	$500,000
3	Utility Markout	5	Day	$1,000	$5,000
4	GPR Survey	2	Day	$2,500	$5,000
5	Subsurface Utility Relocation	1	LS	$500,000	$500,000
6	Temporary Site Fencing	3,000	LF	$35	$105,000
7	Material Staging Area	2	LS	$40,000	$80,000
8	Decontamination Area	1	LS	$10,000	$10,000
9	ISS Pre-Excavation	10,100	CY	$50	$505,000
10	ISS Treatment	33,700	CY	$75	$2,527,500
11	Post-ISS QA/QC Testing	68	Each	$1,000	$68,000
12	Passive Walls Pre-Excavation	800	CY	$65	$52,000
13	Passive Barrier Wall Installation	24,300	VSF	$10	$243,000
14	Passive Barrier Wall Backfill	2,600	CY	$25	$65,000
15	Jet Grouting - Passive Barrier Walls	4,200	VLF	$75	$315,000
16	Spoils Handling - Barrier Wall Jet Grouting	560	CY	$15	$8,400
17	Temporary Sheet Pile	27,000	SF	$40	$1,080,000
18	Excavation Enclosure	1	LS	$1,100,000	$1,100,000
19	Vapor Treatment	1	LS	$300,000	$300,000
20	Soil Excavation and Handling	17,400	CY	$45	$783,000
21	Vapor/Odor Control	34	Week	$3,000	$102,000
22	Backfill	16,000	CY	$40	$640,000
23	Surface Material Removal	6,600	CY	$30	$198,000
24	Asphalt Subbase	5,300	CY	$30	$159,000
25	Asphalt Pavement	14,100	Ton	$100	$1,410,000
26	Solid Waste Characterization	120	Each	$1,000	$120,000
27	Solid Waste Transportation and Disposal - C&D	14,400	Ton	$100	$1,440,000
28	Solid Waste Transportation and Disposal - LTTD	13,100	Ton	$85	$1,113,500
29	Solid Waste Transportation and Disposal - Nonhaz	32,300	Ton	$60	$1,938,000
30	DNAPL/LNAPL Collection Wells	16	Each	$4,000	$64,000
31	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$15,586,400
32				Administration and Engineering (10%)	$1,109,490
				Construction Management (10%)	$1,109,490
				Contingency (20%)	$3,117,280
				Total Capital Cost	$20,922,660

Table 1
Cost Estimate for Alternative FMA-4 (REVISED)
ISS, Limited Soil Removal, Capping, Containment, Passive NAPL Recovery via Wells and Barrier Wall, and Institutional Controls

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
OPERATION AND MAINTENANCE COSTS					
33	Quarterly NAPL Monitoring and Annual Reporting	1	LS	$28,000	$28,000
34	Annual Cap Inspection and	1	LS	$15,000	$15,000
35	Verification of Institutional Controls	1	LS	$5,000	$5,000
				Subtotal O&M Cost	$48,000
				Contingency (20%)	$9,600
				Total O&M Cost	$57,600
36				30-Year Total Present Worth Cost of O&M	$885,312
				Total Estimated Cost	**$21,807,972**
				Rounded to	**$21,800,000**

General Notes:

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

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

Assumptions:

1. Pre-design investigation cost estimate includes labor, equipment, and materials necessary to conduct pre-design investigation in support of the remedial design for this alternative, including a test boring/geotechnical program.

2. Mobilization/demobilization cost estimate includes mobilization and demobilization of all equipment, materials, and labor necessary to complete the remedial activities that comprise this alternative.

3. Utility location and markout cost estimate includes labor, equipment, and materials necessary to locate, identify, and markout underground utilities at the site. Cost assumes that utility location and markout would be conducted by a private utility locating company over a period of five days at a rate of $1,000 per

4. GPR survey cost estimate includes labor, equipment, and materials necessary to conduct ground-penetrating radar survey of the former manufactured gas plant area prior to implementing remedial activities. Cost estimate assumes equipment operator will require two days to complete survey activities.

5. Subsurface utility relocation cost estimate includes labor, equipment, and materials necessary to relocate subsurface gas lines, electrical lines, and telephone lines in the northern portion of the FMA to facilitate ISS treatment activities. Estimate assumes subsurface utilities are relocated further north on National Grid property.

6. Temporary site fencing cost estimate includes labor, equipment, and materials necessary to purchase, install, and remove a six-foot tall woven steel chain link fence equipped with barbed wire. Cost estimate includes up to 3,000 linear-feet of fencing used to secure excavation, working, and staging areas.

7. Material staging area cost estimate includes labor, equipment, and materials necessary to construct two 100-foot by 100-foot material staging areas consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner for staging excavated material. Separate staging areas used to segregate visually impacted material from non-visually impacted material prior to waste characterization. Maintenance includes inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting. Estimate assumes construction cost of approximately $4 per square-foot of pad.

8. Decontamination area cost estimate includes labor, equipment, and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

9. ISS pre-excavation cost estimate includes labor, equipment, and materials necessary to pre-excavate ISS treatment area to verify presence/absence and location of underground utilities prior to conducting ISS treatment activities and to allow for expansion of site soil during ISS treatment. Cost estimate assumes excavation activities to be completed using a backhoe and hand digging. Cost estimate assumes pre-excavation activities completed to a depth of 5 feet below grade.

10. ISS treatment cost estimate includes labor, equipment, and materials necessary to conduct in-situ soil stabilization to the top of weathered bedrock via large diameter auger mixing methods in the targeted area west of the Vehicle Maintenance Building. Volume estimate based on in-place soil volume. Cost estimate based on information provided to ARCADIS by Geo-Solutions, Inc. on January 27, 2009.

11. Post-ISS QA/QC testing cost estimate includes labor, equipment, and materials necessary to perform quality assurance/quality control testing of stabilized material to verify performance criteria have been achieved. Cost estimate assumes QA/QC samples will be collected from a soil boring completed for every 1,000 square-feet of stabilized material. Cost estimate assumes up to eight borings completed per day and includes cost for a geologist, drill rig and crew, and laboratory analysis of samples for unconfined compressive strength and permeability.

12. Passive walls pre-excavation cost estimate includes labor, equipment, and materials necessary to pre-excavate a trench along the passive barrier wall alignments to verify presence/absence and location of underground utilities prior to installation of passive walls. Cost estimate assumes excavation activities to be completed using a backhoe and hand digging and excavation will be backfilled following mark-out/isolation/ deactivation of utilities. Cost estimate assumes pre-excavation activities completed to a depth of 5 feet below grade for a wall lengths of 290 linear-feet and 780 linear-feet.

13. Passive barrier wall installation cost estimate includes labor, equipment, and materials necessary to install a passive barrier wall. Cost estimate includes mixing and placing slurry within the trench excavation and assumes excavation activities to be completed using a long-stick excavator. Cost estimate assumes 780 linear-feet of wall (minus 50 linear-feet to be completed via jet grouting) and 290 linear-feet of wall (minus 50 linear-feet to be completed by jet grouting) at an installation depth of 25 feet below grade, keyed one foot into bedrock. Unit cost based on vertical square-footage (VSF) of wall. Cost estimate based on information provided to ARCADIS by Geo-Solutions, Inc. on January 27, 2009.

14. Passive barrier wall backfill cost estimate includes labor, equipment, and materials necessary to purchase, import, and place pea-gravel stone within slurry-supported trench excavation to serve as passive barrier wall.

15. Jet grouting - passive barrier walls cost estimate includes labor, equipment, and materials necessary to complete jet grouting around underground utilities for passive barrier wall installation. Cost estimate assumes jet grout drilling completed for two 50 linear-feet sections of each wall, drilling completed 2.5 feet on-center to a depth of 25 feet below grade. Unit cost based on vertical linear-footage (VLF) of jet grout drilling. Cost estimate based on information provided to ARCADIS by Geo-Solutions, Inc. on January 27, 2009.

16. Spoils handling - barrier wall jet grouting cost estimate includes labor, equipment, and materials necessary to transfer jet grouting spoils to material staging area for characterization to facilitate off-site disposal. Cost estimate assumes spoils volume equal to jet grouting volume.

17. Temporary sheet pile cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary water-tight steel sheet pile. Cost estimate assumes sheet piling (with an embedment depth of 18 feet due to the depth of weathered bedrock) is reinforced with internal bracing (struts and walers, due to the adjacent railroad). It was assumed that two layers of bracing and struts would be utilized, and the excavation south of the vehicle maintenance building would be completed in two cells spanning the length of the excavation (to provide a manageable span for struts). Final excavation support system to be determined as part of the Remedial Design.

18. Excavation enclosure cost estimate includes rental of an approximately 100-foot by 400-foot Sprung structure to enclosure excavation area east of Building #2. Cost estimate assumes a 6-month lease price of approximately $20 per square-foot and construction cost of approximately $6 per square-foot. Cost estimate assumes structure is equipped with square ends and overheard doors for truck and excavator access. Final structure construction details to be determined as part of the Remedial Design. Cost estimate based on information provided by Sprung Instant Structures, Inc.

19. Vapor treatment cost estimate includes rental of vapor treatment system to collect and treat air within the excavation enclosure. Cost estimate includes a 6-month lease of all vapor collection and treatment equipment, delivery and set-up fees, and filter media change out.

20. Soil excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate material, transfer excavated material to an on-site staging area, and load staged material for transportation off-site. Estimated quantity based on in-place volume of heavily NAPL-impacted soil east and northeast of Building #2 excavated to approximately 2 feet into the silt and clay unit. Cost estimate includes air monitoring during intrusive activities. Estimate includes an increased excavation cost due to logistical issues encountered when excavating around the internal excavation bracing (struts and walers).

21. Vapor/odor control cost estimate includes labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and excavated materials staged on-site.

22. Backfill cost estimate includes labor, equipment, and materials necessary to purchase, import, place, grade, and compact select fill within excavation areas to within one foot of the surrounding grade. Cost estimate assumes general fill placed in 12-inch lifts and compacted to 95% maximum compaction based on standard Proctor testing. Cost estimate includes survey verification and compaction testing. Cost estimate includes air monitoring during intrusive activities. Assumes the cost of excavation would be increased by 30% due to logistical issues encountered when excavating and backfilling around the internal excavation bracing (struts and walers).

23. Surface material removal cost estimate includes labor, equipment, and materials necessary to remove the top one foot of existing ground cover (i.e., asphalt pavement and subgrade) to facilitate installation of a new site cap.

24. Asphalt subbase cost estimate includes labor, equipment, and materials necessary to purchase, import, place, grade, and compact 6 inches of gravel to serve as asphalt cap subbase for 284,000 square-feet of new cap. Cost estimate includes survey verification and compaction testing.

25. Asphalt pavement cost estimate includes labor, equipment, and material necessary to purchase, place, and compact asphalt pavement to serve as site cap. Cost estimate assumes final asphalt cap consists of a 4-inch (compacted) binder course and 2-inch (compacted) top course (total 8 inches prior to compaction) at an assumed weight of 2 tons per cubic-yard for 284,000 square-feet of new cap.

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

27. Solid waste transportation and disposal - C&D cost estimate includes labor, equipment, and materials necessary to transport select material off-site for disposal as construction and demolition debris. Estimated quantity based on volume of jet grout spoils and surface material removed at an assumed density of 2 tons per cubic-yard.

28. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport excavated material characteristically hazardous for benzene off-site for thermal treatment via low-temperature thermal desorption. Estimated quantity based on approximately 50% of soil excavated east and northeast of Building #2. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at ESMI's LTTD facility located in Fort Edward, New York. Cost estimate includes transportation fuel charge and all applicable taxes. Cost estimate assumes treated soil will not require disposal at a solid waste landfill.

29. Solid waste transportation and disposal - nonhaz cost estimate includes labor, equipment, and materials necessary to transport non-hazardous excavated material off-site for disposal at a solid waste landfill. Estimated quantity based on approximately 50% of soil excavated from east and northeast of Building #2 and soil excavated to facilitate installation of slurry cut-off and passive barrier walls. Cost estimate assumes a material density of 1.5 tons per cubic-yard. Cost estimate assumes soil would be managed at Seneca Meadows Landfill located in Waterloo, New York or City of Albany Landfill located in Albany, New York. Cost estimate includes transportation fuel charge and all applicable taxes.

30. DNAPL/LNAPL collection wells cost estimate includes labor, equipment, and materials necessary to install NAPL collection wells following completion of site remedial activities. Cost estimate includes oversight by a geologist, and drill rig and crew. Cost estimate assumes PVC well construction.

31. Institutional controls cost estimate includes legal expenses to institute environmental easements and deed restrictions to limit/prevent potential future land and groundwater use. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, and/or informational devices.

32. Administration and engineering and construction management costs are based on an assumed 10% of the total capital costs, not including costs for off-site treatment/disposal of material.

33. Quarterly NAPL monitoring cost estimate includes labor, equipment, and materials necessary to conduct quarterly NAPL monitoring and recovery (to the extent possible, if NAPL is present) from existing monitoring wells and new NAPL recovery wells. Cost estimate assumes monitoring activities to be completed in two days, four times per year. Cost estimate assumes up to two drums of PPE and disposable sampling equipment to be generated per year. Estimate also includes costs to prepare an annual report to summarize monitoring activities.

34. Annual cap inspection and maintenance cost estimate includes labor, equipment, and materials necessary to maintain the integrity of the asphalt cap. Estimate includes costs to visually inspect cap for cracks or eroded pavement and repair up to 2,500 square-feet of asphalt pavement each year.

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

36. Present worth is estimated based on a 5% beginning-of-year discount rate (adjusted for inflation). It is assumed that "year zero" is 2013.

Table 2

Cost Estimate for Alternative FMA-5 (REVISED)
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Item #	Description	Estimated Quantity	Unit	Unit Price (materials and labor)	Estimated Cost
CAPITAL COSTS					
1	Relocate GRS and Electrical Substation	1	LS	$10,000,000	$10,000,000
2	Mobilization/Demobilization	1	LS	$400,000	$400,000
3	Building Characterization, Demolition and Disposal	1	LS	$7,500,000	$7,500,000
4	Utility Markout	5	Day	$1,000	$5,000
5	GPR Survey	2	Day	$2,500	$5,000
6	Temporary Site Fencing	5,000	LF	$35	$175,000
7	Material Staging Area	2	LS	$90,000	$180,000
8	Decontamination Area	2	LS	$7,500	$15,000
9	Surface Material Removal	11,000	CY	$30	$330,000
10	Pre-Design Investigation	1	LS	$200,000	$200,000
11	Excavation Enclosure	1	LS	$1,100,000	$1,100,000
12	Vapor Treatment	1	LS	$300,000	$300,000
13	Temporary Sheet Pile	166,000	SF	$50	$8,300,000
14	Excavation Area Dewatering and Water Treatment	110	Month	$50,000	$5,500,000
15	Soil Excavation and Handling	244,300	CY	$35	$8,550,500
16	Soil Amendment	18,400	Ton	$125	$2,300,000
17	Vapor/Odor Control	490	Week	$3,000	$1,470,000
18	Backfill	233,300	CY	$30	$6,999,000
19	Storm Sewer System	1	LS	$400,000	$400,000
20	Gravel Surface Cover	11,000	CY	$30	$330,000
21	Liquid Waste Characterization	860	Each	$1,000	$860,000
22	Solid Waste Characterization	820	Each	$1,000	$820,000
23	Solid Waste Transportation and Disposal - C&D	22,000	Ton	$100	$2,200,000
24	Solid Waste Transportation and Disposal - LTTD	192,500	Ton	$85	$16,362,500
25	Solid Waste Transportation and Disposal - Nonhaz	192,500	Ton	$60	$11,550,000
				Subtotal Capital Cost	$85,852,000
26				Administration and Engineering (10%)	$4,573,950
				Construction Management (10%)	$4,573,950
				Contingency (20%)	$17,170,400
				Total Estimated Cost	**$112,170,300**
				Rounded to	**$112,000,000**

Table 2

Cost Estimate for Alternative FMA-5 (REVISED)
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

General Notes:

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

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

Assumptions:

1. Relocate GRS and electrical substation cost estimate includes labor, equipment, and materials necessary to deactivate, demolish, remove, and rebuilt the gas regulator station and Genesee Street Substation and associated infrastructure to facilitate excavation of soil in this area of the site.

2. Mobilization/demobilization cost estimate includes mobilization and demobilization of equipment, materials, and labor necessary to complete the remedial activities that comprise this alternative.

3. Building characterization, demolition, and disposal cost estimate includes labor, equipment, and materials necessary to remove Building #2 and the Vehicle Maintenance Building prior to conducting excavation activities. Estimate includes costs to conduct characterization sampling, removal of liquids and equipment from the buildings prior to demolition, removal of asbestos containing materials (ACM) including roof structure, demolition of existing structures, air monitoring during demolition activities, and transportation of demolition debris at a C&D landfill, TSCA landfill, ACM landfill. Estimate assumes no salvage value.

4. Utility location and markout cost estimate includes labor, equipment, and materials necessary to locate, identify, and markout underground utilities at the site. Cost assumes that utility location and markout would be conducted by a private utility locating company over a period of five days at a rate of $1,000 per day.

5. GPR survey cost estimate includes labor, equipment, and materials necessary to conduct ground-penetrating radar survey of the former manufactured gas plant area prior to implementing remedial activities. Cost estimate assumes equipment operator will require two days to complete survey activities.

6. Temporary site fencing cost estimate includes labor, equipment, and materials necessary to purchase, install, and remove a six-foot tall woven steel chain link fence equipped with barbed wire. Cost estimate includes up to 5,000 linear-feet of fencing used to secure excavation, working, and staging areas.

7. Material staging area cost estimate includes labor, equipment, and materials necessary to construct two 150-foot by 150-foot material staging areas consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner for staging excavated material. Separate staging areas used to segregate visually impacted material from non-visually impacted material prior to waste characterization. Maintenance includes inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting. Estimate assumes construction cost of approximately $4 per square-foot of pad.

Table 2

Cost Estimate for Alternative FMA-5 (REVISED)
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

8. Decontamination area cost estimate includes labor, equipment, and materials necessary to construct and remove two 60-foot by 30-foot decontamination pads and appurtenances. The decontamination pads would consist of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner and a 6-inch layer of gravel.

9. Surface material removal cost estimate includes labor, equipment, and materials necessary to remove the top one foot of existing ground cover (i.e., asphalt pavement and subgrade) to facilitate excavation of site soil.

10. Pre-design investigation cost estimate includes labor, equipment, and materials necessary to conduct pre-design investigation in support of the remedial design for this alternative, including a test boring/geotechnical program.

11. Excavation enclosure cost estimate includes rental of an approximately 100-foot by 400-foot Sprung structure to enclosure excavation area east of Building #2. Cost estimate assumes a 6-month lease price of approximately $20 per square-foot and construction cost of approximately $6 per square-foot. Cost estimate assumes structure is equipped with square ends and overheard doors for truck and excavator access. Final structure construction details to be determined as part of the Remedial Design. Cost estimate based on information provided by Sprung Instant Structures, Inc.

12. Vapor treatment cost estimate includes rental of vapor treatment system to collect and treat air within the excavation enclosure. Cost estimate includes a 6-month lease of all vapor collection and treatment equipment, delivery and set-up fees, and filter media change out.

13. Temporary sheet pile cost estimate includes labor, equipment, and materials necessary to install, remove, and decontaminate temporary water-tight steel sheet pile secured and anchored with rock pins and/or tie-backs and reinforced with internal bracing. Final excavation support system to be determined as part of the Remedial Design.

14. Excavation area dewatering and water treatment cost estimate includes installation of sumps within excavation areas and rental of a portal water treatment system capable of operating at 50 gallons-per-minute. Cost estimate assumes water treatment system includes pumps, influent piping and hoses, frac tanks, carbon filters, bag filters, discharge piping and hoses, and flow meter. Cost estimate assumes bag filters will require change out approximately once per day of operation. Estimate assumes treated water would be discharge to local storm sewer and subsequently the Hudson River at no additional cost.

15. Soil excavation and handling cost estimate includes labor, equipment, and materials necessary to excavate material, transfer excavated material to an on-site staging area, and load staged material for transportation off-site. Estimated quantity based on in-place volume of soil containing constituents at concentrations greater than 6NYCRR Part 375-6 unrestricted use soil cleanup objectives. Cost estimate includes air monitoring during intrusive activities.

16. Soil amendment cost estimate includes labor, equipment, and materials necessary to purchase and import stabilizing agent (e.g., Portland cement) to amend approximately 50% of excavated soil. Estimated quantity based on an assumed 10% of excavated soil (by weight) to be amended at 1.5 tons per cubic-yard.

17. Vapor/odor control cost estimate includes labor, equipment, and materials necessary to monitor vapor/odor emission during intrusive site activities. Cost estimate includes application of vapor/odor suppressing foam to open excavations and excavated materials staged on-site.

Table 2

Cost Estimate for Alternative FMA-5 (REVISED)
Soil Removal to 6NYCRR Part 375-6 Unrestricted Use Soil Cleanup Objectives

National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

18. Backfill cost estimate includes all labor, equipment, and materials necessary to purchase, import, place, grade, and compact select fill within excavation areas to within one foot of the surrounding grade. Cost estimate assumes general fill placed in 12-inch lifts and compacted to 95% maximum compaction based on standard Proctor testing. Cost estimate includes survey verification and compaction testing.

19. Storm sewer system cost estimate includes labor, equipment, and materials necessary to install a new storm sewer system in the FMA following excavation and backfilling activities. Cost estimate includes piping, manholes, and catch basins and assumes new storm sewer system will connect to the existing storm sewer system that conveys stormwater to Manhole MH-3 located in the Yard Storage Area.

20. Gravel surface cover cost estimate includes labor, equipment, and materials necessary to purchase, import, place, grade, and compact 12 inches of gravel to serve as final site cover. Cost estimate includes survey verification and compaction testing.

21. Liquid waste characterization cost estimate includes the analysis of wastewater sample for PCBs, VOCs, SVOCs, metals, and pesticides. Liquid waste characterization to be conducted in accordance with the requirements provided by disposal facility. Cost estimate assumes one liquid waste characterization to be collected for every 50,000 gallons of treated water. More than an estimated 43,000,000 gallons of water are anticipated to generated during soil excavation activities.

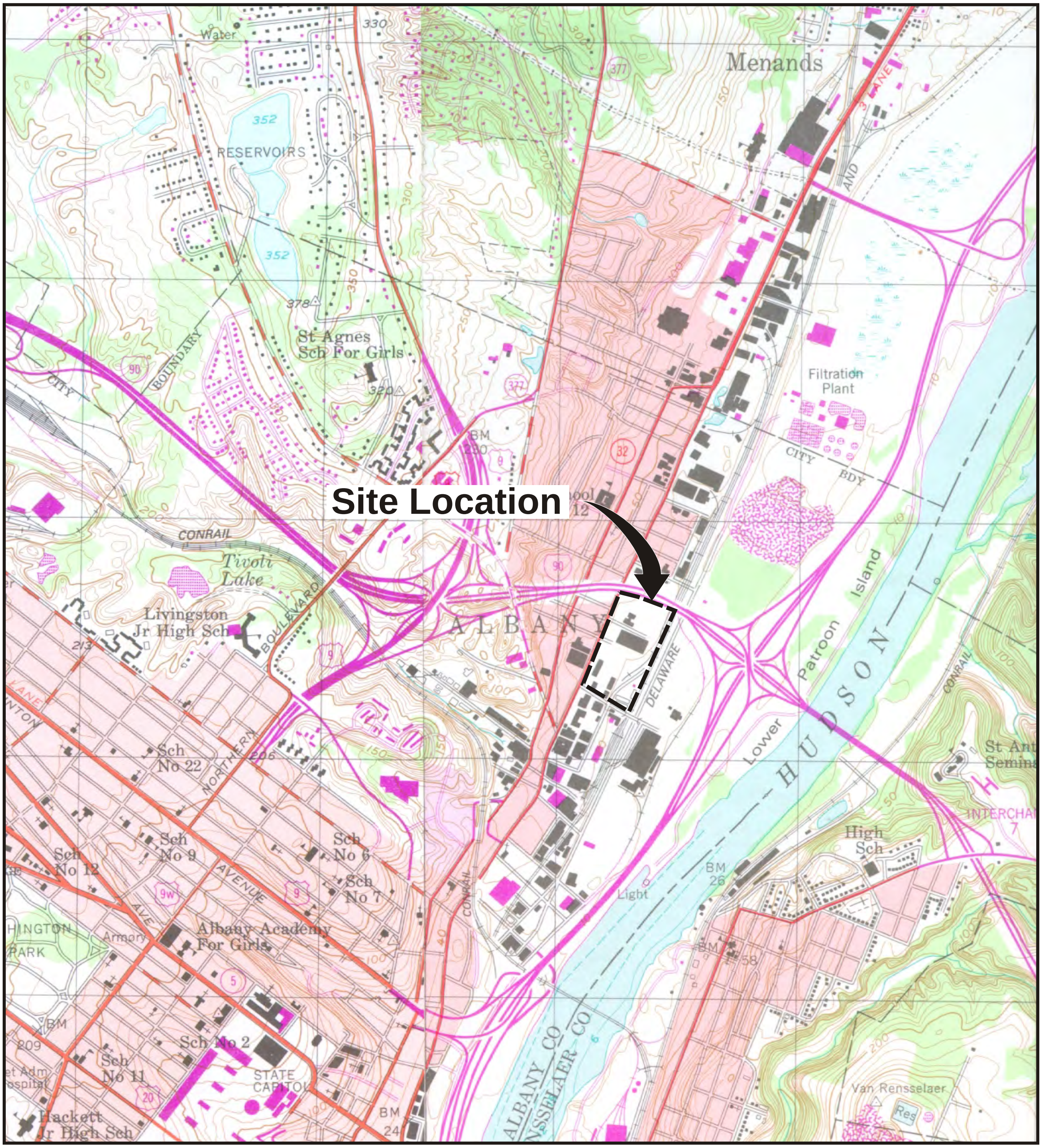
22. Solid waste characterization cost estimate includes the analysis of soil samples (including, but not limited to, PCBs, VOCs, SVOCs, and RCRA Metals). Costs assumes that waste characterization samples would be collected at a frequency of one sample per every 500 tons of material destined for off-site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

23. Solid waste transportation and disposal - C&D cost estimate includes labor, equipment, and materials necessary to transport select material off-site for disposal at as construction and demolition debris. Estimated quantity based on volume of surface material removed at an assumed density of 2 tons per cubic-yard.

24. Solid waste transportation and disposal - LTTD cost estimate includes labor, equipment, and materials necessary to transport excavated material characteristically hazardous for benzene off-site for thermal treatment via low-temperature thermal desorption. Estimated quantity based on approximately 50% of excavated soil. Cost estimate assumes a material density of 1.5 tons per cubic-yard and an additional 10% by weight for the addition of a soil amendment. Cost estimate assumes soil would be managed at ESMI's LTTD facility located in Fort Edward, New York. Cost estimate includes transportation fuel charge and all applicable taxes. Cost estimate assumes treated soil will not require disposal at a solid waste landfill.

25. Solid waste transportation and disposal - nonhaz cost estimate includes labor, equipment, and materials necessary to transport non-hazardous excavated material off-site for disposal at a solid waste landfill. Estimated quantity based on approximately 50% of excavated soil. Cost estimate assumes a material density of 1.5 tons per cubic-yard and an additional 10% by weight for the addition of a soil amendment. Cost estimate assumes soil would be managed at Seneca Meadows Landfill located in Waterloo, New York or City of Albany Landfill located in Albany, New York. Cost estimate includes transportation fuel charge and all applicable taxes.

26. Administration and engineering and construction management costs are based on an assumed 10% of the total capital costs, not including costs for the relocation of the GRS and electrical substation or for off-site treatment/disposal of material.



REFERENCE: Base Map USGS Quads., Albany, New York, 1980 and Troy South, New York, 1980.

2000' 0 2000'

Approximate Scale: 1" = 2000'

Area Location

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK

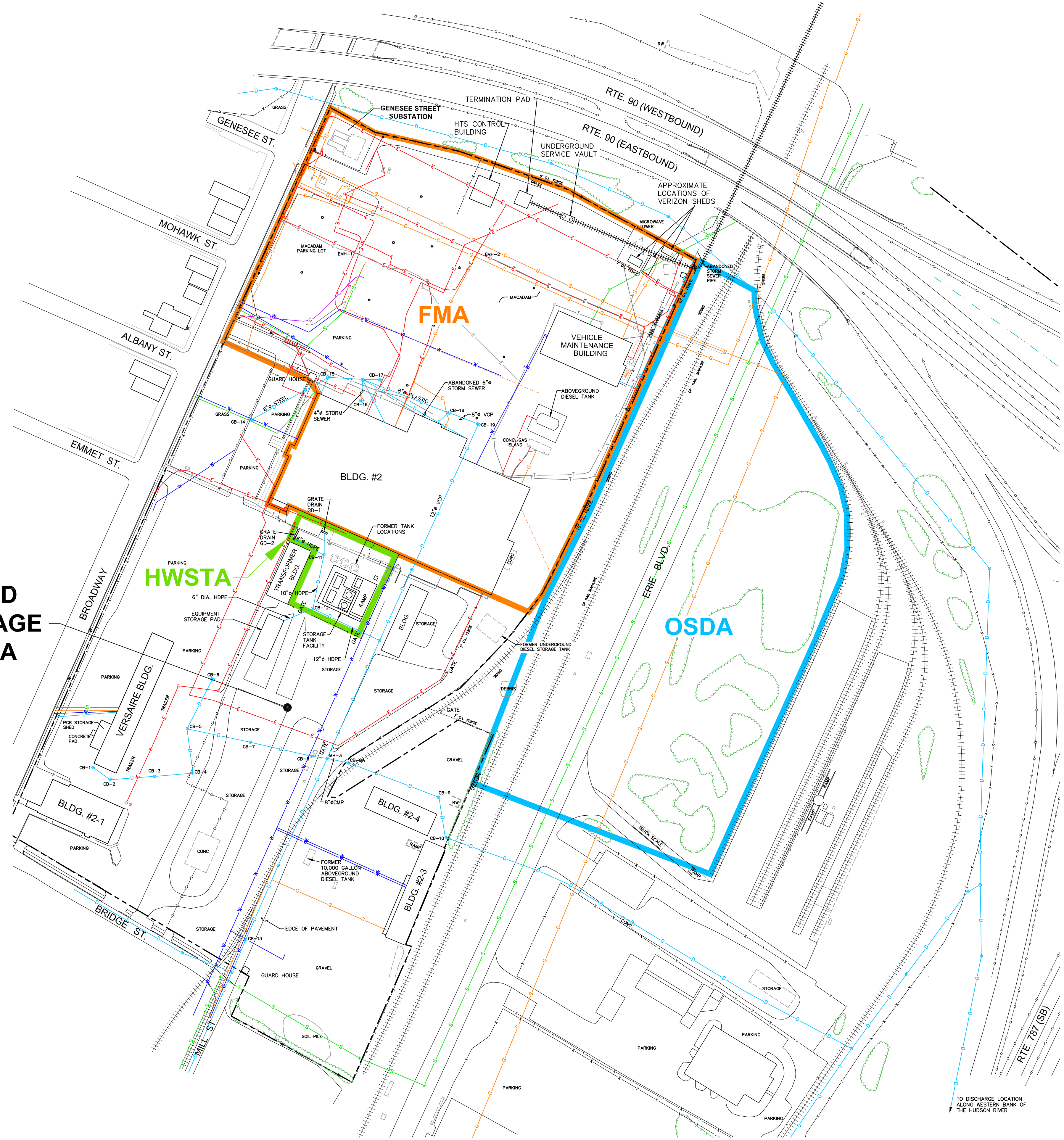
FEASIBILITY STUDY REPORT

SITE LOCATION MAP

ARCADIS

FIGURE
1-1

02/25/09 SYRACUSE-NY-ENV141-DJH
B0036648/0000/00021/CDR/36648N01.CDR



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- FORMER MGP AREA
- OFF-SITE DOWNGRADIENT AREA
- HAZARDOUS WASTE STORAGE TANK AREA

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C-29736-C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON-SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D-29734-E, FILE INDEX NO. 20.3-A1.1-B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATIONS OF NATURAL GAS MAINS ARE APPROXIMATED BASED ON FIELD OBSERVATIONS DURING UTILITY LOCATING ACTIVITIES. ACTUAL LOCATIONS OF UNDERGROUND GAS UTILITIES MUST BE DETERMINED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 1997.
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. FMA = FORMER MANUFACTURED GAS (MGP) PLANT AREA.
6. OSDA = OFF-SITE DOWNGRADIENT AREA.
7. HWSTA = HAZARDOUS WASTE STORAGE TANK AREA.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

SITE PLAN

ARCADIS

FIGURE
2

CITY: SYRACUSE NY DIV/GROUP: ENVCAD DB: LJP, R. BASSETT, E. KRAHMER LD:(Opt) PIC: T. YOUNG PM: M.JONES TM: M.JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF* PLOTTED: 2/12/2013 10:22 AM BY: KRAHMER, ERIC
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CITY: SYRACUSE NY DIV/GROUP: ENVCAD DB: R. ALLEN, R BASSETT, E. KRAHMER LD:(Opt) PIC: T. YOUNG PM: M. JONES TM: M. JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF*
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XREFS: 36648X02 36648X01 IMAGES: PROJECTNAME: ----

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE LOCATION OF PASSIVE NAPL BARRIER WALL
- APPROXIMATE SOIL EXCAVATION AREA
- APPROXIMATE CAP LIMITS
- APPROXIMATE ISS AREAS (SUBJECT TO ACCESS)(TO BE CAPPED)
- APROXIMATE LOCATION OF LNAPL COLLECTION WELL
- APPROXIMATE LOCATION OF DNAPL COLLECTION WELL

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM SURVEYS CONDUCTED BY NMPC DURING JULY/AUGUST 1997 AND NATIONAL GRID DURING OCTOBER 2012.
4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LNAPL = LIGHT NON–AQUEOUS PHASE LIQUID.
6. DNAPL = DENSE NON–AQUEOUS PHASE LIQUID.

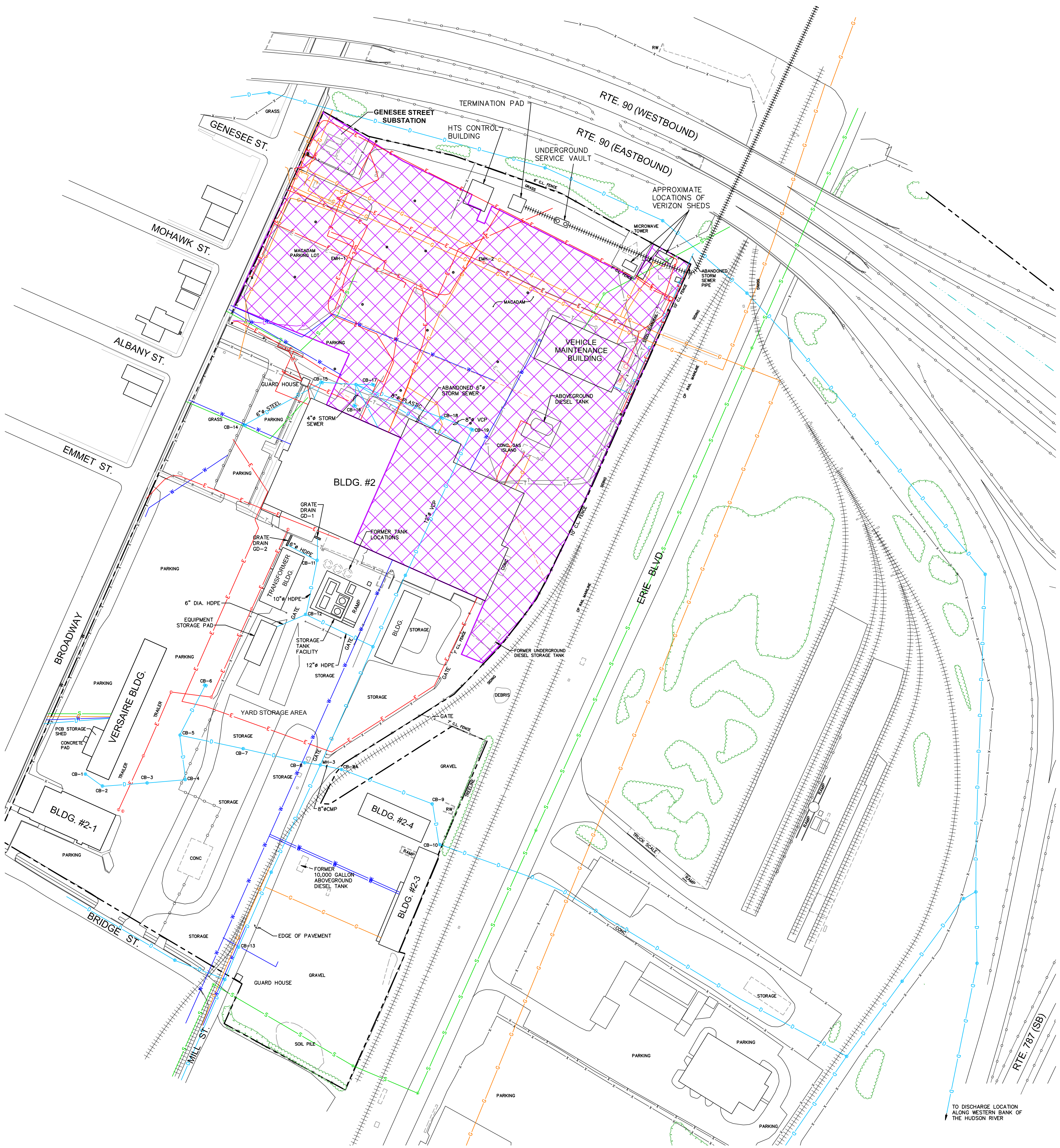
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE FMA-4

ARCADIS

FIGURE
3



LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING ELECTRICAL MANHOLE
- EXISTING TELEPHONE MANHOLE
- EXISTING UNKNOWN UTILITY MANHOLE
- STORM SEWER
- SANITARY SEWER
- TELEPHONE LINE
- ELECTRICAL LINE
- GAS LINE
- WATER LINE
- CABLE LINE
- UNKNOWN UTILITY
- APPROXIMATE SOIL EXCAVATION AREA

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
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4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. LNAPL = LIGHT NON–AQUEOUS PHASE LIQUID.
6. DNAPL = DENSE NON–AQUEOUS PHASE LIQUID.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

ALTERNATIVE FMA-5

ARCADIS

FIGURE
4

CITY: SYRACUSE NY DIV/GROUP: ENVCAD DB: LJP R. BASSETT, E. KRAHMER LD:(Opt) PIC: T. YOUNG PM: M.JONES TM: M.JONES TR: J. GOLUBSKI LYR:(Opt)ON=*;OFF=*REF*
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XREFS: 36648X03 36648X12 36648X01 IMAGES: PROJECTNAME: ----

ARCADIS

Appendix B

Predictive Groundwater Simulations Memorandum

ARCADIS
6723 Towpath Road
P.O. Box 66
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.0017

MEMO

To:
Jason Brien

Copies:

From:
Jerry Shi

Date:
December 18, 2009

ARCADIS Project No.:
B0036648.0000.00021

Subject:
Evaluation of Groundwater Mounding, Hydraulic Gradient , and Groundwater Flow Related to Remedial Alternatives at North Albany Former MGP Site in Albany, New York

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This technical memorandum summarizes predictive simulation results of groundwater levels, vertical gradients and flow patterns related to potential remedial alternatives at the North Albany Former Manufactured Gas Plant (MGP) Site in Albany, New York. The simulations were performed using an existing, steady-state MODFLOW model developed for the site in 2001. This MODFLOW model contained the following hydrogeologic units (from the top to the bottom): 1) shallow overburden/fill (primarily sands), 2) clay/silt, 3) deep overburden (sand/gravel), 4) glacial till/weathered shale, and 5) competent shale bedrock. Each hydrogeologic unit corresponds to an individual model numerical layer with the exception of the competent bedrock, which was divided into three (3) numerical layers. Therefore, there were a total of seven (7) numerical layers that represent five (5) hydrogeologic units. After the construction, the model was calibrated and the differences between predicted and measured heads at monitoring wells/piezometers were within acceptable ranges. Details of the MODFLOW model can be found in the modeling report (BBL, 2001).

Introduction

As part of the feasibility study (FS), ARCADIS proposed three potential remedial alternatives to address remaining MGP- and petroleum-related impacts within the former manufactured gas plant area (FMA). Summaries of the remedial alternatives are as follows:

- Alternative FMA-2: This alternative includes a low-permeability slurry cutoff wall downgradient of the Genesee Street substation in the northwest corner of the Site, asphalt capping of the site north of Building #2, excavation between Building #2 and the eastern property line, and installation of 4-inch diameter LNAPL and DNAPL collection wells. The slurry cutoff wall would be installed from ground surface to the top of the competent bedrock. The excavation would extend approximately 10 to 15 ft below ground surface (bgs) and be backfilled with clean sand/gravel. The LNAPL collection wells would be screened across the water table (approximately 5 to 10 ft bgs), with a diameter of 4 inches. The DNAPL collection wells would be placed to the top of the competent bedrock with a diameter of 4 inches. Approximate locations of the remedial components for this alternative are presented on Figure 1.

- Alternative FMA-3: This alternative includes the same remedial components as Alternative FMA-2. In addition, Alternative FMA-3 contains a passive NAPL collection trench/barrier system along the eastern property line. The passive trench would be excavated and keyed into to the top of the competent bedrock. The trench would be filled with pea gravel at its lower portion and low permeable barrier at its upper portion. The low permeable barrier would extend from the ground surface to approximately 2 ft below the seasonal low water table elevation. Approximate locations of the remedial components for this alternative are presented on Figure 2.

- Alternative FMA-4: This alternative includes the same remedial components as Alternative FMA-3. In addition, Alternative FMA-4 contains in-situ soil (ISS) stabilization of NAPL-impacted soils and soils containing greater than 1,000 ppm PAHs near the Vehicle Maintenance Building. The ISS would be performed from ground surface to the top of till/weathered bedrock. Approximate locations of the remedial components of this alternative are presented in Figure 3.

It is expected that the remedial components would likely change the groundwater flow, including changes in groundwater flow direction and hydraulic gradient, and may cause water table to fall or rise. As a result, LNAPL/DNAPL could be re-mobilized or flooding could occur. This groundwater modeling study was conducted to help predict these changes and their magnitudes to aid with the remedial alternative evaluation.

Modeling Procedures

The remedial components in each of the alternatives were simulated using different MODFLOW packages and are described as follows:

Alternative FMA-2

- Slurry Wall at Genesee Street Substation: This barrier wall was simulated using a MODFLOW wall package in Model Layers 1 through 4 with a thickness of 3 ft and a hydraulic conductivity (K) of 1E-07 cm/sec.

- Asphalt Cap: To be conservative, the area with new asphalt cap was assigned a relatively high groundwater recharge rate of 5 in/year, which is greater than a typical anticipated recharge rate for an asphalt–covered surface. A higher recharge rate will create stronger groundwater mounding and downward hydraulic gradient, both of which would be unfavorable conditions in this area following remedial construction.

- Excavation: The backfill at the excavation area was simulated using a relatively high K zone (Kx = Ky = Kz = 300 ft/day) in Model Layers 1 and 2. This K value is equivalent to coarse sand and gravel, and one order magnitude higher than the K value assigned to the fill unit in the model.

- NAPL Collection Wells: Because no pumping will be involved, the impacts of NAPL collection wells on the groundwater flow are expected to be minimal and, thus, were not simulated in this modeling study.

Alternative FMA-3

- Slurry Walls at Genesee Street Substation: Same as *Alternative FMA-2.*

- Asphalt Cap: Same as *Alternative FMA-2*.

- Excavation: Same as *Alternative FMA-2*.

- NAPL Collection Wells: Same as *Alternative FMA-2*.

- Passive Trench: The hanging wall in the upper portion of the trench was simulated in Model Layers 1 and 2 using a MODFLOW wall package with a thickness of 3 ft and a K value of 1E-7 cm/sec. The lower portion of the trench was presumably backfilled with ¼” diameter pea gravel in Model Layers 3 and 4. The hydraulic conductivity (K_1) of the pea gravel was estimated using the following equation from Kozeny-Carmen Bear (1972):

$$K_1 = \frac{\rho_w g}{u} \frac{n^3}{(1-n)^2} \frac{d_m^2}{180}$$

Where ρ_w is water density (1 g/cm^3), g is gravitational constant (980 cm/s^2), u is water viscosity (0.011404 g/(s.cm)), n is porosity (0.3), and d_m is representative grain size (1/4 inches or 0.635 cm). The K_1 was then calculated as 10.6 cm/s or 30047 ft/day.

Because the model cell size is 25 ft by 25 ft and the trench will be only 3 ft wide, the effective K values of the trench cells (K_x, K_y, and K_z) were calculated using the following equations revised based on Leonards (1962):

$$K_x = \frac{C}{W * K_1 + (C - W) * K_{cx}}$$

$$K_y = \frac{W * K_1 + (C - W) * K_{cy}}{C}$$

$$K_z = \frac{W * K_1 + (C - W) * K_{cz}}{C}$$

Where C is the cell size (25 ft), W is the trench width (3 ft), K_{cx} is the cell K along x-direction (ft/day), K_{cy} is the cell K along y-direction (ft/day), and K_{cz} is the cell K along z-direction (ft/day). The calculated effective K values are summarized below:

Model Layer	K_{cx} (ft/day)	K_{cy} (ft/day)	K_{cz} (ft/day)	Trench Width (ft)	Cell Size (ft)	K of Pea gravel (ft/day)	Effective K_x	Effective K_y	Effective K_z
3	15	15	2	2	25	30047	17.04	3619	3607
3	1	1	0.1	2	25	30047	1.136	1307	3606
4	1	1	0.2	2	25	30047	1.136	1307	3606

These calculated effective K values were assigned to respective model cells.

Alternative FMA-4

- Slurry Walls at Genesee Street Substation: Same as *Alternative FMA-3.*
- Asphalt Cap: Same as *Alternative FMA-3*.
- Excavation: Same as *Alternative FMA-3*.
- NAPL Collection Wells: Same as *Alternative FMA-3*.
- Passive Trench: Same as *Alternative FMA-3*.
- ISS Area: This zone was simulated using a low K value of 1E-06 cm/sec for Model Layers 1 through 3.

Because ISS will limit groundwater infiltration, the groundwater recharge rate at the ISS area was estimated based on the following assumptions and observations:

- According to http://www.nrcc.cornell.edu/ccd/prge0198.html, Albany had an average of 135 days with precipitation 0.01 in/day or greater during a year.
- To be conservative, the ISS area is presumably covered with water pools and infiltration continues due to gravity force alone for 24 hours a day for 135 days during a year. As a result, the infiltration rate is assumed to be equal to its *K* value.
- The average groundwater infiltration/recharge rate (*R*) was then calculated using the following equation:

$$R = \frac{135}{365} K$$

Where K is the hydraulic conductivity of the ISS. Thus, the groundwater recharge rate was calculated as 0.001048 ft/day at the ISS area.

Modeling Results

After the components of the remedial alternatives were constructed in the model, predictive simulations were performed. Three aspects were evaluated in comparison with the calibrated model (i.e. the existing conditions) using the predictive models: change of groundwater table, change of vertical hydraulic gradient, and change of groundwater travel pathline.

The water table change was calculated by subtracting the existing water table from the predicted remedy water table. The vertical hydraulic gradients were calculated between the water table and Model Layer 4. The groundwater travel pathline was evaluated using the U.S.G.S. code, MODPATH (Pollock, 1989). The particles originated from proposed LNAPL recovery well locations in Model Layers 1 through 4. For FMA-4, additional particle tracking was performed by placing particles around and within the ISS. The simulation results are summarized as follows:

Alternative FMA-2

- Change of Water Table (Figure 4): Groundwater is predicted to mound approximately 2.5 ft relative to the existing conditions behind the slurry wall at the Genesee Street substation. The model also predicted a water table decrease up to approximately 4 ft at the proposed excavation/backfill area along the eastern property line.

- Change of Vertical Hydraulic Gradient (Figure 5): For comparison, distribution of vertical hydraulic gradients from the calibrated model (representing the existing conditions) is presented as Figure 6. The largest difference between Figures 5 and 6 is that the vertical gradients were reversed from downward under the existing conditions to upward within the proposed excavation/backfill area along the eastern portion of the FMA.

- Groundwater Travel Pathline (Figure 7). Groundwater particles originating from Model Layer 4 (till/weathered bedrock units) behind the slurry wall near the Genesee Street Substation is predicted to move downward and pass the slurry wall while other particles in the shallower model layers are predicted to travel around the slurry wall. Along the eastern property line, the particles originating in shallower model layers are predicted to migrate along the high K zone (backfill) first and then to move southeast consistent with the groundwater flow existing conditions.

Alternative FMA-3

- Change of Water Table (Figure 8): The model predicted a change to the water table similar to that described for Alternative FMA-2.

- Change of Vertical Hydraulic Gradient (Figure 9): The model predicted a change to the hydraulic gradient within the proposed excavation/backfill area similar to that described for Alternative FMA-2.

- Groundwater Travel Pathline (Figure 10): The model predicted a similar groundwater travel pathline pattern as that described for Alternative FMA-2.

Alternative FMA-4

- Change of Water Table (Figure 11): The model predicted the water table to rise up to 4.5 ft within the proposed ISS area. However, this predicted water table is not expected to be above the ground surface given the current depth to groundwater in this area. The predicted water table is for the steady-state model and represents a long-term situation. The groundwater recharge rate used for the ISS area was based on conservation assumptions which may have over-estimated the recharge rate. Therefore, it is not expected that the water table would rise more than this predicted amount.

- Change of Vertical Hydraulic Gradient (Figure 12): The model predicted stronger downward vertical hydraulic gradients within the ISS area and stronger upward gradients northwest of the ISS. The change in the water table elevation within the excavation area would depend on the actual K value for the backfill material after it is placed and compacted.

- Groundwater Travel Pathline (Figures 13 through 18): The model predicted that particles originating from the Genesee Street substation may pass around or underneath the ISS zone and then travel southeast (Figure 13). The model also predicted that the particles originating near the eastern property line may travel south first along a leeway near the eastern property line produced by the ISS, and then flow toward southeast (Figure 13). Particles at the northwest of the ISS may bypass the ISS zone either horizontally around it or vertically beneath it (Figures 14 through 18). Due to this, the travel times for these particles were also predicted longer for the FMA-4 than the existing conditions (Figures 14 through 17). The impacts on travel times depended on the locations relative to the ISS AREA. The ISS zone was predicted to have greater impacts on particles closer to the ISS zone. For example, the particles just outside but upgradient of the ISS zone may travel at least 50% slower than the existing conditions (Figures 14 through 17). The particles at the ISS zone may likely migrate downward into the more permeable till/weathered bedrock unit (Model Layer 4) and then approximately follow that unit toward downgradient (Figure 18).

Summary

In summary, the findings of this groundwater modeling study indicated follows:

- For Remedial Alternatives 2, 3 and 4, groundwater mounding may be produced behind the slurry wall at the Genesee Street substation. Because the existing water table is expected to be more than 5 ft bgs, a mounding of approximately 2.5 ft should not cause flooding at this area. The slurry wall may also change the groundwater flow direction at this area. At the proposed excavation/backfill area near the eastern property line, the groundwater table is predicted to be up to approximately 4 ft lower than the existing conditions. However this would be dependent upon the actual K value achieved by the backfill relative to the K value of the existing fill material.

- For Remedial Alternative 4, groundwater mounding and strong downward hydraulic gradients may be present within the stabilized soil area. However, the mounding would likely be below the ground surface. The ISS, excavation and slurry wall may also change the groundwater flow direction. As a result, the majority of groundwater would bypass the ISS zone horizontally and vertically.

References

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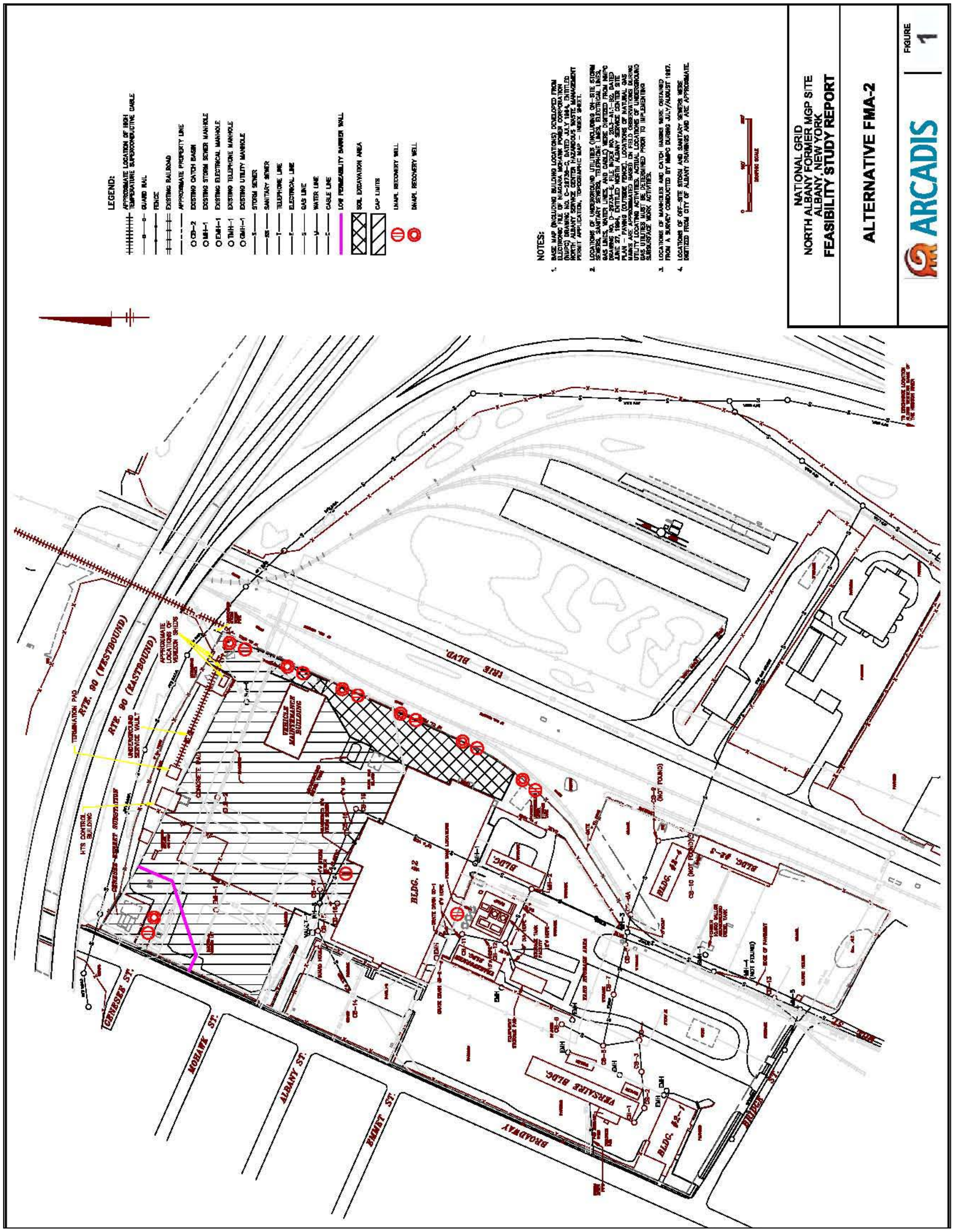
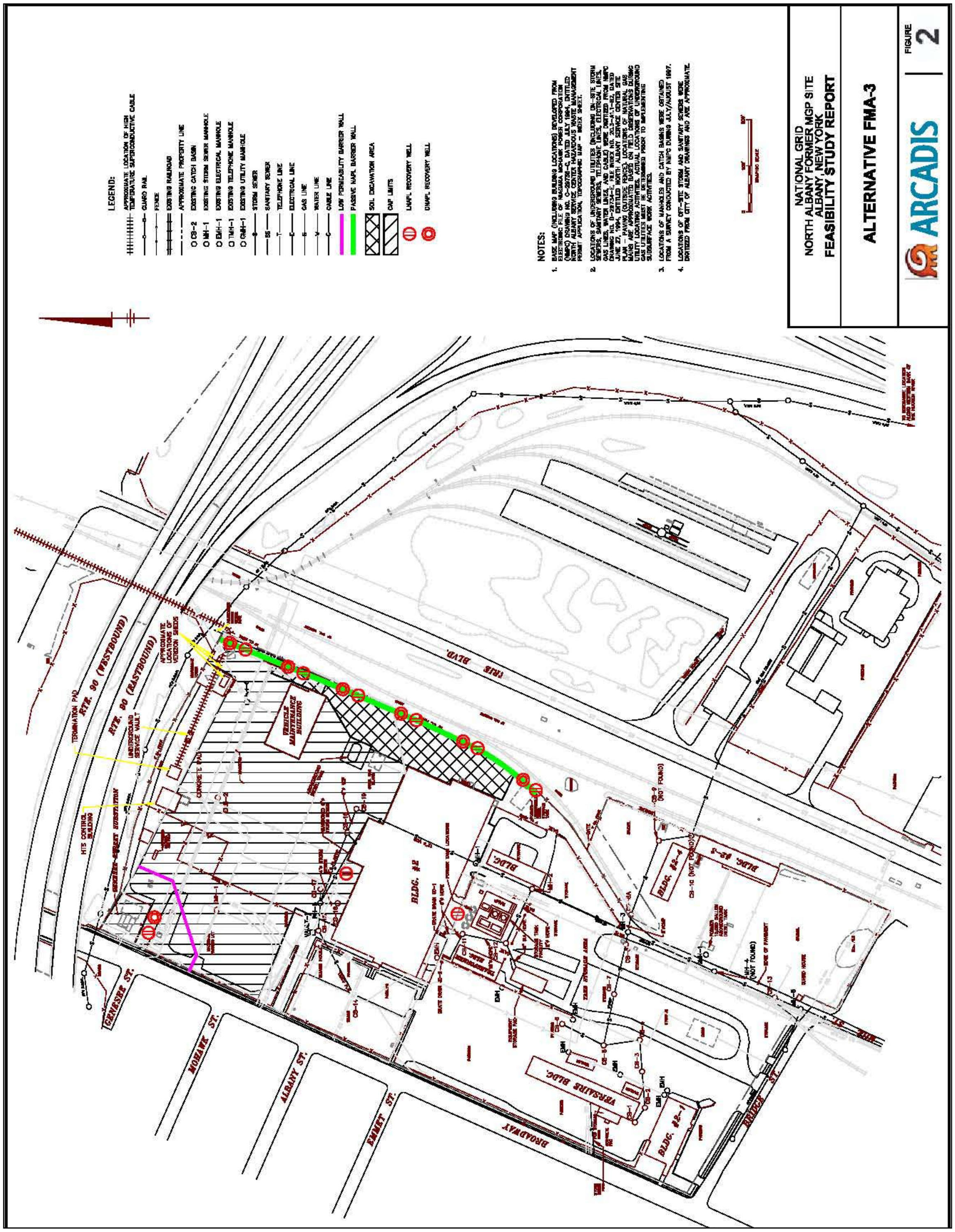
McDonald, M.G. and A.W. Harbaugh. 1988. A Modular, Three-Dimensional, Finite-Difference Groundwater Flow Model, USGS Techniques of Water Resource Investigations (Book 6).

Pollock, D.W. 1989. Documentation of computer programs to complete and display pathlines using results from the U.S. Geological Survey modular three-dimensional finite-difference ground-water model. USGS, Open File Report 89-381, 81 p.


NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT
ALTERNATIVE FMA-2
FIGURE
1
ARCADIS
LEGEND:
NOTES:
BROADWAY
GENESEE ST.
MOHAWK ST.
ALBANY ST.
EMMET ST.
ERIE BLVD.
RTE. 90 (WESTBOUND)
RTE. 90 (EASTBOUND)
BLDG. #2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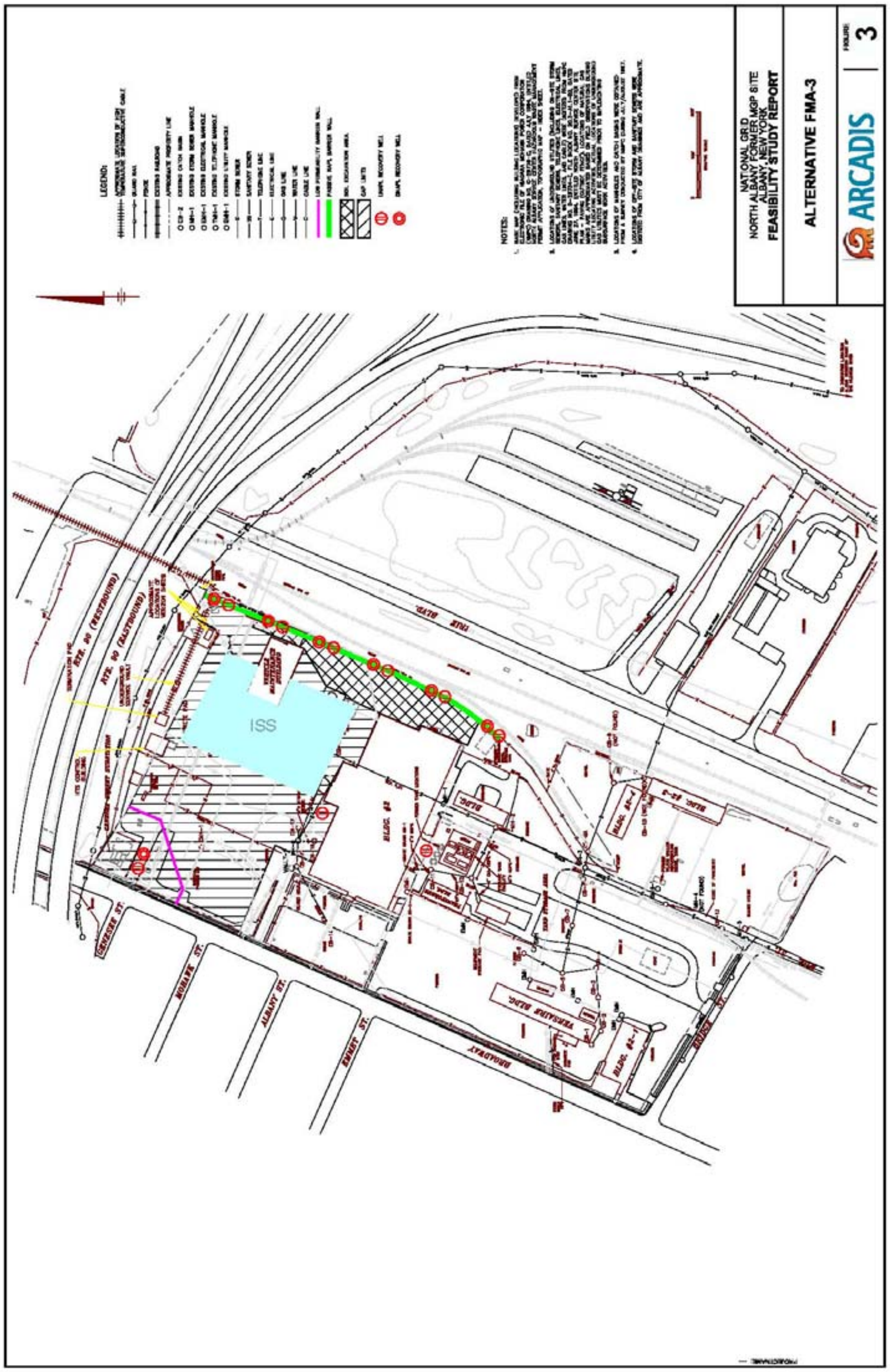
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT
ALTERNATIVE FMA-3
ARCADIS
FIGURE
2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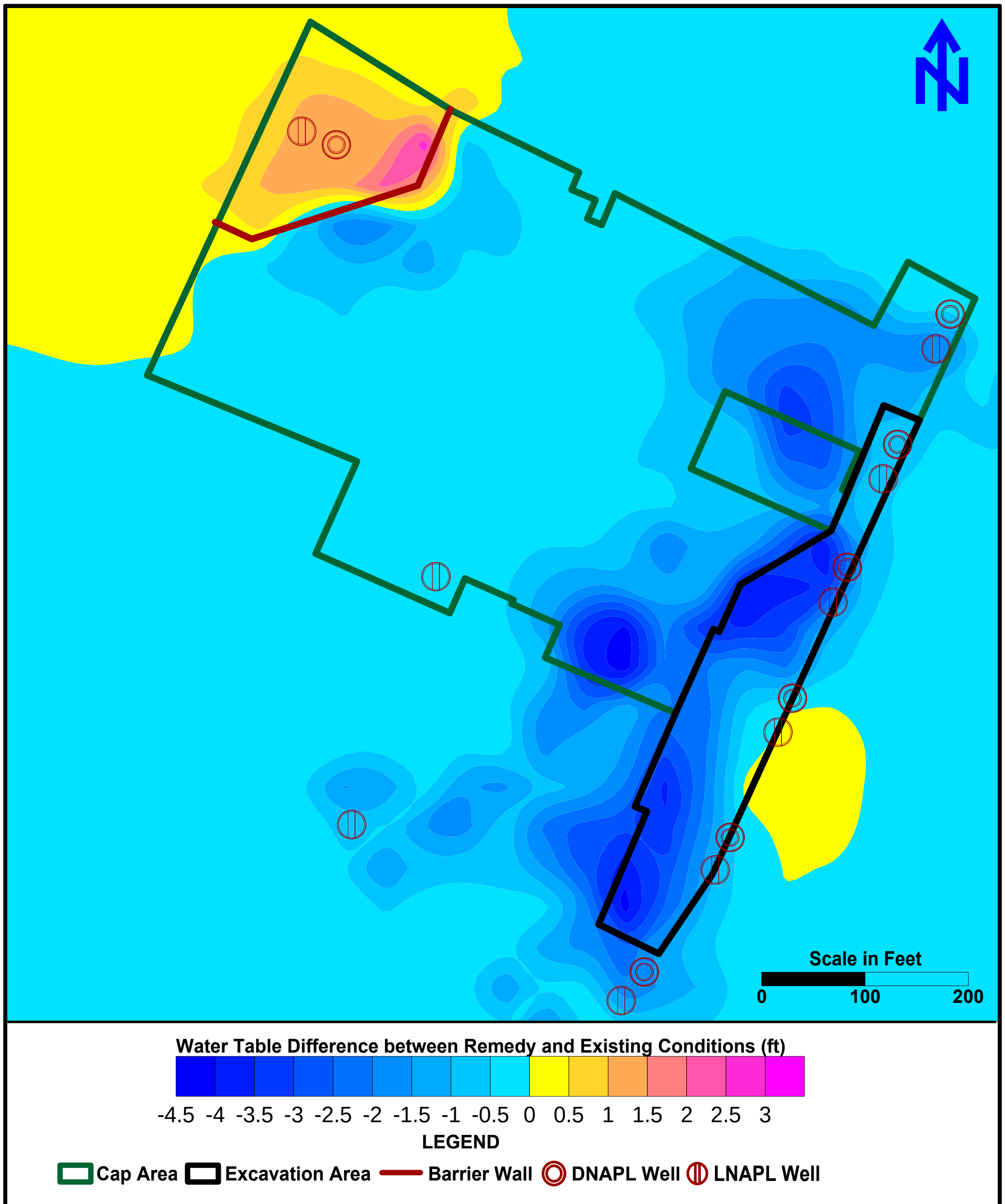
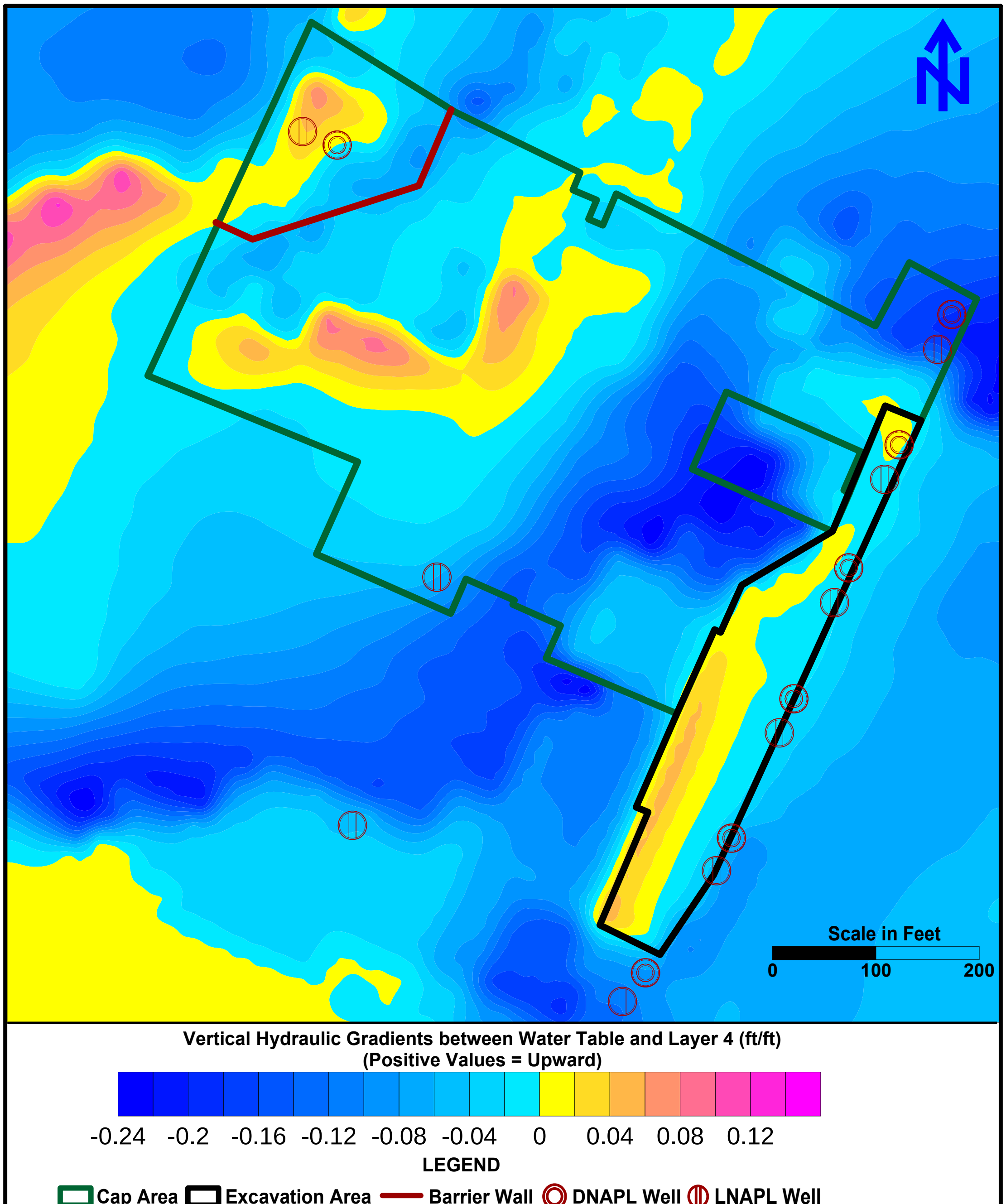
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT
ALTERNATIVE FMA-3
ARCADIS
3
ISS



ARCADIS 6723 Towpath Road Syracuse, NY 13214 Tel (315) 671-9434 Fax (315) 446-8053	ALTERNATIVE FMA-2 SIMULATED WATER TABLE DIFFERENCE NORTH ALBANY FORMER MGP SITE NATIONAL GRID ALBANY, NEW YORK	PROJECT MANAGER JDB DRAFTER JSHI PROJECT NUMBER B0036648.0000.00021	DEPARTMENT MANAGER CHECKED NA DRAWING NUMBER 4



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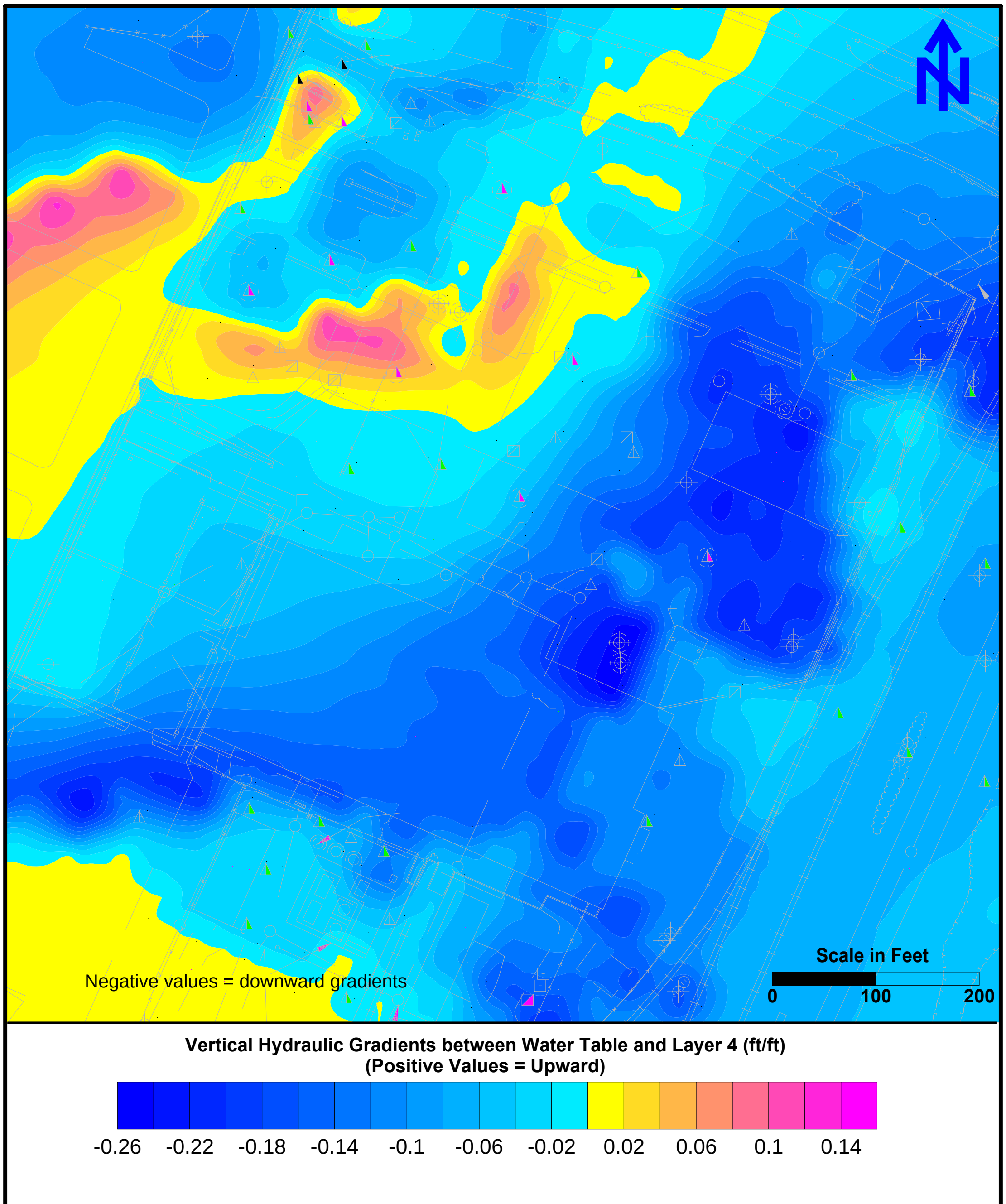
ALTERNATIVE FMA-2
SIMULATED VERTICAL HYDRAULIC GRADIENT
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER 5



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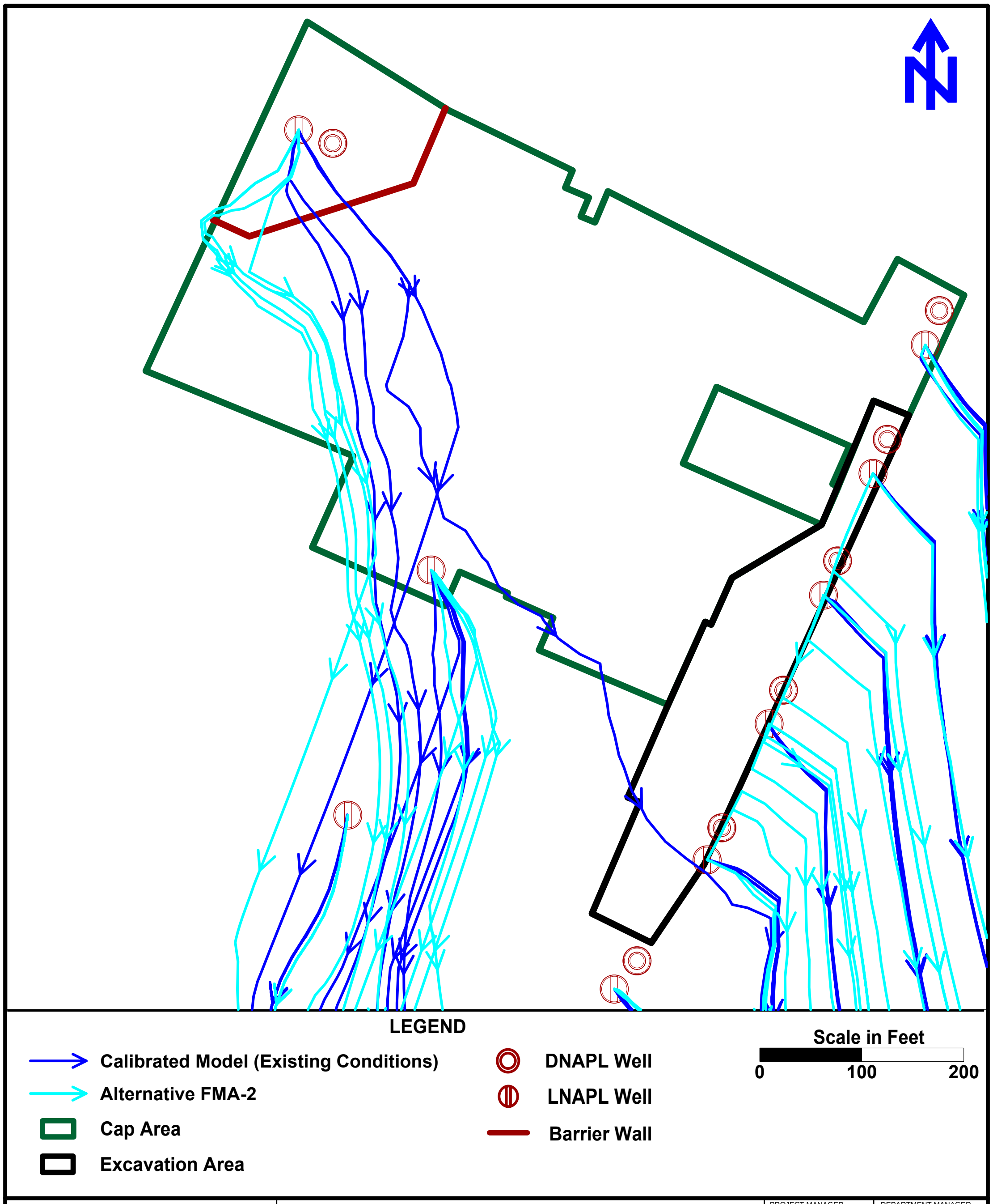
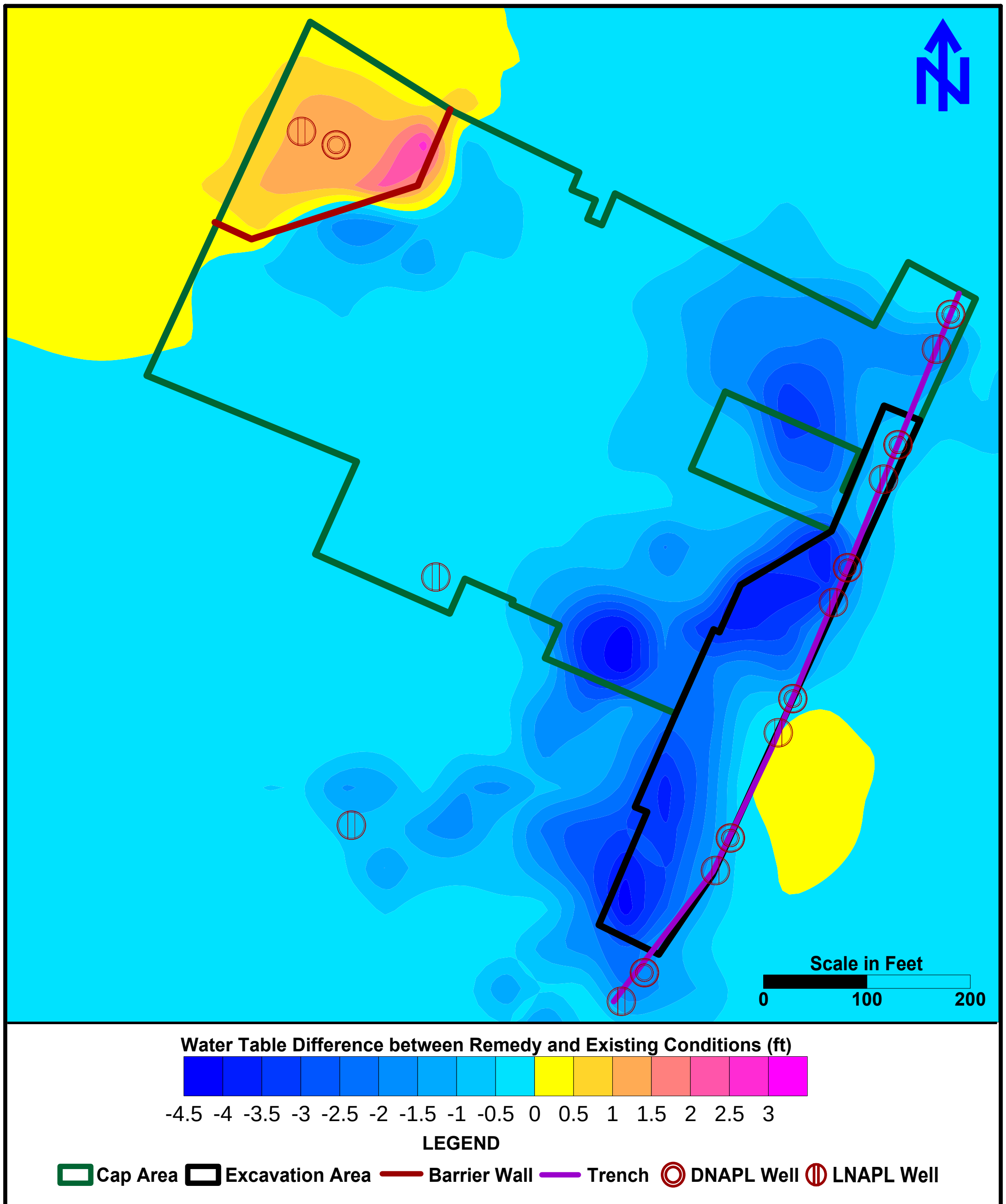
CALIBRATED MODEL (EXISTING CONDITIONS)
SIMULATED VERTICAL HYDRAULIC GRADIENT
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER	DEPARTMENT MANAGER
JDB	
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER 6



ARCADIS 6723 Towpath Road Syracuse, NY 13214 Tel (315) 671-9434 Fax (315) 446-8053	ALTERNATIVE FMA-2 GROUNDWATER FLOW PATHLINES NORTH ALBANY FORMER MGP SITE NATIONAL GRID ALBANY, NEW YORK	PROJECT MANAGER JDB DRAFTER JSHI PROJECT NUMBER B0036648.0000.00021	DEPARTMENT MANAGER CHECKED NA DRAWING NUMBER 7



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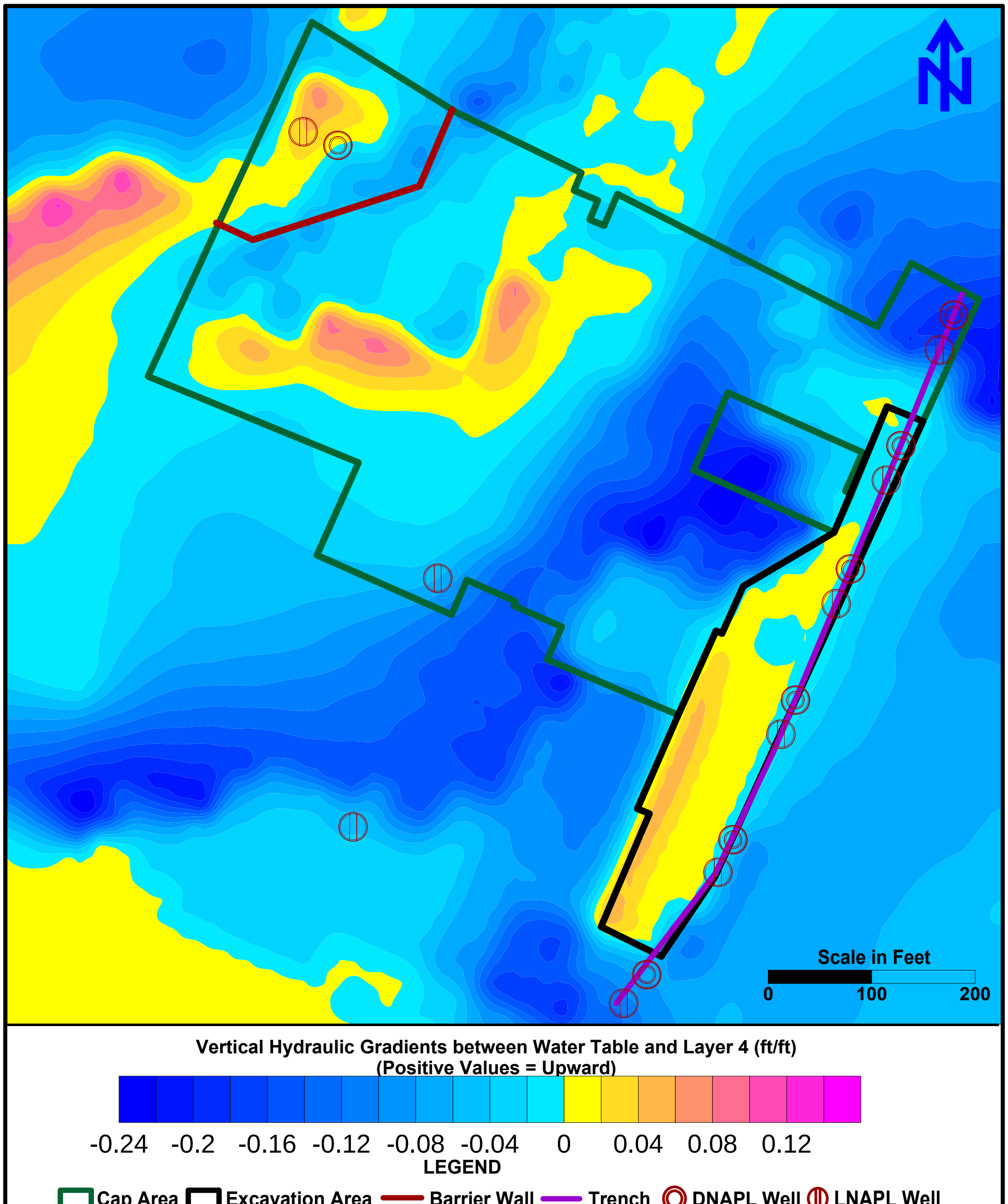
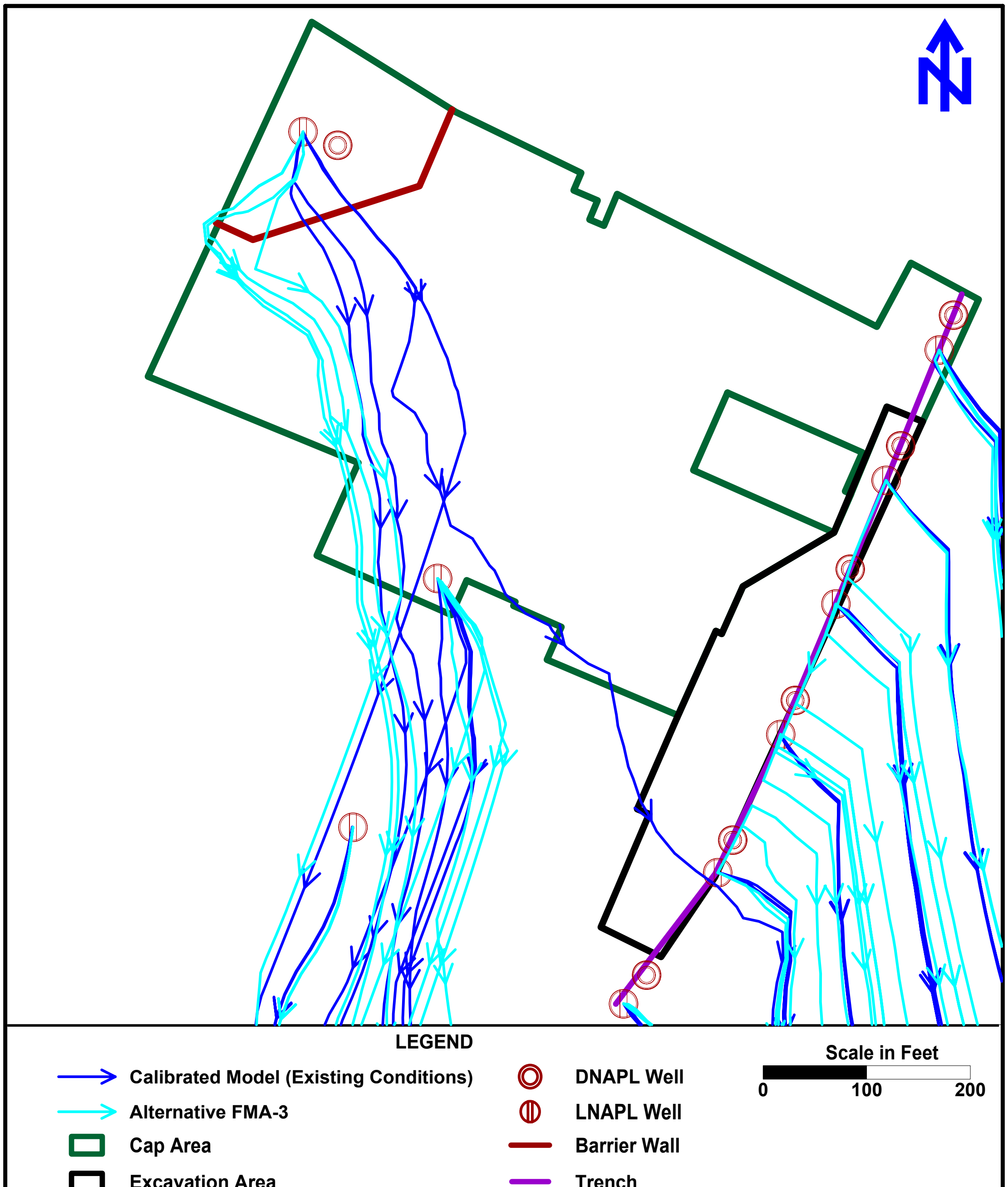
ALTERNATIVE FMA-3
SIMULATED WATER TABLE DIFFERENCE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER 8



ARCADIS 6723 Towpath Road Syracuse, NY 13214 Tel (315) 671-9434 Fax (315) 446-8053 copyright © 2001	ALTERNATIVE FMA-3 SIMULATED VERTICAL HYDRAULIC GRADIENT NORTH ALBANY FORMER MGP SITE NATIONAL GRID ALBANY, NEW YORK	PROJECT MANAGER JDB DRAFTER JSHI PROJECT NUMBER B0036648.0000.00021	DEPARTMENT MANAGER CHECKED NA DRAWING NUMBER 9



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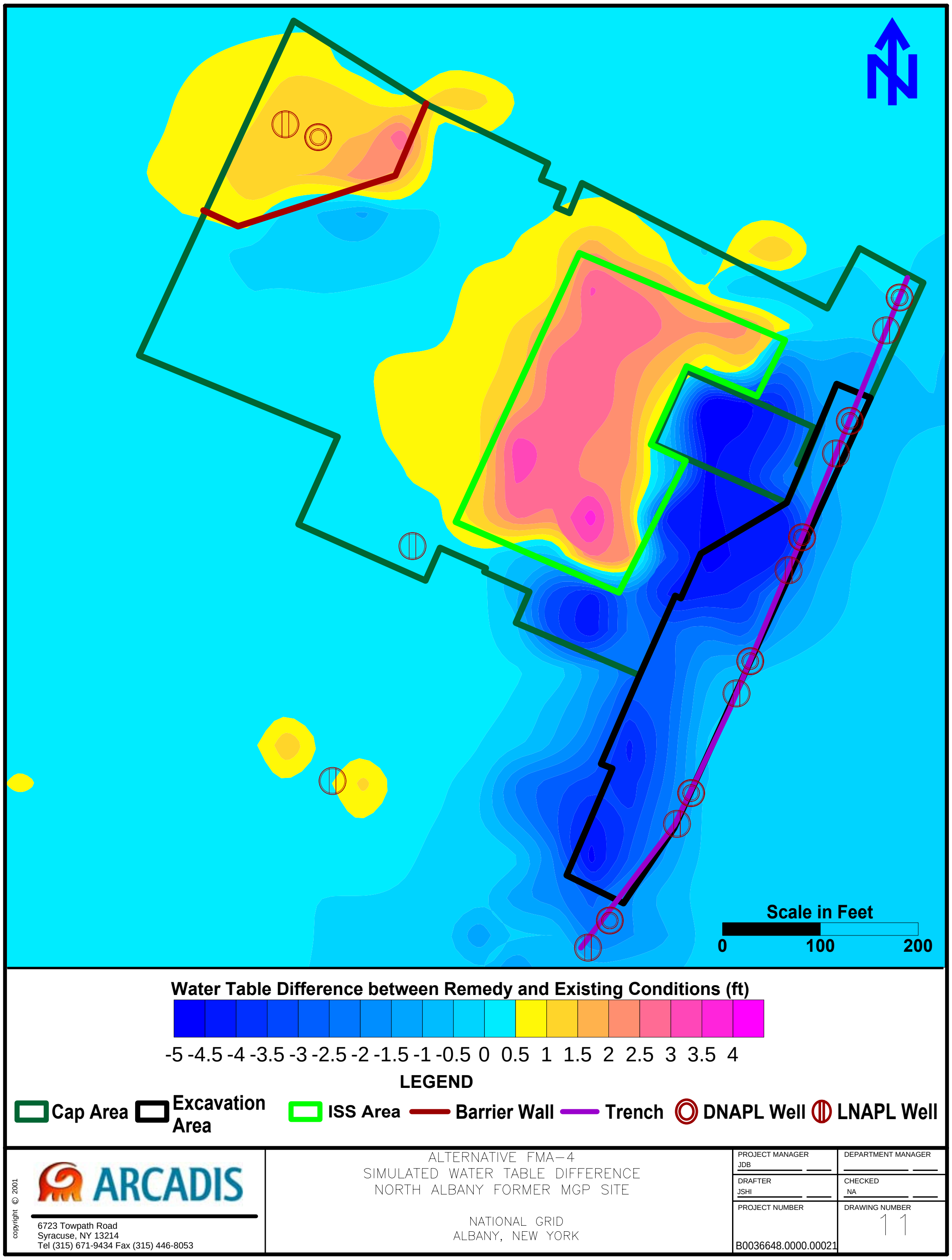
ALTERNATIVE FMA-3
GROUNDWATER FLOW PATHLINES
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER 10


Scale in Feet
0
100
200
Water Table Difference between Remedy and Existing Conditions (ft)
-5 -4.5 -4 -3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5 4
LEGEND
Cap Area
Excavation Area
ISS Area
Barrier Wall
Trench
DNAPL Well
LNAPL Well
ARCADIS
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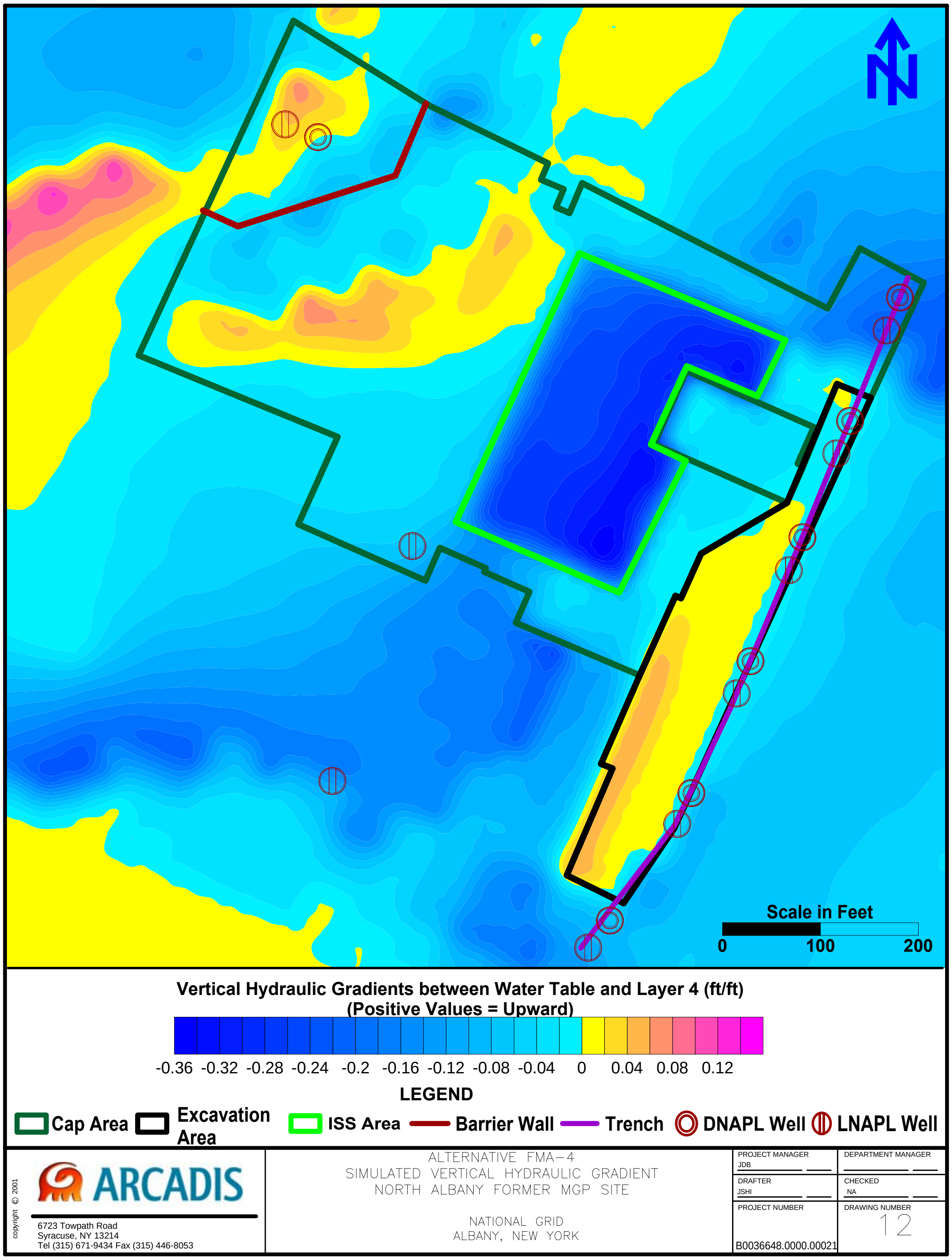
ALTERNATIVE FMA-4
SIMULATED WATER TABLE DIFFERENCE
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER
JDB
DEPARTMENT MANAGER
DRAFTER
JSHI
CHECKED
NA
PROJECT NUMBER
B0036648.0000.00021
DRAWING NUMBER
11



N
Scale in Feet
0
100
200
Vertical Hydraulic Gradients between Water Table and Layer 4 (ft/ft)
(Positive Values = Upward)
-0.36 -0.32 -0.28 -0.24 -0.2 -0.16 -0.12 -0.08 -0.04 0 0.04 0.08 0.12
LEGEND
Cap Area
Excavation Area
ISS Area
Barrier Wall
Trench
DNAPL Well
LNAPL Well
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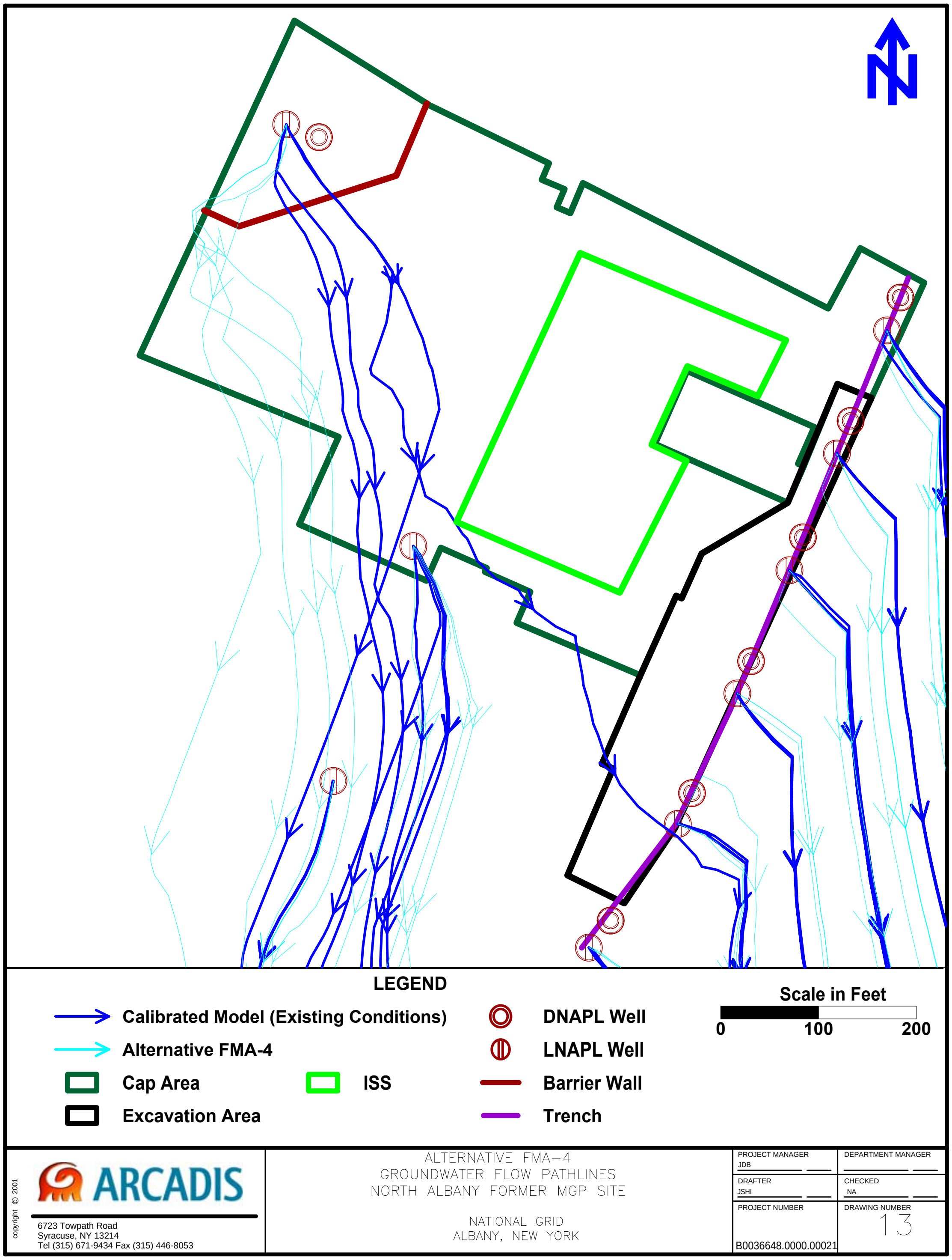
ALTERNATIVE FMA-4
SIMULATED VERTICAL HYDRAULIC GRADIENT
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER
JDB
DEPARTMENT MANAGER
DRAFTER
JSHI
CHECKED
NA
PROJECT NUMBER
B0036648.0000.00021
DRAWING NUMBER
12


LEGEND
Calibrated Model (Existing Conditions)
Alternative FMA-4
Cap Area
ISS
Excavation Area
DNAPL Well
LNAPL Well
Barrier Wall
Trench
Scale in Feet
0
100
200
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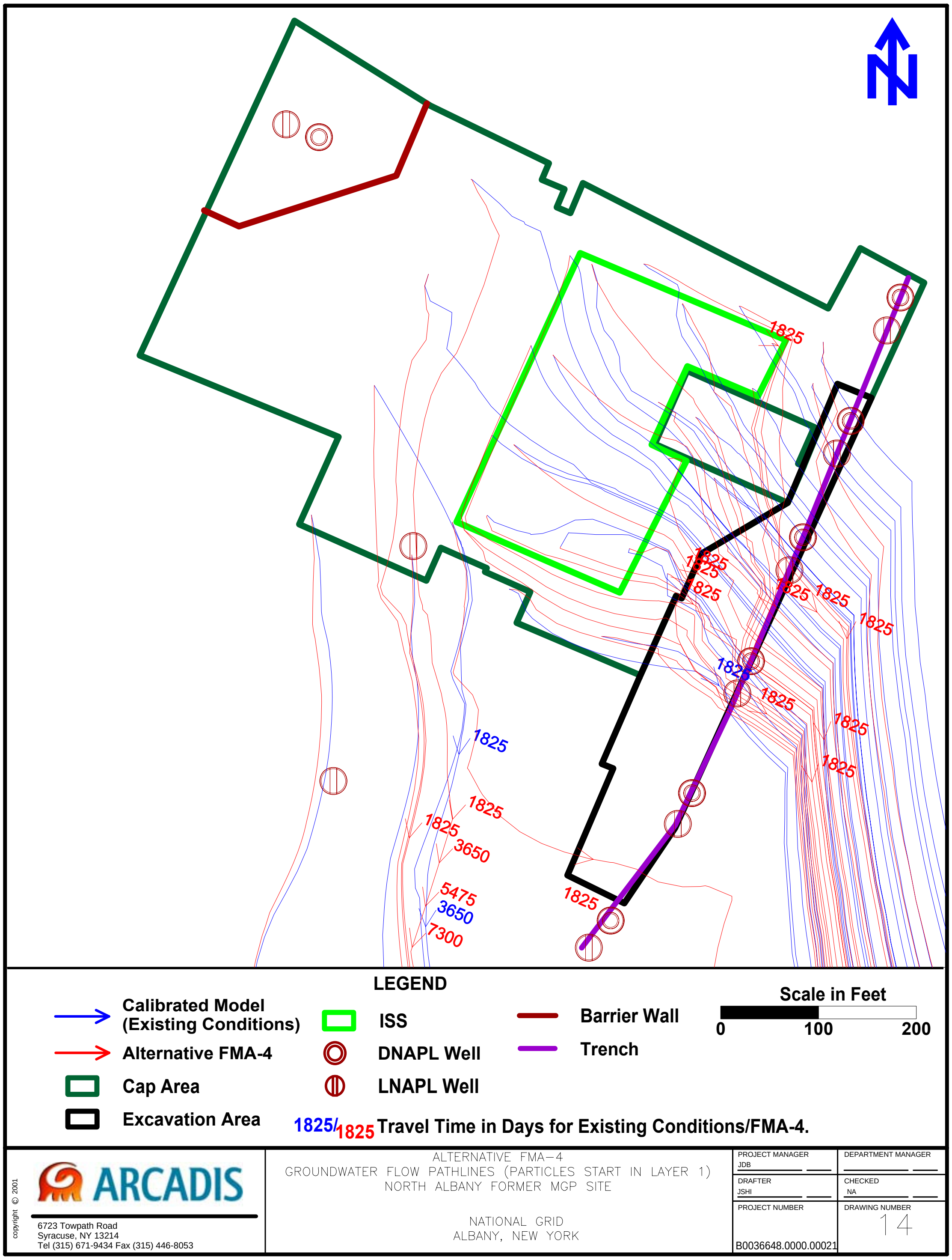
ALTERNATIVE FMA-4
GROUNDWATER FLOW PATHLINES
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER
JDB
DEPARTMENT MANAGER
DRAFTER
JSHI
CHECKED
NA
PROJECT NUMBER
B0036648.0000.00021
DRAWING NUMBER
13


N
1825
1825
1825
1825
1825
1825
1825
1825
1825
1825
1825
1825
3650
5475
3650
7300
LEGEND
Calibrated Model (Existing Conditions)
Alternative FMA-4
Cap Area
Excavation Area
ISS
DNAPL Well
LNAPL Well
Barrier Wall
Trench
Scale in Feet
0 100 200
1825/1825 Travel Time in Days for Existing Conditions/FMA-4.
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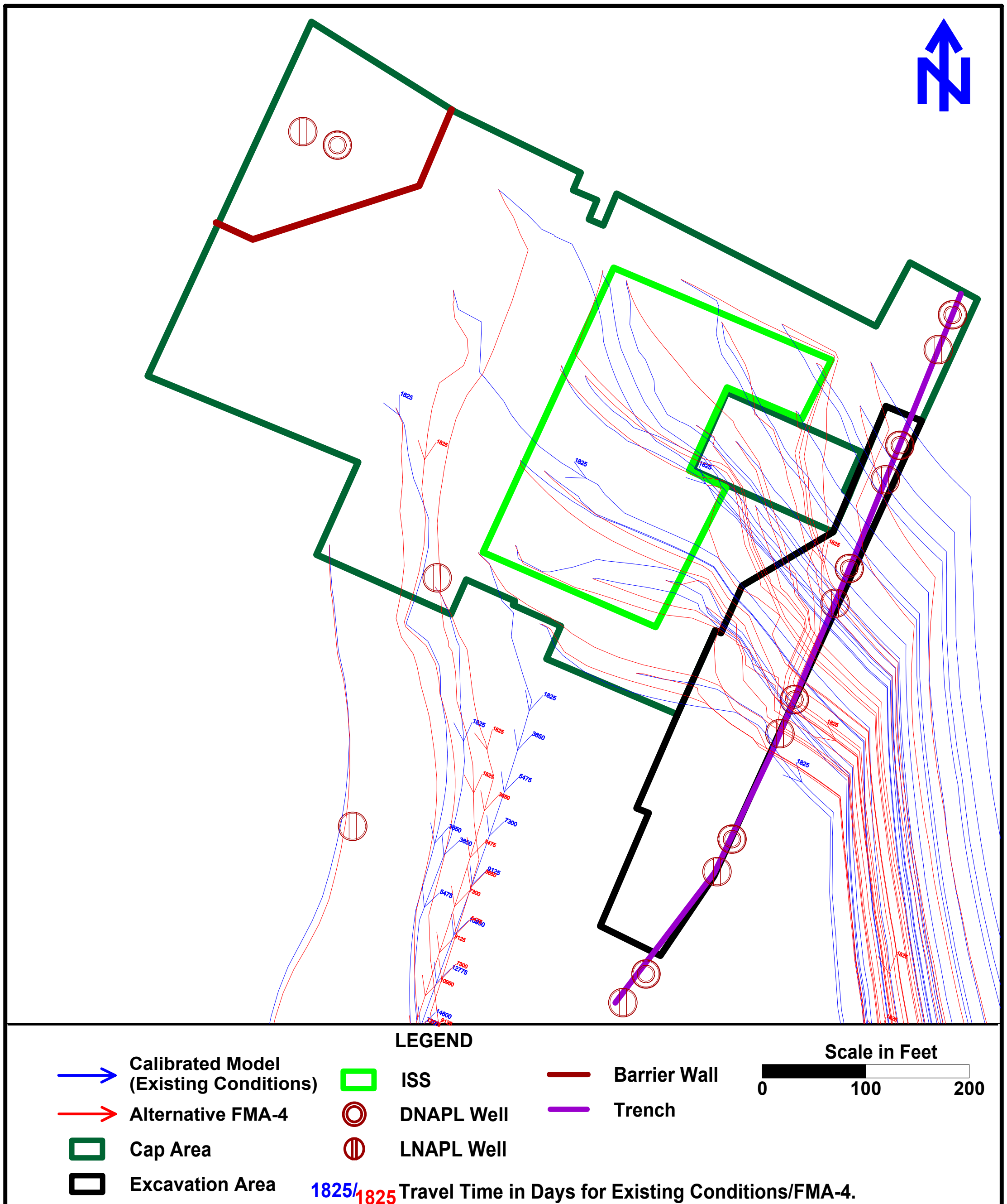
ALTERNATIVE FMA-4
GROUNDWATER FLOW PATHLINES (PARTICLES START IN LAYER 1)
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER JDB
DEPARTMENT MANAGER
DRAFTER JSHI
CHECKED NA
PROJECT NUMBER B0036648.0000.00021
DRAWING NUMBER 14



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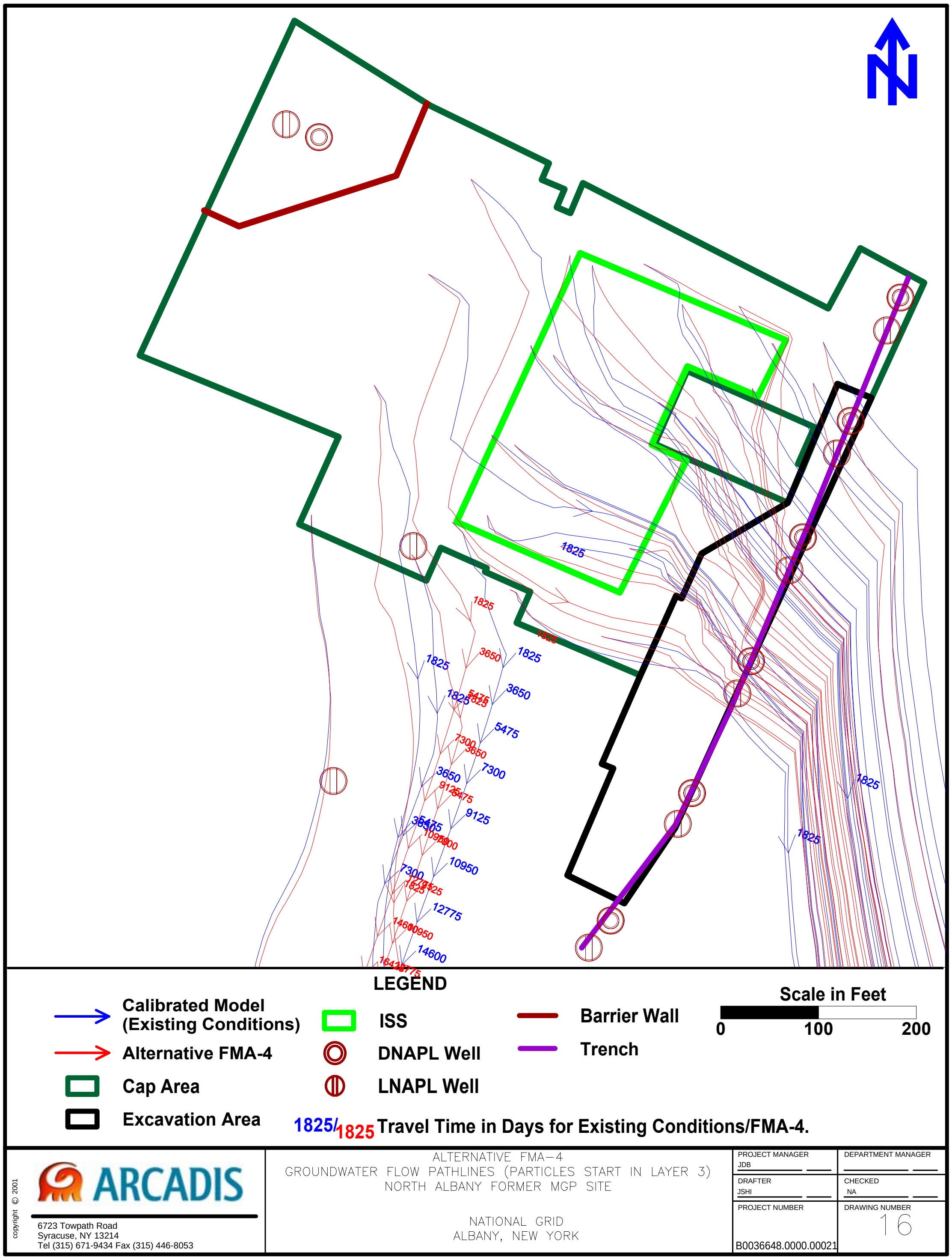
ALTERNATIVE FMA-4
GROUNDWATER FLOW PATHLINES (PARTICLES START IN LAYER 2)
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER 15



N
LEGEND
Calibrated Model (Existing Conditions)
Alternative FMA-4
Cap Area
Excavation Area
ISS
DNAPL Well
LNAPL Well
Barrier Wall
Trench
Scale in Feet
0
100
200
1825/1825 Travel Time in Days for Existing Conditions/FMA-4.
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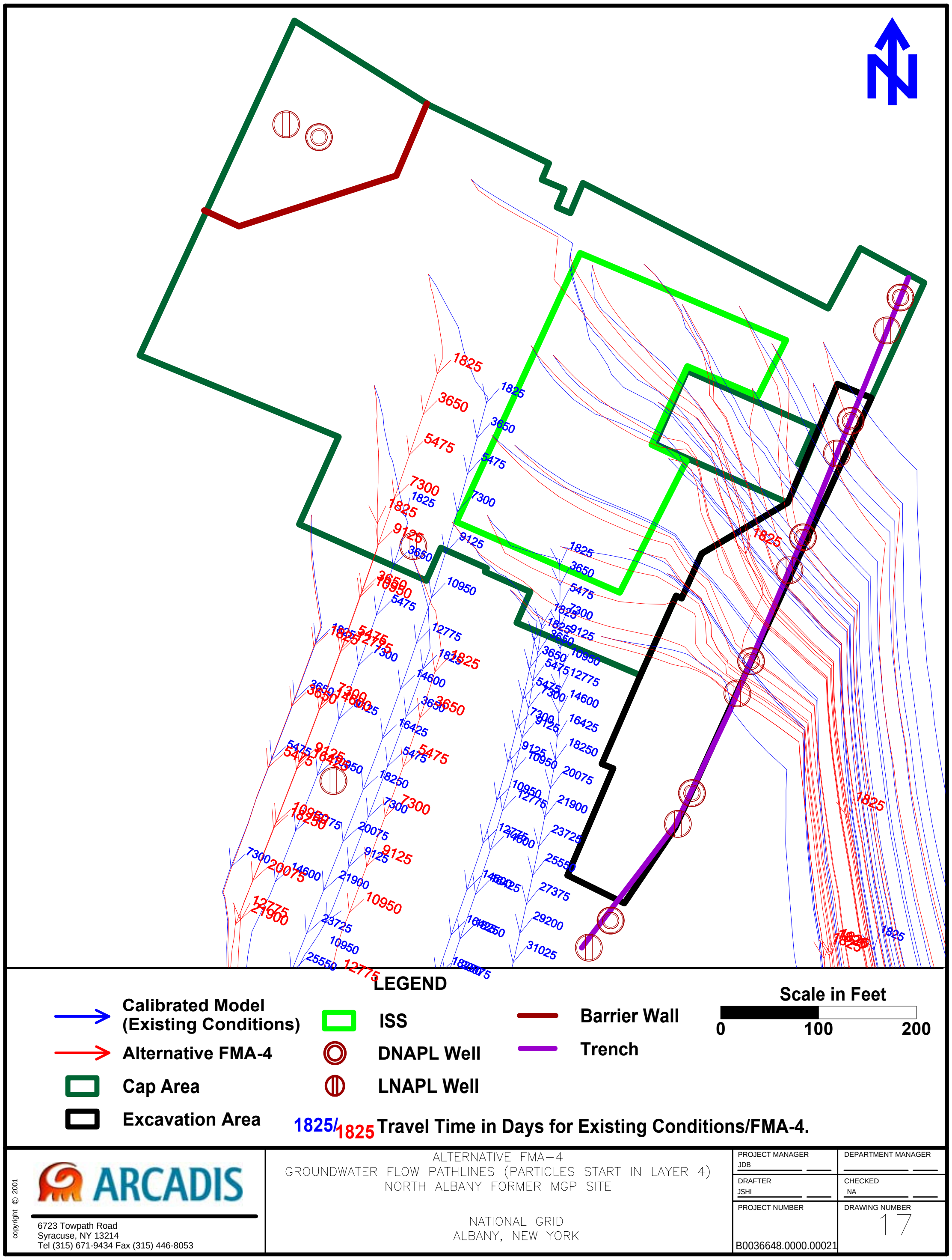
ALTERNATIVE FMA-4
GROUNDWATER FLOW PATHLINES (PARTICLES START IN LAYER 3)
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER
JDB
DEPARTMENT MANAGER
DRAFTER
JSHI
CHECKED
NA
PROJECT NUMBER
B0036648.0000.00021
DRAWING NUMBER
16



LEGEND
Calibrated Model (Existing Conditions)
Alternative FMA-4
Cap Area
Excavation Area
ISS
DNAPL Well
LNAPL Well
Barrier Wall
Trench
Scale in Feet
0
100
200
1825/1825 Travel Time in Days for Existing Conditions/FMA-4.
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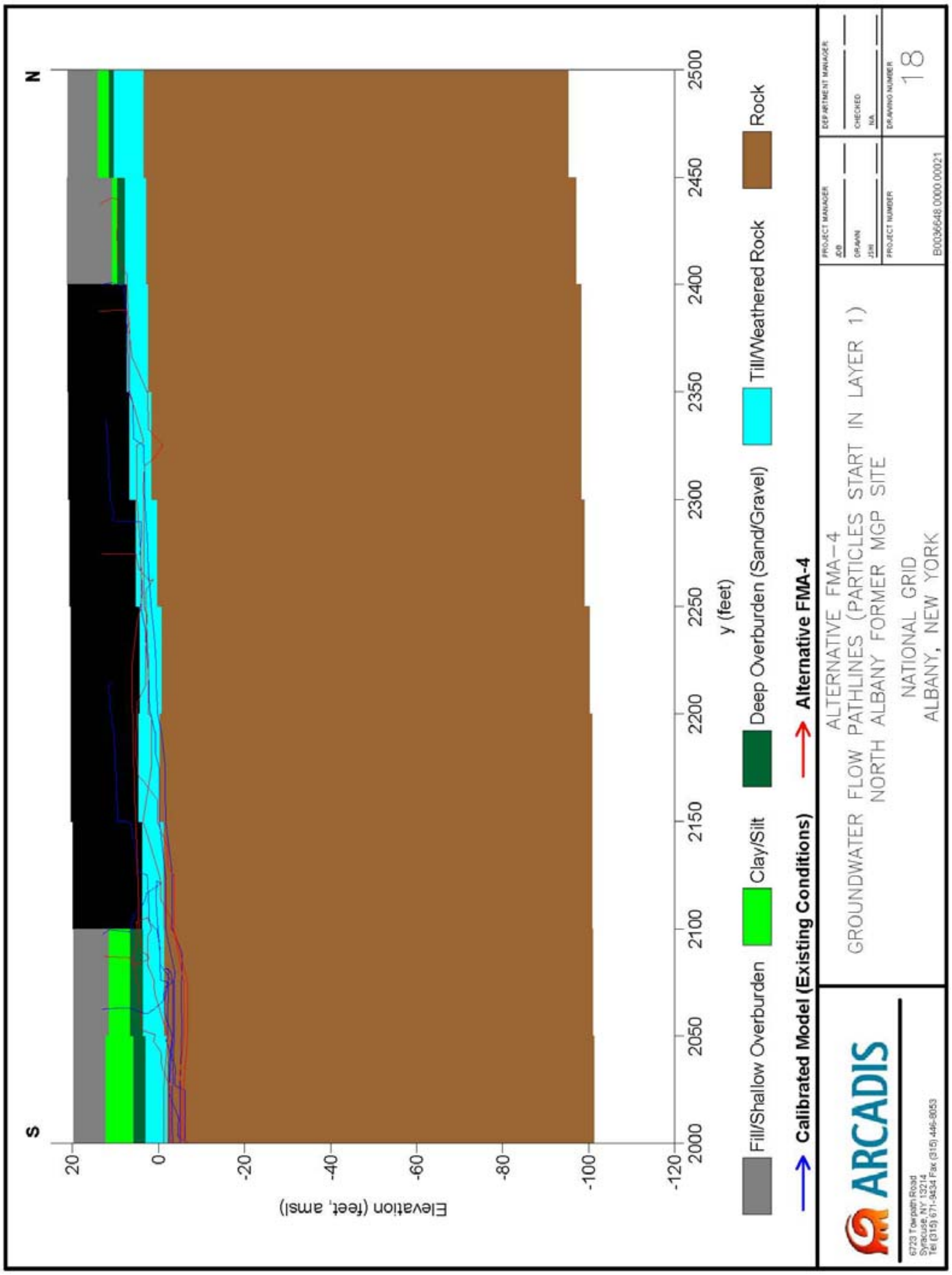
ALTERNATIVE FMA-4
GROUNDWATER FLOW PATHLINES (PARTICLES START IN LAYER 4)
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER
JDB
DEPARTMENT MANAGER
DRAFTER
JSHI
CHECKED
NA
PROJECT NUMBER
B0036648.0000.00021
DRAWING NUMBER
17


S
N
Elevation (feet, amsl)
20
0
-20
-40
-60
-80
-100
-120
2000
2050
2100
2150
2200
2250
2300
2350
2400
2450
2500
y (feet)
Fill/Shallow Overburden
Clay/Silt
Deep Overburden (Sand/Gravel)
Till/Weathered Rock
Rock
Calibrated Model (Existing Conditions)
Alternative FMA-4
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ALTERNATIVE FMA-4
GROUNDWATER FLOW PATHLINES (PARTICLES START IN LAYER 1)
NORTH ALBANY FORMER MGP SITE
NATIONAL GRID
ALBANY, NEW YORK
PROJECT MANAGER
JDB
DRAWN
JSH
PROJECT NUMBER
B0036648.0000.00021
DEPARTMENT MANAGER
CHECKED
NA
DRAWING NUMBER
18

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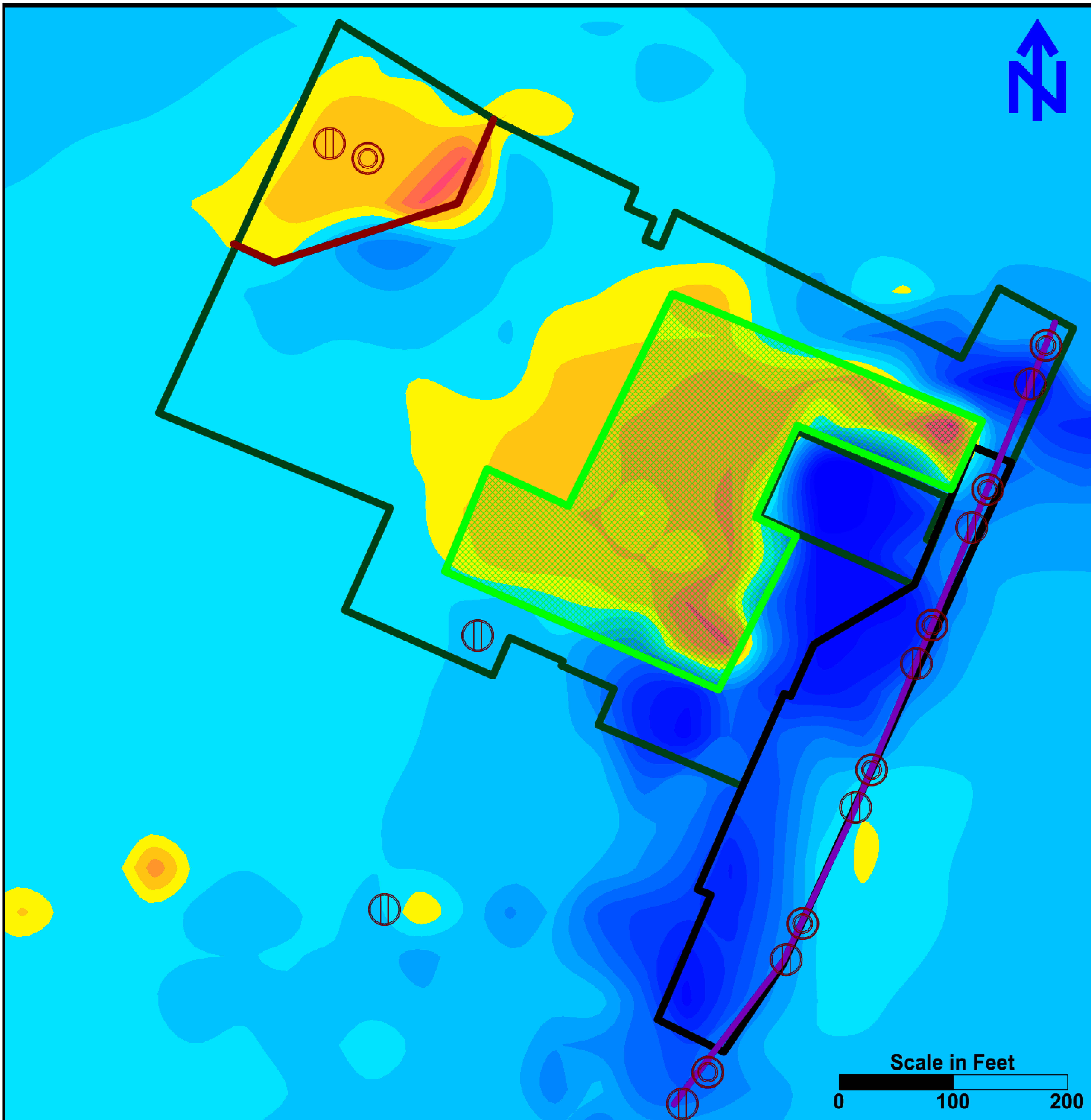
Appendix C

Additional Groundwater Modeling Simulations



Water Table Difference between Remedy and Existing Conditions (ft)

-5 -4.5 -4 -3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5 4

LEGEND

Cap Area | Excavation Area | ISS Area | Barrier Wall | Trench | DNAPL Well | LNAPL Well

2/13/03

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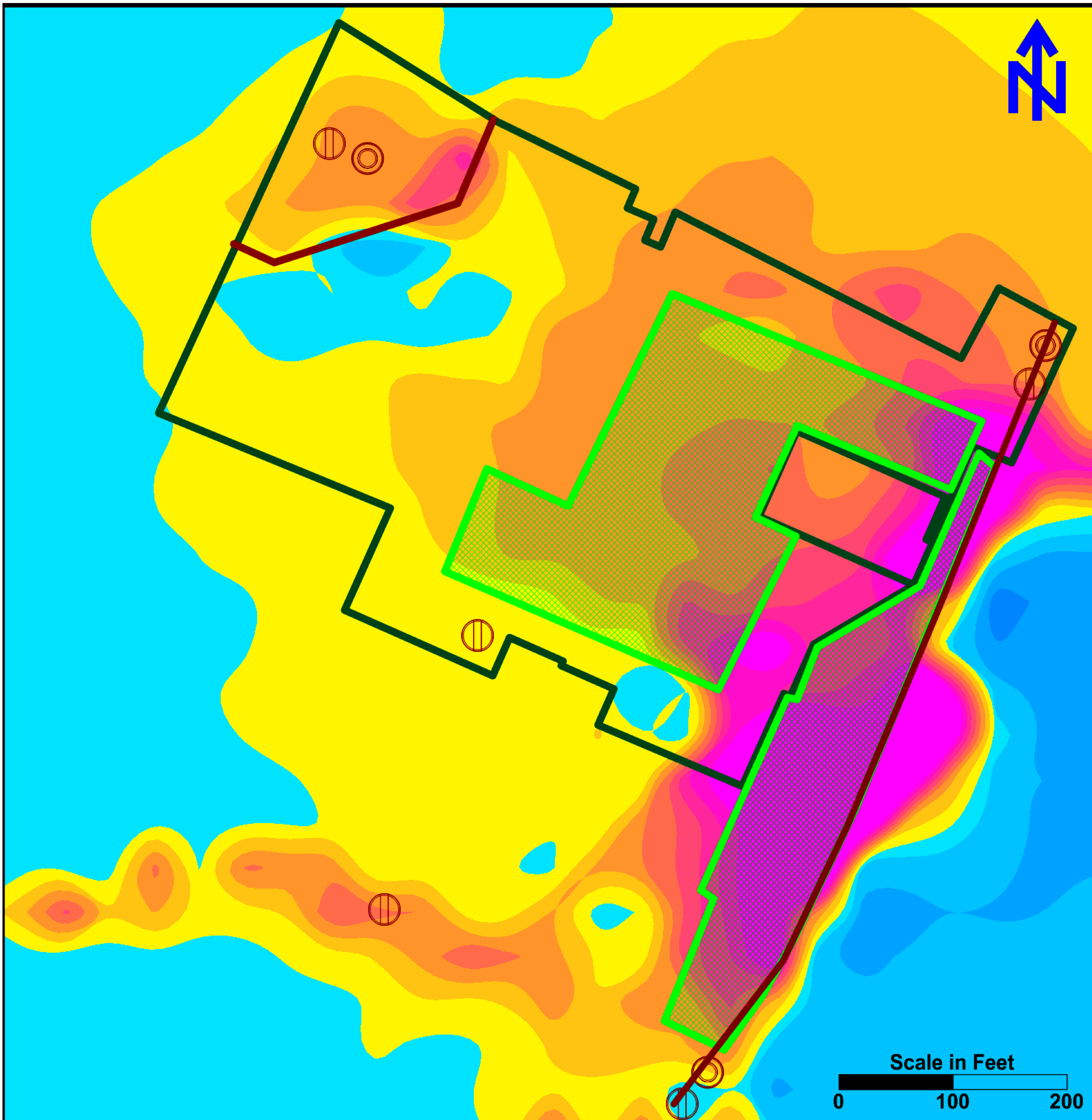
SIMULATION 4A
SIMULATED WATER TABLE DIFFERENCE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Water Table Difference between Remedy and Existing Conditions (ft)

-5 -4.5 -4 -3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5 4

LEGEND

Cap Area **ISS Area** **Barrier Wall** **DNAPL Well** **LNAPL Well**

2/13/03

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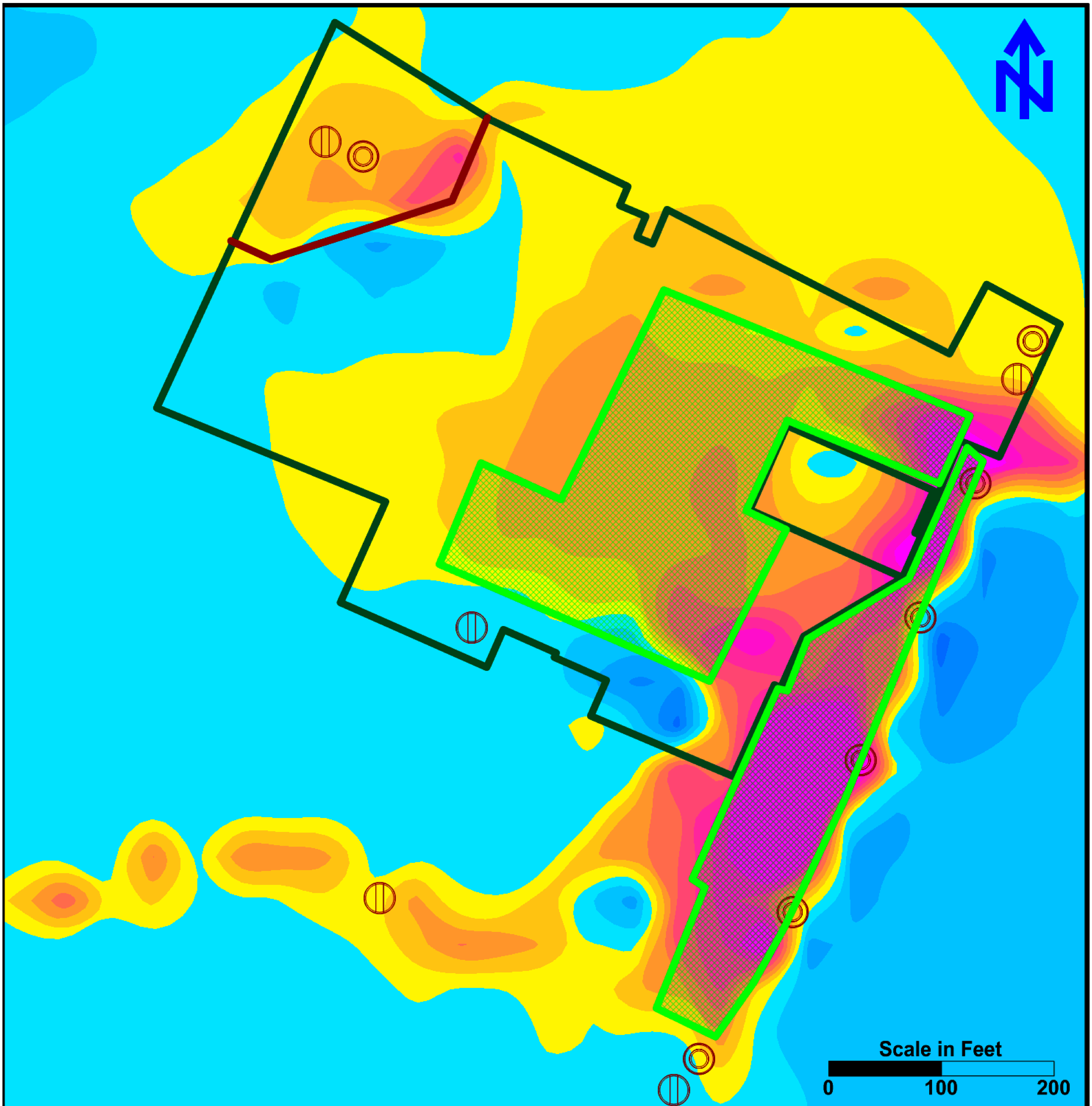
SIMULATION 4B
SIMULATED WATER TABLE DIFFERENCE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Water Table Difference between Remedy and Existing Conditions (ft)

-5 -4.5 -4 -3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5 4

LEGEND

Cap Area | **ISS Area** | **Barrier Wall** | **DNAPL Well** | **LNAPL Well**

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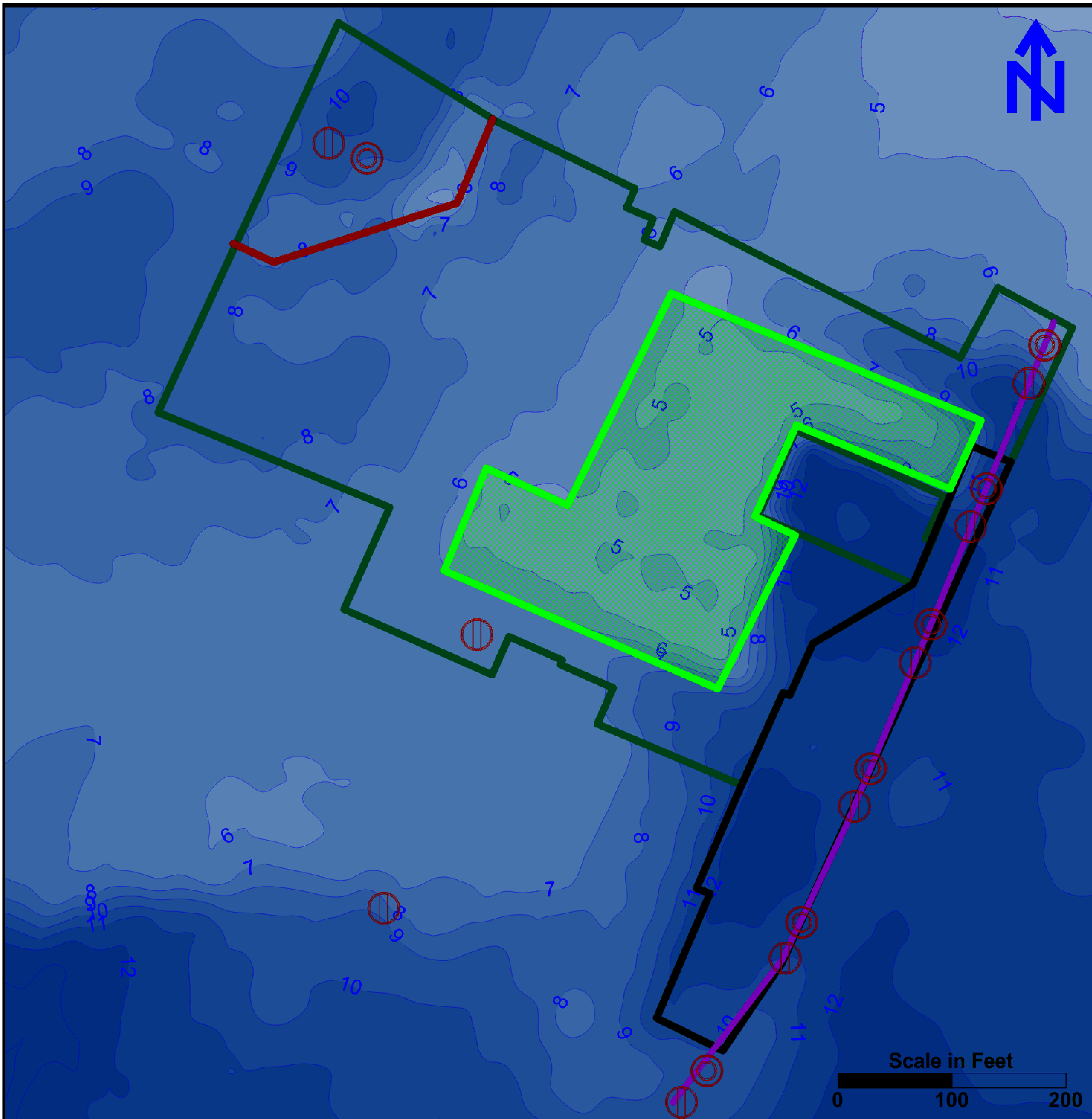
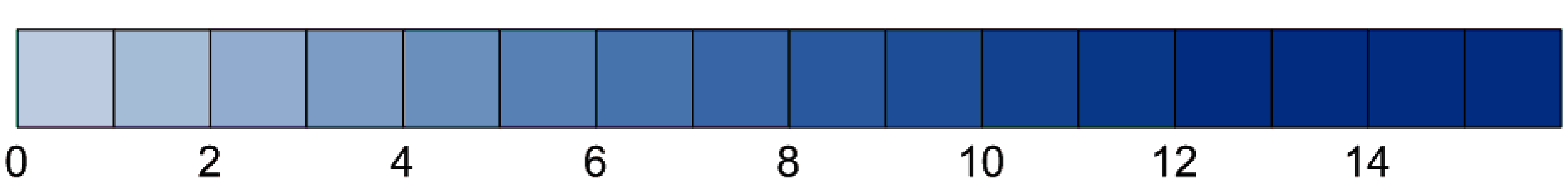
SIMULATION 4C
SIMULATED WATER TABLE DIFFERENCE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Depth to water below ground surface (ft)



LEGEND

Cap Area | Excavation Area | ISS Area | Barrier Wall | Trench | DNAPL Well | LNAPL Well

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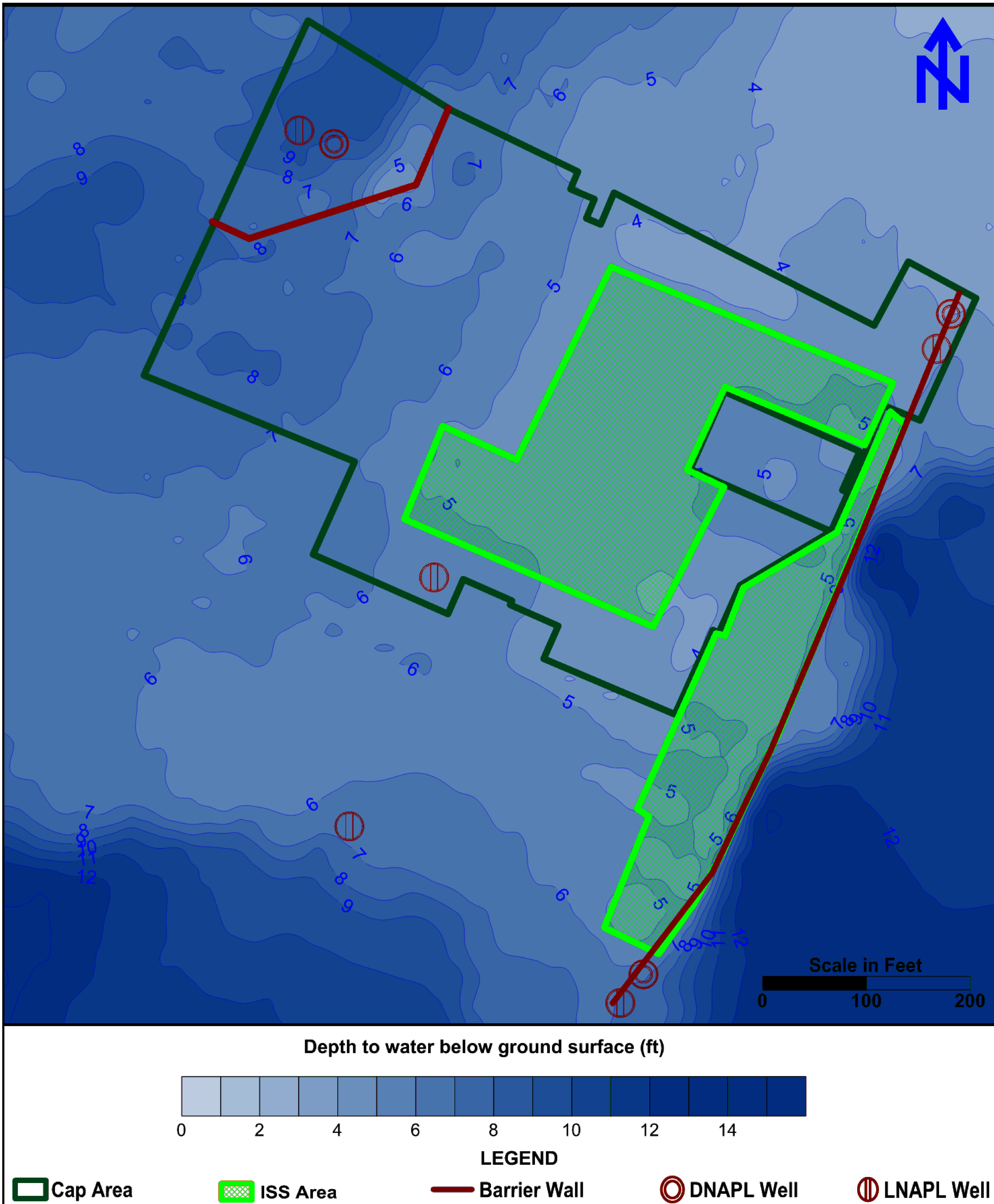
SIMULATION 4A
DEPTH TO WATER BELOW GROUND SURFACE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



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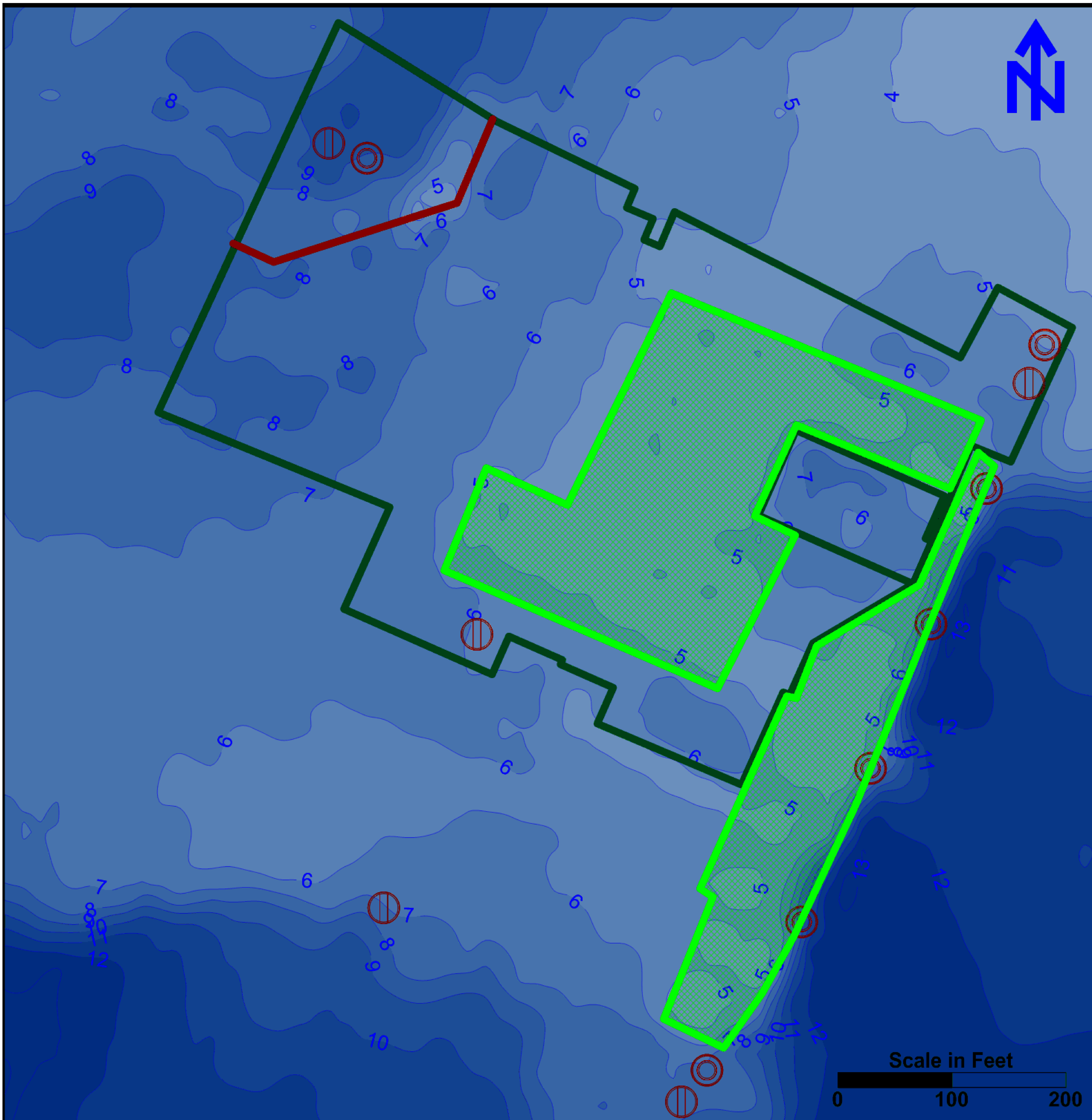
SIMULATION 4B
DEPTH TO WATER BELOW GROUND SURFACE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Depth to water below ground surface (ft)

0 2 4 6 8 10 12 14

LEGEND

Cap Area **ISS Area** **Barrier Wall** **DNAPL Well** **LNAPL Well**

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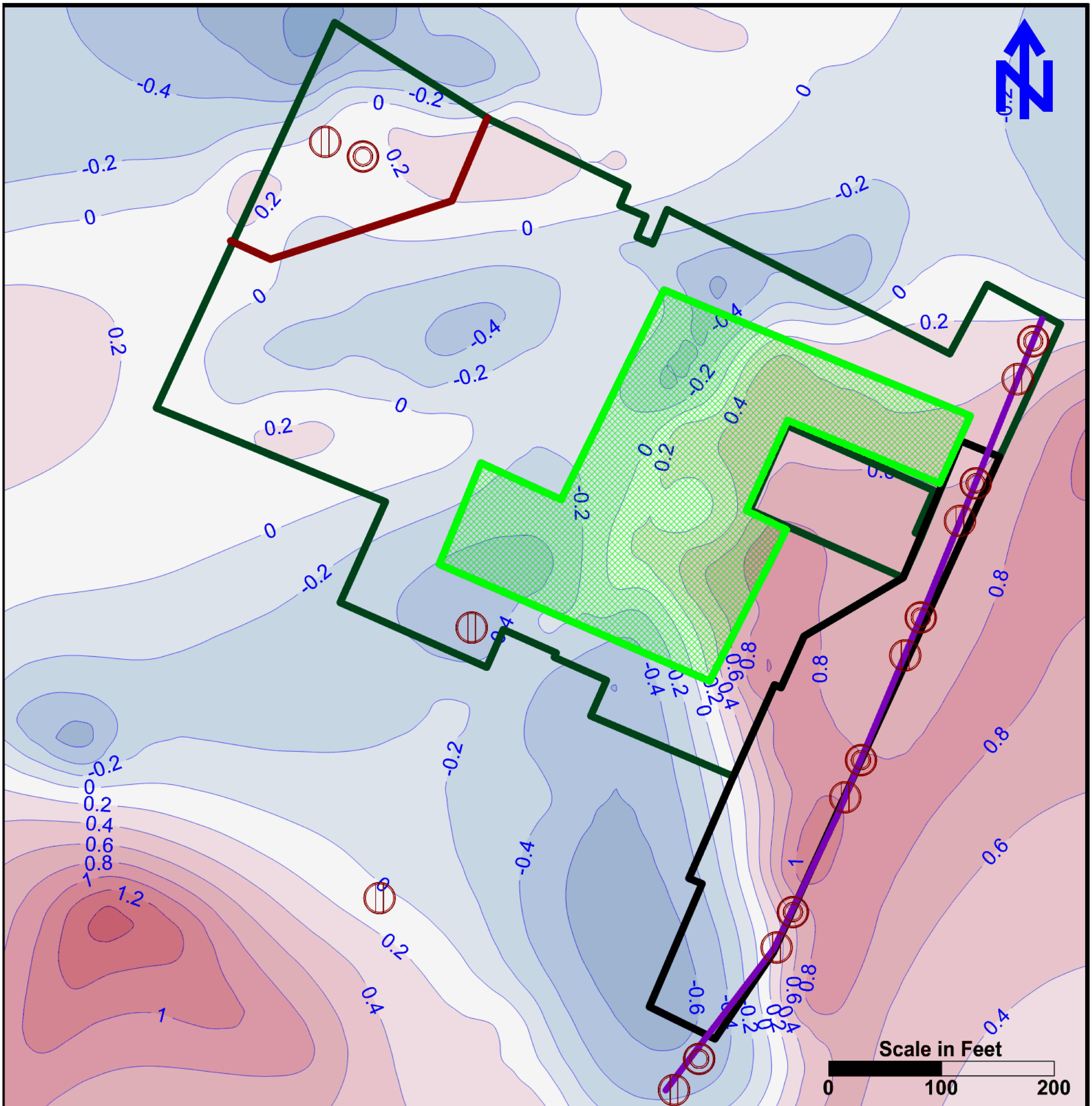
SIMULATION 4C
DEPTH TO WATER BELOW GROUND SURFACE
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Head difference between weathered rock and bedrock (ft)
(positive values denote upward gradient)

-3 -2.6 -2.2 -1.8 -1.4 -1 -0.6 -0.2 0.2 0.6 1 1.4 1.8 2.2 2.6 3

Calibrated model did not simulate site remedial systems - proposed locations are shown for comparison only.

LEGEND

Cap Area | **Excavation Area** | **ISS Area** | **Barrier Wall** | **Trench** | **DNAPL Well** | **LNAPL Well**

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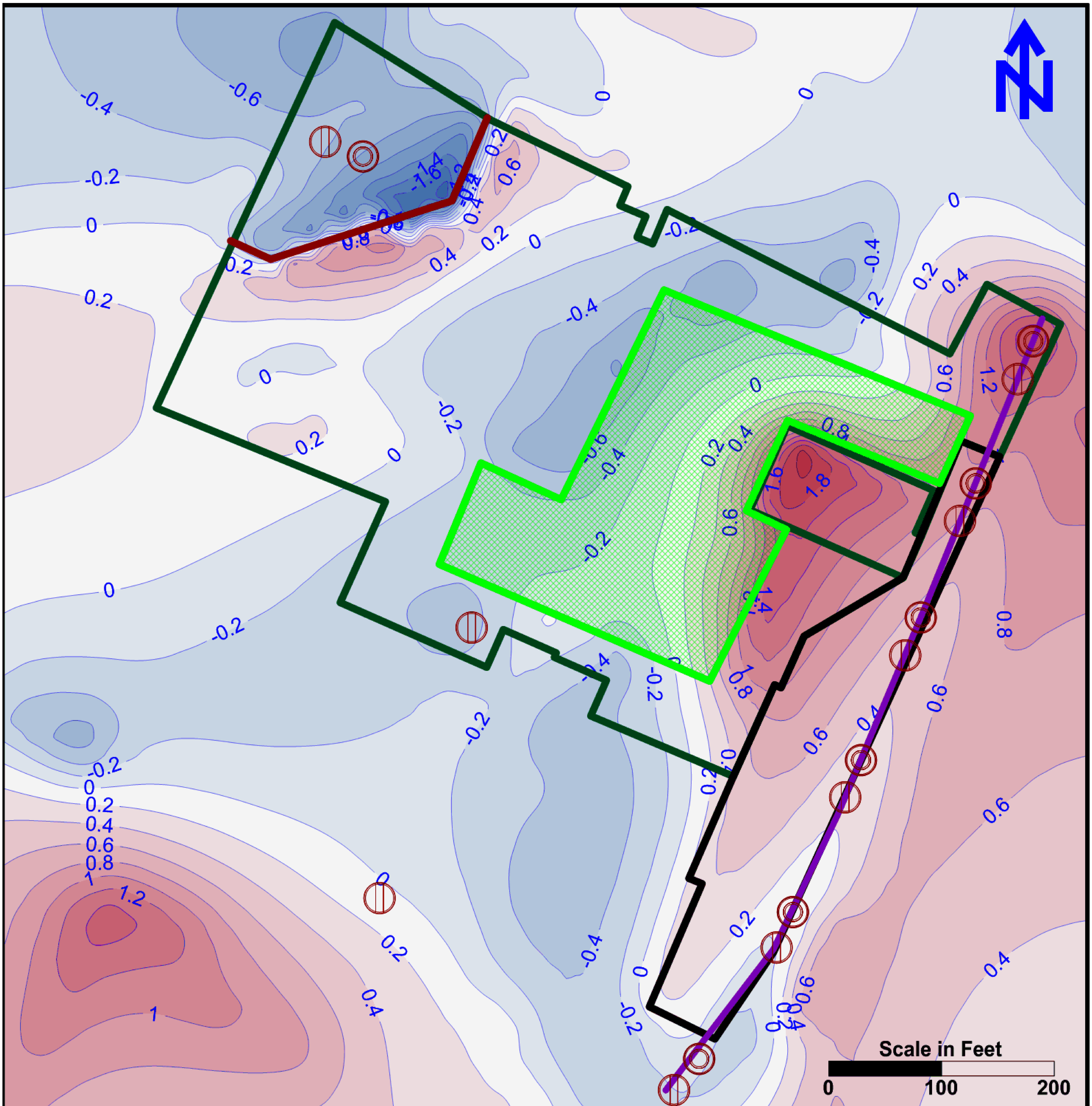
CALIBRATED MODEL
HEAD DIFFERENCE: WEATHERED ROCK AND BEDROCK
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Head difference between weathered rock and bedrock (ft)
(positive values denote upward gradient)

-3 -2.6 -2.2 -1.8 -1.4 -1 -0.6 -0.2 0.2 0.6 1 1.4 1.8 2.2 2.6 3

LEGEND

Cap Area | Excavation Area | ISS Area | Barrier Wall | Trench | DNAPL Well | LNAPL Well

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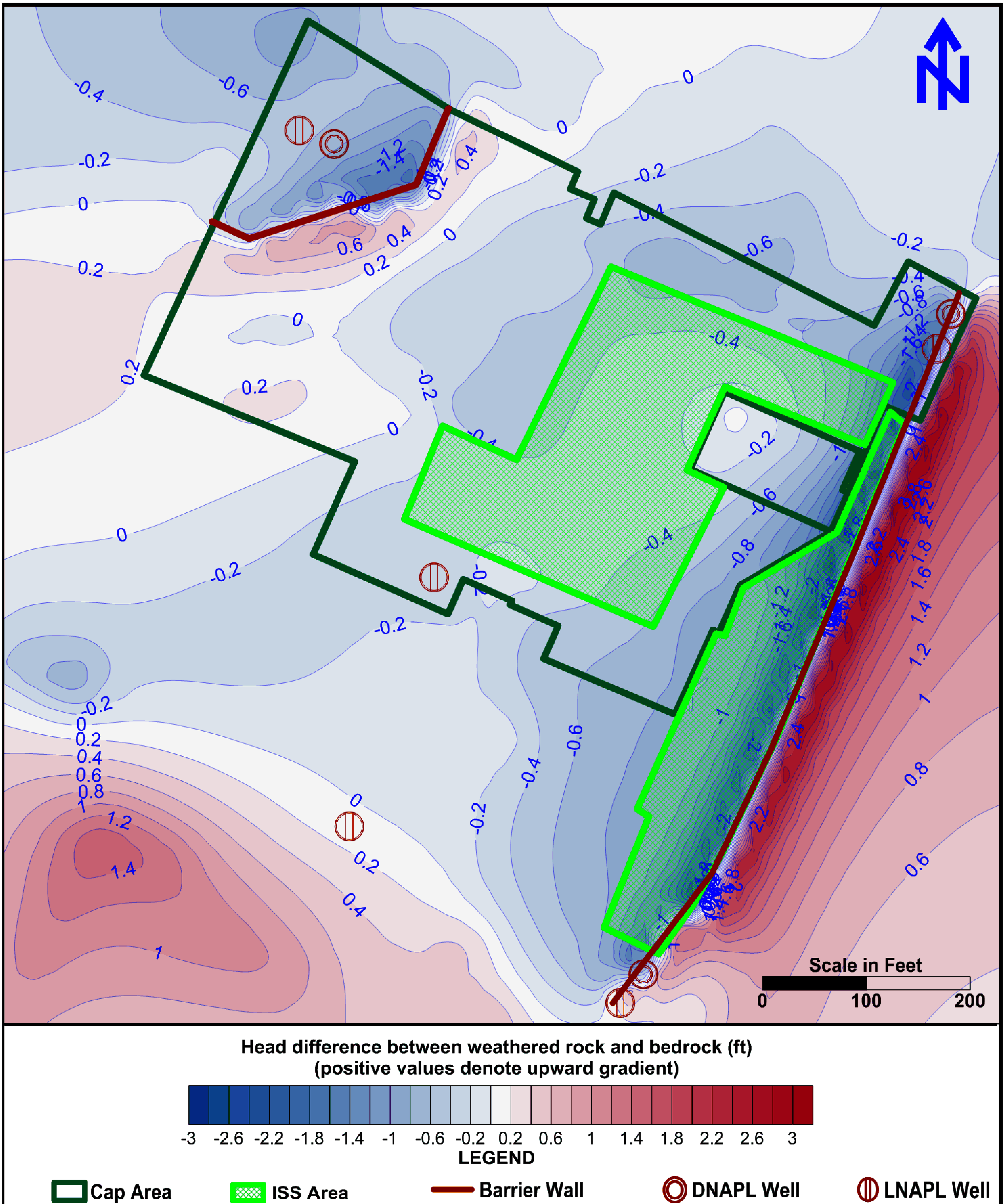
SIMULATION 4A
HEAD DIFFERENCE: WEATHERED ROCK AND BEDROCK
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



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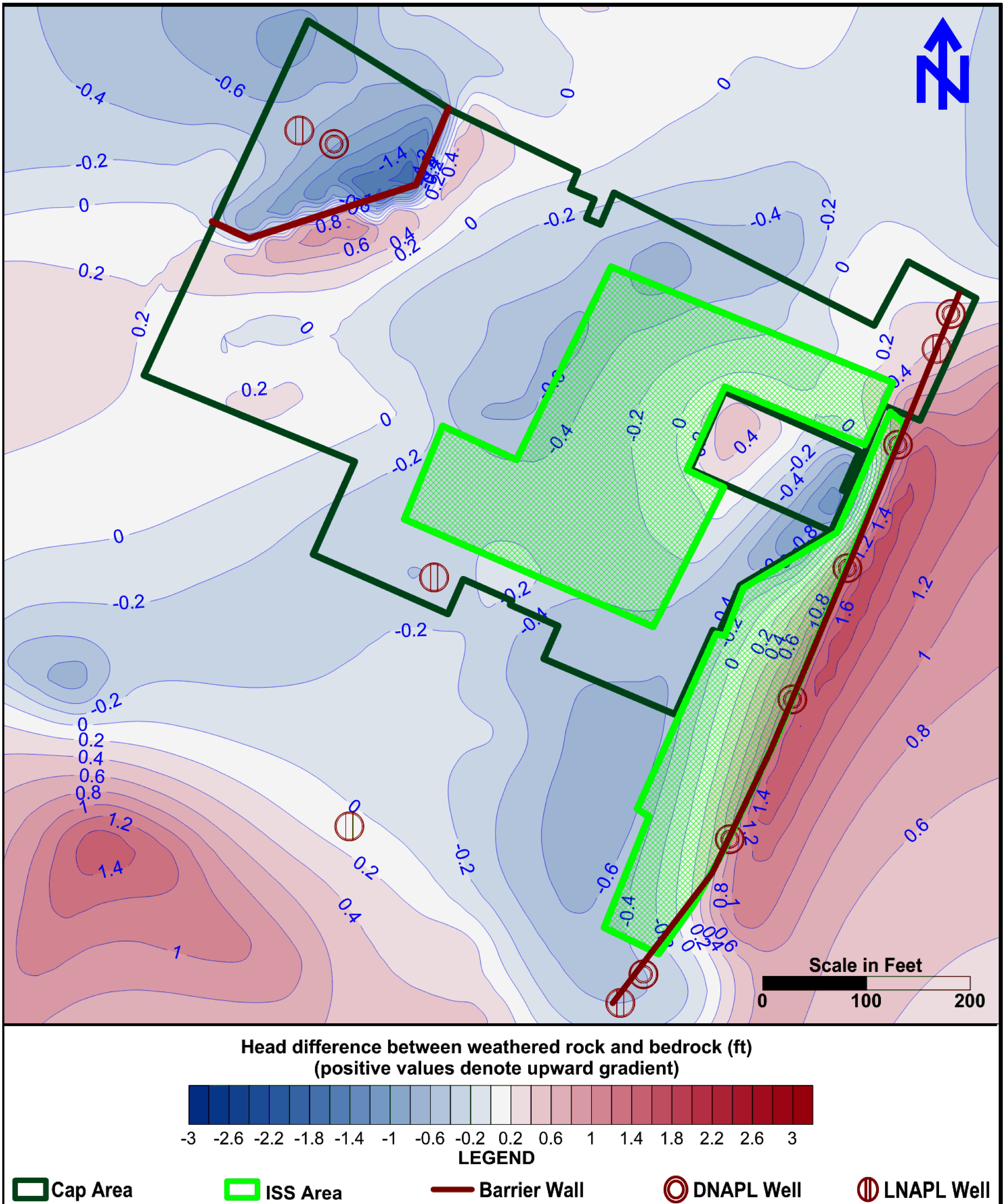
SIMULATION 4B
HEAD DIFFERENCE: WEATHERED ROCK AND BEDROCK
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



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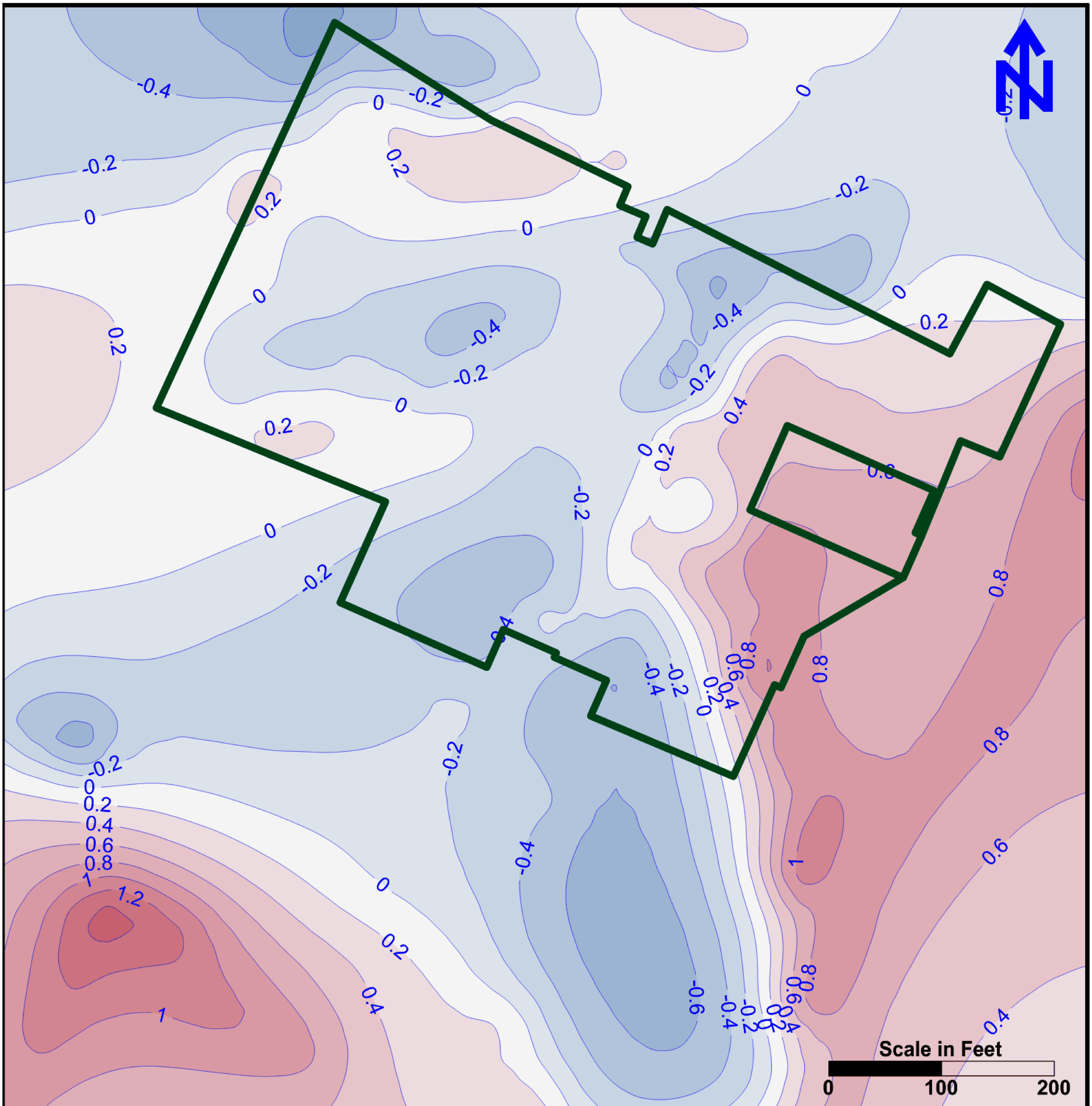
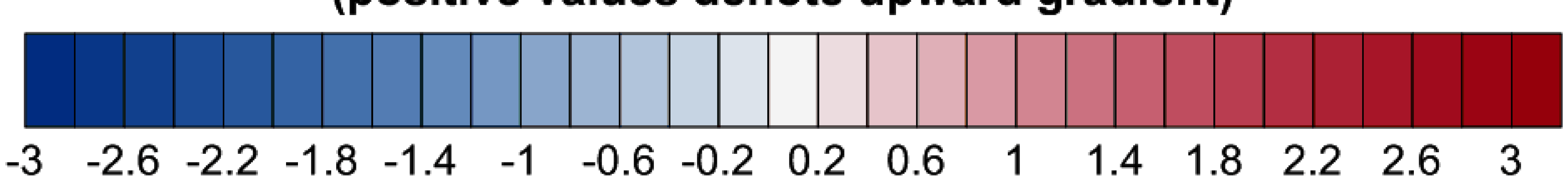
SIMULATION 4C
HEAD DIFFERENCE: WEATHERED ROCK AND BEDROCK
NORTH ALBANY FORMER MGP SITE

NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER



Head difference between weathered rock and bedrock (ft)
(positive values denote upward gradient)



LEGEND

Cap Area

ARCADIS
6723 Towpath Road
Syracuse, NY 13214
Tel (315) 671-9434 Fax (315) 446-8053

CALIBRATED MODEL
HEAD DIFFERENCE: WEATHERED ROCK AND BEDROCK
NORTH ALBANY FORMER MGP SITE

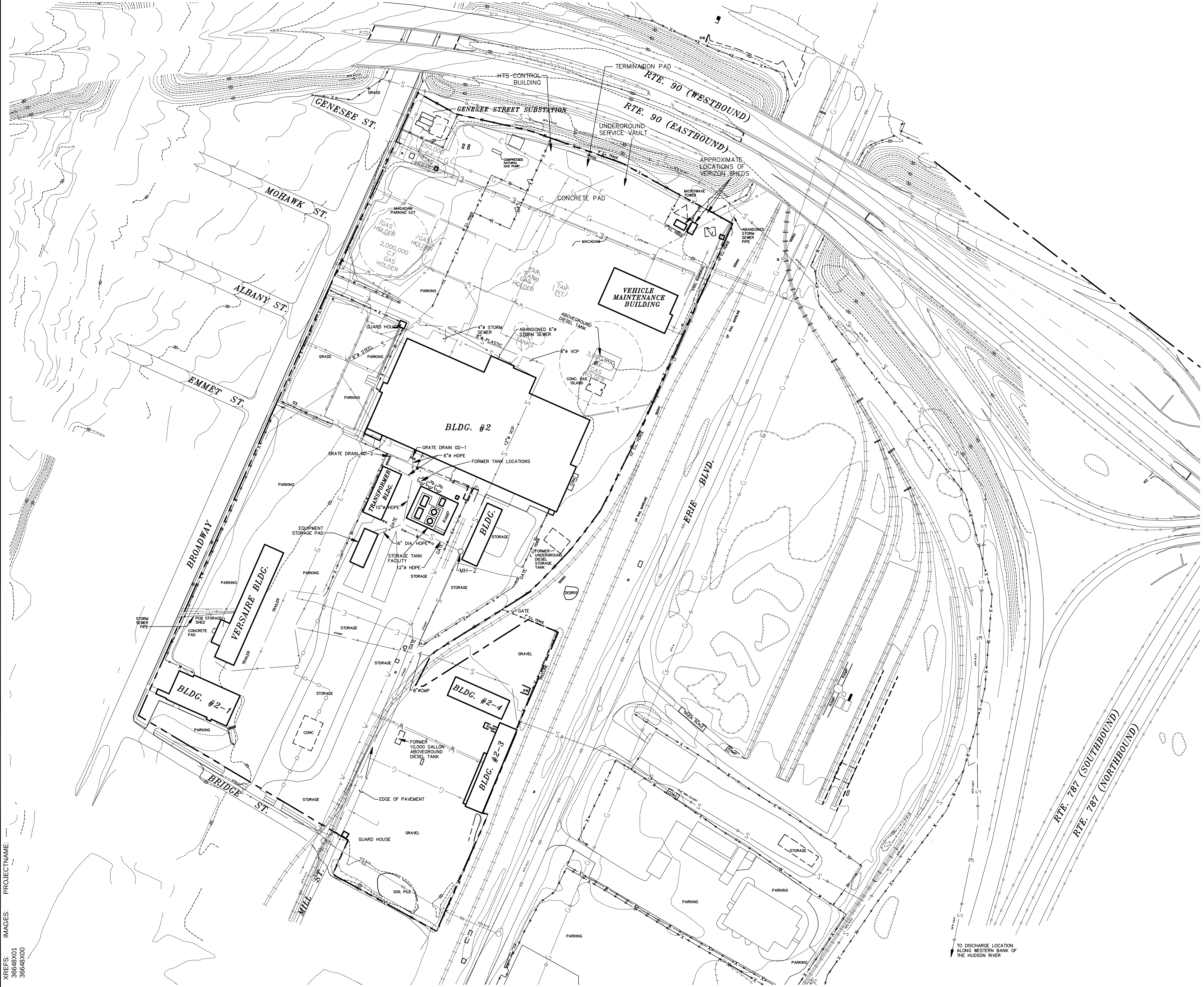
NATIONAL GRID
ALBANY, NEW YORK

PROJECT MANAGER JDB	DEPARTMENT MANAGER
DRAFTER JSHI	CHECKED NA
PROJECT NUMBER B0036648.0000.00021	DRAWING NUMBER

ARCADIS

Appendix D

Topographic Site Map



LEGEND:

	APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
	GUARD RAIL
	FENCE
	EXISTING RAILROAD
	APPROXIMATE PROPERTY LINE
○ CB-2	EXISTING CATCH BASIN
○ MH-1	EXISTING STORM SEWER MANHOLE
○ EMH-1	EXISTING ELECTRICAL MANHOLE
○ TMH-1	EXISTING TELEPHONE MANHOLE
○ GMH-1	EXISTING UTILITY MANHOLE
S	STORM SEWER
SS	SANITARY SEWER
T	TELEPHONE LINE
E	ELECTRICAL LINE
G	GAS LINE
W	WATER LINE
C	CABLE LINE
	5 FOOT TOPOGRAPHIC CONTOUR LINE
	10 FOOT TOPOGRAPHIC CONTOUR LINE

NOTES:

1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (INCLUDING ON–SITE STORM SEWERS, SANITARY SEWERS, TELEPHONE LINES, ELECTRICAL LINES, GAS LINES, WATER LINES, AND CABLE) WERE DIGITIZED FROM NMPC DRAWING NO. D–29734–E, FILE INDEX NO. 20.3–A1.1–B2, DATED JUNE 27, 1994, ENTITLED NORTH ALBANY SERVICE CENTER SITE PLAN – PAVING (OUTSIDE FENCE). LOCATIONS OF NATURAL GAS MAINS ARE APPROXIMATED BASED ON FIELD OBSERVATIONS DURING UTILITY LOCATING ACTIVITIES. ACTUAL LOCATIONS OF UNDERGROUND GAS UTILITIES MUST BE DETERMINED PRIOR TO IMPLEMENTING SUBSURFACE WORK ACTIVITIES.
3. LOCATIONS OF MANHOLES AND CATCH BASINS WERE OBTAINED FROM A SURVEY CONDUCTED BY NMPC DURING JULY/AUGUST 1997.
4. LOCATIONS OF OFF–SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. TOPOGRAPHY BASED ON FIGURE PROVIDED BY ERDMAN ANTHONY CONSULTING ENGINEERS OBTAINED BY PHOTOGRAMMETRIC METHODS FROM APRIL 12, 1992 AERIAL PHOTOGRAPHY AT 1" = 500'. SOME TOPOGRAPHY MAY BE OBSCURED DUE TO VEGETATION OR SHADOWS.

0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
FEASIBILITY STUDY REPORT

SITE TOPGRAPHIC MAP

ARCADIS

FIGURE
A-1

CITY: SYRACUSE DIV/GROUP: 141/ENV DB: R.BASSETT LD:(Opt) PIC:(Opt) PM:(Reqd) TM: J.HORSTMAN LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036648\0000\00021\DWG\FS-REPORT\36648T01.DWG LAYOUT: A-1 SAVED: 12/17/2009 12:59 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/17/2009 12:59 PM BY: LISTER, PAUL
XREFS: 36648X01 36648X00 IMAGES: PROJECTNAME: ----