DRAFT

REMEDIAL DESIGN WORK PLAN

North Albany Former Manufactured Gas Plant Site

NYSDEC Site Number: 4-01-040

October 2016

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Certification

I, Terry W. Young, certify that I am currently a New York State registered professional engineer and that this *Remedial Design Work Plan* was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER *Technical Guidance for Site Investigation and Remediation* (DER-10).

Signature   Date

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
C&D	Construction and Demolition Debris
CAMP	Community Air Monitoring Plan
CD	Compact Disc
CERP	Community and Environmental Response Plan
CF	Cubic Feet
COC	Constituent of Concern
CP	Canadian Pacific
CPP	Citizen Participation Plan
CQAP	Construction Quality Assurance Plan
CY	Cubic Yards
DNAPL	Dense Non-Aqueous Phase Liquid
EE	Environmental Easement
EM	Electromagnetic
FMA	Former MGP Area
FS	Feasibility Study
FSP	Field Sampling Plan
GPR	Ground Penetrating Radar
GRS	Gas Regulator Station
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
HTS	High-Temperature Superconductive
HWSTA	Hazardous Waste Storage Tank Area
IRM	Interim Remedial Measure
ISS	In-Situ Stabilization
LNAPL	Light Non-Aqueous Phase Liquid
LTTD	Low Temperature Thermal Desorption

MGP	Manufactured Gas Plant
MOC	Material of Concern
NAPL	Non-Aqueous Phase Liquid
NMPC	Niagara Mohawk Power Corporation
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OSDA	Off-Site/Downgradient Area
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDI	Pre-Design Investigation
POTW	Publicly-Owned Treatment Works
ppm	Parts Per Million
QAPP	Quality Assurance Project Plan
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RDWP	Remedial Design Work Plan
ROD	Record of Decision
SMP	Site Management Plan
SPDES	State Pollution Discharge Elimination System
SPT	Standard Penetration Test
SVOCs	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Units
SWPPP	Stormwater Pollution Prevention Plan
TAGM	Technical and Administrative Guidance Memorandum
TCLP	Toxicity Characteristic Leaching Procedure
TOGs	Division of Water Technical and Operation Guidance Series Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations
TSDF	Treatment, Storage and Disposal Facility
TSS	Tar Saturated Soil

USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
WMP	Waste Management Plan
YSA	Yard Storage Area

1 INTRODUCTION

This Remedial Design Work Plan (RDWP) provides the framework for preparing the Remedial Design to address environmental impacts at the National Grid North Albany Former Manufactured Gas Plant (MGP) site (the site) located at 1125 Broadway in Albany, New York. The selected remedy for the site is presented in New York State Department of Environmental Conservation's (NYSDEC's) March 2016 Record of Decision (NYSDEC 2016; the "ROD"). This RDWP has been prepared by Arcadis of New York Inc. (Arcadis) on behalf of National Grid and in general accordance with the following:

- December 7, 1992 and November 7, 2003 Orders on Consent ("Consent Orders") between Niagara Mohawk and the NYSDEC (Index Nos. D0-0001-9210 and A4-0473-0000, respectively).
- Section 5.2 of NYSDEC's DER-10 *Technical Guidance for Site Investigation and Remediation* (DER-10), dated May 3, 2010 (NYSDEC 2010a).
- NYSDEC's ROD dated March 2016 (NYSDEC 2016).
- The NYSDEC-approved Feasibility Study (FS), dated January 2016 (Arcadis 2016).
- Applicable provisions of the New York State Environmental Conservation Law and associated regulations, including Title 6 of the New York Code of Rules and Regulations (NYCRR) Part 375-6 (NYSDEC 2006; 6 NYCRR Part 375-6).

This section of the RDWP describes the report organization, relevant background information, remedial objectives, and an overview of the selected remedy.

1.1 Report Organization

This RDWP has been organized into the following sections:

Section	Purpose
Section 1 – Introduction	Presents background information relating to the RDWP, remedial objectives, and an overview of the selected remedy.
Section 2 – Pre-Design Investigation	Presents the scope and rationale for Pre-Design Investigation (PDI) activities to support the Remedial Design.
Section 3 – Remedial Design	Describes the Remedial Design activities to be completed to prepare the design for the selected site remedy.
Section 4 – Permits	Identifies the required permits and approvals to complete the Remedial Design and implement the remedial action.
Section 5 – Design Documents	Identifies the documents that will be included to support the Remedial Design
Section 6 – Schedule	Presents the anticipated schedule for preparation of the Remedial Design submittals.
Section 7 – Post-Construction Activities	Outlines the requirements for post-construction plans, including a Site Management Plan and Environmental Easement.
Section 8 – References	Lists the reference used to prepare this RDWP.

1.2 Background Information

This section summarizes the site background information relevant to the development of the Remedial Design, including a site description, site history, site geology and hydrogeology, investigation and remediation history, and the nature and extent of impacts remaining at the site.

1.2.1 Site Description

The site is located at the National Grid North Albany Service Center in Albany, New York (see Figure 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.

The site consists of the following areas, as depicted on Figure 2:

- 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.
- 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 Service Center is located on an approximately 25-acre parcel that consists of several buildings, parking lots, and storage areas. Much of the site is paved and used for parking and equipment storage. 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.

Building #2 is the primary building and consists of a three-story structure containing offices, meeting rooms, storage areas, and maintenance shops. In addition to Building #2, there are other features within and around the former MGP that may be affected by remedial actions, including but not limited to the Vehicle Maintenance Building. A detailed site plan showing these features is presented as Figure 2.

Current site features within the FMA include an electric substation (Genesee Street Substation) and a gas regulator station (GRS). Numerous subsurface gas and electric lines associated with the GRS and substation enter the property from the west (i.e., from Broadway). Two gas distribution mains (consisting of 12-inch and 16-inch medium pressure mains) extend across the northern portion of the FMA. Numerous other subsurface utilities are present throughout the FMA, including: electric lines, sewer pipes, water lines, storm sewer pipes, and natural gas lines that service Building #2. Aboveground utilities located in the FMA include telephone lines, fiber optic lines, and telecommunication/microwave tower communication lines. The approximate locations of known utilities are shown on Figure 3.

1.2.2 Site History

This subsection presents a discussion of historical site use at the North Albany Service Center property.

1.2.2.1 Historical Site Use

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.

1.2.2.2 Historical MGP Operations

The former MGP 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. 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 for the former relief gas holder, the 2,000,000 cubic foot (CF) gas holder, and the former oil tanks.

1.2.2.3 Hazardous Waste Storage 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 TSDF consisted of bermed storage areas within a transformer maintenance shop inside building #2, an aboveground storage tank area south of Building #2, and pumps/piping that were used to transfer polychlorinated biphenyl (PCB)-containing transformer oil. The NYSDEC issued a final 6 NYCRR 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. SWMUs were addressed by TSDF closure activities conducted in 2000, by interim remedial measures (IRMs) implemented in 1999 and 2007, or will be addressed by the forthcoming remedial activities.

1.2.3 Site Geology and Hydrogeology

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. Based on the top of the bedrock elevation, as determined by the soil borings and the ground penetrating radar (GPR) survey results, the interpreted bedrock surface generally slopes to the east/southeast in the area east of the facility.

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) unit. Where the silt and clay unit is present, two separate hydrostratigraphic units (a shallow overburden unit and a deep overburden unit) are present. A shallow groundwater potentiometric surface elevation contour map reflecting groundwater elevations measured in December 2015 is included as Figure 4. 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. 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).

1.2.4 Summary of Previous Investigations and Remedial Measures

This subsection presents an overview of historical investigations, previous remedial activities, and FS support activities that have been implemented to evaluate and/or address environmental conditions at the North Albany Service Center (including information used to develop the Remedial Action Objectives [RAOs]).

1.2.4.1 Summary of Historical Investigations

Numerous investigation activities and monitoring events 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)
- *Pre-Design Soil Investigation Letter Report* (NMPC [Niagara Mohawk Power Corporation – now known as National Grid] 2001)
- *High-Temperature Superconductive (HTS) Cable Installation Subsurface Soil Sampling Letter (NMPC* 2004)
- *Vapor Intrusion Investigation Report* (Arcadis 2010)

- Periodic groundwater and non-aqueous phase liquid (NAPL) monitoring letter reports (various dates from 1997 through 2015)

In total, more than 40 groundwater monitoring wells have been installed, approximately 110 soil borings have been drilled, 22 test pits were excavated, 22 surface soil samples were collected, and more than 220 subsurface soil samples were collected. Groundwater samples have been collected from select wells periodically over the course of the last 18 years. Additional information on each of the investigations performed above is presented in the FS.

1.2.4.2 Summary of Previous Remedial Activities

Previous Remedial Activities are summarized below:

- *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 (primarily in the YSA south of Building 2). Following the IRM, the storm sewer system is not considered to be a preferential pathway for migration of constituents of concern. The storm sewer IRM activities were documented in the *Interim Remedial Measure Summary Report – Storm Sewer Cleaning Activities* (BBL 2000b).
- *TSDF Closure Activities* – The North Albany hazardous waste TSDF was closed in 2000 in accordance with an NYSDEC-approved *Closure Work Plan* (BBL 2000a). TSDF closure activities addressed specific non-MGP impacted SWMUs. 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 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 activities were documented in the *TSDF Closure Certification Report* (BBL 2000c).
- *Chemical Oxidation Treatability Studies* – Bench-scale and pilot-scale treatability studies were conducted during 2002/2003 and 2005/2006 to assess the effectiveness of using chemical oxidation for treating site-related impacts including benzene, toluene, ethylbenzene, xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), and coal tar residuals. The result of the studies concluded that in-situ chemical oxidation may not be an effective technology for source removal/reduction, but that the technology may be applicable to target dissolved-phase impacts in the OSDA following FMA source material (i.e., NAPL and heavily impacted soil) remediation. The bench-scale findings are summarized in the *Chemical Oxidation Bench-Scale Treatability Study Summary Report* (BBL 2003), and the pilot-scale findings are summarized in the *Pilot-Scale Treatability Testing Summary Report* (Arcadis 2007a).
- *YSA IRM* – Approximately 6,000 cubic-yards (CY) of impacted soil, gravel and debris were removed in 2007 to address environmental concerns associated with spills and releases in the yard storage area. The removal limits of the IRM are shown on Figure 5. Disturbed areas were restored and covered with asphalt pavement. The YSA IRM is described in the *Yard Storage Area Interim Remedial Measure Summary Report* (Arcadis 2007b).

Historical remedial actions are described in greater detail in the FS.

1.2.4.3 FS Support Activities

As described in the FS, the following additional activities were conducted to support the evaluation of remedial alternatives for the site:

- A bench-scale in-situ solidification (ISS) treatability test was completed to confirm the feasibility and formulate an ISS mix design that could be used to successfully treat waste from: (1) the area east and northeast of Building #2 (hereinafter referred to as "the purifier waste area"); and (2) the central portion of the FMA located west and north of the Vehicle Maintenance Building.
- A utility survey was conducted to identify both known and previously unknown subsurface storm sewer, sanitary sewer, telephone, electrical, gas, water, and cable lines throughout the site. The updated utility information is shown on Figure 3.
- A geophysical survey was implemented to evaluate the presence of subsurface foundations and other obstructions that may potentially interfere with proposed remedial efforts.
- Additional groundwater flow simulations were performed (i.e., in addition to the hydraulic modeling scenarios previously evaluated in support of the Draft FS Report) using the existing MODFLOW[1] model for the site to further evaluate the potential effects of conducting ISS activities and installing low-permeability barriers on site hydrogeology.

1.2.5 Nature and Extent of Impacts

This subsection presents a summary of the nature and extent of MGP- and non-MGP-related environmental concerns identified at the site. Constituents of concern (COCs) and materials of concern (MOCs[2]) primarily consist of the following:

- 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 PAHs, BTEX, and cyanide associated with the former MGP operations conducted in the northern portion of the site. Cyanide is not considered a separate COC because cyanide is co-located with other COCs and/or MOCs.
- 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.
- Although PCBs were identified in YSA surface and subsurface soil, PCB-impacted soil was previously addressed by the IRM implemented during 2007. NYSDEC recommended soil cleanup objectives (SCOs) were achieved for PCBs during this IRM.

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.

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[1] MODFLOW is the United States Geological Service's three-dimensional (3D) finite-difference groundwater model. MODFLOW is considered an international standard for simulating and predicting groundwater conditions and groundwater/surface-water interactions.

[2] MOCs includes highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated woodchips.

1.2.5.1 Subsurface Soil

The following criteria were used to delineate the nature and extent of impacts in subsurface soil:

- 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 parts per million (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). The NYSDEC’s Environmental Remediation Program (6 NYCRR Part 375) issued in December 2006 and supplement document titled “CP-51/Soil Cleanup Guidance,” issued October 21, 2010 replaced TAGM 4046. The objectives of the programs are consistent, but 6 NYCRR Part 375 also considers land use in establishing SCOs (NYSDEC 2006).

Soil sampling locations where visual indications of MGP- and non-MGP-related environmental concerns were encountered are shown on Figure 5. Soil analytical results for total BTEX and total PAHs are shown on Figure 6. Samples containing total BTEX and total PAHs at concentrations greater than 10 ppm and 500 ppm, respectively, are highlighted on the figure. A summary of subsurface soil data is described below.

On-site

Visual indications of NAPL in subsurface soil were encountered throughout portions of the FMA. 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 property boundary (in the purifier waste area and in the vicinity of a former 3,000,000 CF gas holder). The majority of the visual indications of NAPL/tar-saturated soil (TSS) 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. An oil sheen and droplets of separate-phase material were observed on groundwater that infiltrated an excavation (performed as part of the TSDF closure activities) immediately south of Building #2 and slightly northwest of the HWSTA. Additionally, black oil-like material was observed in soil samples collected at soil boring SB-17 from 3.5 to 12.2 feet bgs in the Northern Portion of the HWSTA.

Off-site/Downgradient Area

Soil borings SB-123 and SB-124A were the only locations where visual indications of MGP- and/or non-MGP-related environmental concerns were encountered within OSDA overburden soils. 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 from 13 locations in the OSDA were submitted for analysis of BTEX and PAHs. The analytical results indicated that total PAHs and BTEX SCOs were not exceeded, except for total BTEX at SB-124 from 4 to 6 feet bgs (at a concentration of 23.78 ppm). 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.

1.2.5.2 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. Weathered bedrock analytical results for BTEX and PAHs identified exceedances at SB-129, but not SB-131, indicating a reduction in NAPL impacts with distance from the FMA.

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. No visual observations or elevated PID readings indicating the potential presence of MGP- or non-MGP-related materials were noted during rock coring at MW-16R, MW-21R, and MW-22R. Additionally, NAPL has not been encountered during subsequent gauging events at these wells.

1.2.5.3 Groundwater

There are no current or likely future use 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 Subsection 1.2.4.1, 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 7. Analytical results were compared to the NYSDEC document entitled “Division of Water Technical and Operation Guidance Series 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 (NYSDEC 2004). 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.

Analytical results for groundwater samples collected on-site indicate that dissolved-phase constituents are present in groundwater at concentrations exceeding NYSDEC groundwater quality standards and guidance values presented in TOGs 1.1.1 (including samples collected from monitoring wells MW-2, MW-4, 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, and 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 analytical data indicates that impacted groundwater within the OSDA is generally located along the eastern boundary of the FMA and concentrations decrease with distance from the FMA to the east, often to non-detectable concentrations. Dissolved-phase COCs were observed at concentrations exceeding NYSDEC groundwater quality standards and guidance values in groundwater samples collected from MW-16D, MW-16R, MW-17S, MW-17D, MW-18S and MW-23S. The off-site/downgradient extent of dissolved phase COCs in groundwater has been defined by groundwater samples collected from the most hydraulically downgradient wells in each hydrostratigraphic unit that do not contain COCs at detectable concentrations; however, many of the downgradient wells have been destroyed and have not been sampled for several years.

1.2.5.4 NAPL

Measurable quantities of accumulated DNAPL have been observed 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. Over the course of the NAPL monitoring program, a minimal quantity of DNAPL has been recovered. No indications of DNAPL have been observed in any monitoring wells located in the OSDA, and 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.

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, measurable 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.

1.3 Remedial Action Objectives

This section presents RAOs for impacted media that have been identified in NYSDEC's ROD for the site. These site-specific RAOs represent medium-specific goals that are protective of human health and the environment (DER-10). 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.

1.4 Overview of Selected Remedy

As outlined in the NYSDEC ROD, the selected remedy is a combination of ISS, focused excavation, capping, passive NAPL collection via wells and barrier walls, and Institutional Controls. The selected site remedy is shown on Figure 8.

The primary components of the selected remedy consist of the following:

- Removing approximately 12,600 CY of surface material and shallow subsurface soil during pre-ISS excavation activities.
- Stabilizing approximately 36,200 CY of in-situ subsurface 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 in the purifier waste area.
- Placing clean imported fill material within the purifier waste excavation area.
- Constructing (i.e., excavating and installing materials for) passive NAPL barrier walls east of Genesee Street substation and along the hydraulically downgradient portion of the FMA to: (1) facilitate NAPL collection and recovery; and (2) 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.
- Installing new NAPL recovery wells in the FMA and the HWSTA to facilitate collection and passive recovery of LNAPL and DNAPL. Additionally, new "sentinel" NAPL monitoring wells will be installed west of Broadway.
- Installing up to eight new NAPL recovery wells in the OSDA to facilitate collection and passive recovery of DNAPL.
- 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 purifier waste area) 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 as a non-hazardous waste at a solid waste landfill. The Material will be excavated from: (1) the purifier waste area; (2) the ISS treatment area (surface and shallow subsurface soil to facilitate ISS); and (3) the location where the passive NAPL barrier wall will be installed.
- 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 institutional controls will include a provision for evaluation of the potential for soil vapor intrusion for any buildings developed on the site, in any currently unoccupied on-site buildings upon occupancy or when site-related chemicals of concern are no longer in use in areas inside the on-site buildings.

2 PRE-DESIGN INVESTIGATION

This section describes the PDI to be conducted at the site in support of preparing the Remedial Design for the selected remedy. Detailed descriptions of the PDI activities to be implemented to facilitate the development of the Remedial Design are presented in this section. PDI activities will include:

- PDI Task 1 – Subsurface Structure/Utility Mapping
- PDI Task 2 – Subsurface Soil Sampling
- PDI Task 3 – Bench-Scale ISS Treatability Study
- PDI Task 4 – Structural Inspection
- PDI Task 5 – Groundwater Investigation
- PDI Task 6 – Site Survey

Methodologies and protocols to be followed while completing the PDI activities will be conducted in general accordance with the NYSDEC-approved *Generic Site Characterization/IRM Work Plan for Site Investigations at Former MGP Sites* (Foster Wheeler 2002) and supporting appendices (Field Sampling Plan [FSP] and Quality Assurance Project Plan [QAPP]). For convenience the FSP and QAPP are attached as Appendices A and B. In addition, air monitoring will be conducted in accordance with the New York State Department of Health's (NYSDOH's) most recent version of the Community Air Monitoring Plan (CAMP), as identified in Appendix 1A of DER-10. Health and safety protocols to be followed by field personnel are presented in the Health and Safety Plan (Arcadis 2015) (the "HASP"), which will be updated prior to implementing the PDI activities.

A description of each task associated with the PDI is presented below.

2.1 PDI Task 1 –Subsurface Structure/Utility Mapping

The purpose of this task is to locate subsurface obstructions (e.g., foundations, holders) and verify utilities at and in the immediate vicinity of the proposed remedial limits. Locating subsurface structures and utilities will be a critical PDI activity necessary to support the design and implementation of the remedial activities. Utilities known to be in the remedial areas include water lines, natural gas lines, overhead and underground electric lines, communications cables, storm sewer lines, sanitary sewer lines, and associated manholes/vaults. Prior to implementing intrusive PDI activities, the following activities will be conducted to identify subsurface structures and verify utilities:

- Reviewing historical mapping of the former MGP and utility plans for the site.
- Performing a geophysical survey using electromagnetic (EM) and GPR techniques to identify and mark the location of subsurface structures (mostly concrete) at depths up to 12 feet bgs at and in the immediate vicinity of the proposed remedial limits. The equipment will also be adjusted and the area resurveyed to verify underground utilities.
- Contacting Dig Safely New York to identify and mark the location of underground utilities at and in the immediate vicinity of the proposed remedial limits.

- Subcontracting a private utility locating service to identify and mark the location of underground utilities at and in the immediate vicinity of the proposed remedial limits.
- Obtaining and reviewing utility providers' utility location figures.

Data gathered during the subsurface structure mapping activities will be used to evaluate and select appropriate construction methods to: (1) address identified subsurface obstructions; and (2) minimize the risk of direct contact with the utilities by heavy construction equipment (to avoid unintentional breakage).

It should be noted, that during the subsurface structure mapping activities, additional techniques to field verify the location(s) of obstructions and utilities (that are not outlined in this section of the RDWP) may be identified and implemented.

The location of identified subsurface structures and utilities will be surveyed by a New York State-licensed surveyor after the locating methods have been completed in the field. The utilities will be compared to Figure 3, and utility locations in Figure 3 will be adjusted (or utilities not previously identified added), as needed, before incorporating the utility information into the site base map, which will be used to support the Remedial Design.

2.2 PDI Task 2 – Subsurface Soil Sampling

Subsurface soil sampling will be required to evaluate the following remedial design elements:

- NAPL Barrier Wall
- Excavation Support
- Excavation Limits
- Pre-Excavation Waste Characterization
- ISS Constructability

Soil borings will be completed during the PDI to facilitate collection of soil samples for various analytical and geotechnical tests. Several measures will be taken to clear utilities prior to drilling, including: (1) performing a Dig Safely New York mark out; (2) performing an EM/GPR survey (as described above under PDI Task 1); and (3) using hand or manual excavation methods (e.g., hand augering, vacuum excavation) at proposed soil boring locations. The soil boring locations (as shown on Figure 9 and 10) will be adjusted, as needed, based on the locations of subsurface utilities and/or structures and based on subsurface conditions encountered in the field.

Soil borings will be completed using hollow-stem auger (HSA) drilling methods. Standard penetration test (SPT) data will be obtained at selected soil boring locations in accordance with American Society for Testing and Materials (ASTM) D1586. Soil recovered from each sample interval during drilling will be described and logged by field personnel for color, texture, moisture content, and presence/absence of NAPL. Select soil samples collected from the borings will be submitted for laboratory testing as described below. Additional soil borings may be completed adjacent to the above-identified boring locations if additional soil volume is required for laboratory testing.

Soil borings will be tremie-grouted to the surface following completion using a cement-bentonite grout after the borings reach terminal depth. Soil cuttings and other investigation-derived wastes (e.g., plastic sheeting, decontamination washwaters, etc.) will be containerized in 55-gallon drums for off-site disposal based on the characterization sampling described below. Groundwater displaced during grout placement will be collected and containerized.

A detailed discussion of the soil sampling activities is presented below based on the intended purpose for the borings.

2.2.1 NAPL Barrier Wall

Soil samples collected from soil borings GT-1 through GT-13 will be analyzed for various geotechnical parameters to provide additional information required to complete the design of the NAPL barrier walls. The soil borings will be completed along the proposed NAPL barrier wall alignment at approximate 75 to 100-foot intervals as shown on Figure 9. The soil borings will be completed to bedrock/refusal. Once bedrock/refusal is encountered using HSAs, rock coring will be completed at seven of the boring locations to a depth of approximately 5 feet into competent bedrock to evaluate the weathering and fracturing of the rock. If refusal in other borings occurs above anticipated top of rock, additional rock coring may be performed to confirm refusal is bedrock and not a boulder/buried structure. Rock coring will be performed using an NX-size, double-tube core barrel to evaluate the nature of the refusal and to measure the size of any boulders that may be encountered.

Selected samples will be submitted to a geotechnical laboratory, to confirm visual field classifications, in accordance with the table below.

Analysis	Test Method	Estimated Number of Samples
Grain-size analysis with hydrometer	ASTM D422	2 per boring
Moisture content as a percentage of dry weight	ASTM D2216	2 per boring
Atterberg limits	ASTM D4318	2 per boring

2.2.2 Excavation Support

Soil samples collected from PDI borings GT-8 through GT-12 (completed along the NAPL barrier wall alignments) will also be used to collect information necessary to support the excavation support design for the purifier waste area. Three additional borings (GT-14 through GT-16) will be completed along the proposed excavation area, for a total of eight geotechnical borings installed to facilitate the excavation support design. The soil borings will be completed to bedrock/refusal. Rock coring will be completed at two of the additional boring locations (for GT-14 through GT-16) to a depth of approximately 5 feet into competent bedrock to evaluate the weathering and fracturing of the rock. If cohesive materials are encountered, up to four Shelby tube samples will be collected at the discretion of the geotechnical engineer. Selected soil samples will be submitted for geotechnical testing, in accordance with the table below.

Analysis	Test Method	Estimated Number of Samples
Grain-size analysis with #200 wash	ASTM D422 and ASTM D1140	2 per boring
Moisture content as a percentage of dry weight	ASTM D2216	2 per boring
Atterberg limits	ASTM D4318	1 per boring
Specific gravity	ASTM D4767	4 per boring
Flex-wall permeability, if applicable	ASTM D5084	2 per boring
Tri-axial shear test, if applicable	ASTM D4767 or ASTM D2850	2 per boring
Direct-shear test, if applicable	ASTM D3080	2 per boring

The number of samples to be submitted for testing may be changed based on observations during completion of the borings. A geotechnical engineer or geologist will observe the completion of the geotechnical borings and record the information necessary to complete the remedial design activities described in Section 3.

2.2.3 Excavation Limits

Soil borings (GT-14 through GT-16) completed for the excavation support system design will also be used to gather additional delineation information regarding the horizontal limits of the excavation. Soil boring GT-14 will provide information to further delineate the southern limit of the excavation and GT-15 and GT-16 will provide information to define the western limit of the excavation. Additional “step-out” borings may be required based on observations made at these initial boring locations. Soils from each borings will be collected continuously and will be characterized for the presence of highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated wood chips that have been observed in this portion of the site. Step-out borings will be completed if these materials are encountered in the initial borings. The ability to step out the excavation limits will be considered in the remedial design based on existing facilities.

2.2.4 In-Situ Waste Characterization Sampling

Although there may be opportunities to utilize some excavated soil as onsite backfill, most (or all) of the excavated soil generated by remedial activities will be transported for offsite LTTD treatment or landfill disposal. Additional data is needed as part of the PDI to characterize the soil to be removed from the purifier waste area, ISS area, and barrier wall (estimated to be approximately 58,600 tons at a unit weight of 1.75 tons per cubic yard), for direct-loading and transportation to an off-site disposal/treatment facility. Based on the previous experience, it is assumed that the potential disposal facilities will require the collection and analysis of characterization samples at a frequency of approximately one sample per 1,000 tons for landfill disposal and one sample per 750 tons for LTTD. To address this data need, the PDI will include preliminary in-situ soil waste characterization sampling. Additional sampling will be conducted following completion of the remedial design and prior to Contractor bidding to fully delineate the soil for waste characterization purposes.

Composite soil samples will be collected from soil borings completed at 11 locations (samples WC-1 through WC-11) as part of the PDI to provide a preliminary characterization of disposition requirements for soil that will be transported for off-site disposal/treatment. Proposed waste characterization soil boring locations are shown on Figure 10 and the in-situ waste characterization sampling approach is summarized in Table 1. Samples will be analyzed for one or both analyte sets listed in the table below:

Landfill Characterization Analyte Set	LTTD Characterization Analyte Set
• Toxicity Characteristic Leaching Procedure (TCLP[3]) volatile organic compounds (VOCs) (USEPA Method 8260) • TCLP semi-volatile organic compounds (SVOCs) (USEPA Method 8270) • TCLP metals (USEPA Method 6010 and 7470 [mercury]) • TCLP pesticides and herbicides (USEPA Method 8081 and 8151) • PCBs (USEPA Method 8082) • Ignitability (USEPA Method 1030) • Corrosivity (pH) (USEPA Method 9045C) • Reactive sulfide (USEPA Method 7.3.3 and 9034) • Reactive cyanide (USEPA Method 7.3.4 and 9012) • Paint filter (USEPA Method 9095A)	• Total petroleum hydrocarbons (USEPA Method 8015 GRO/DRO) • Total VOCs (USEPA Method 8260B) • Total VOCs (USEPA Method 8270C) • PCBs (USEPA Method 8082 [if sample is not analyzed for landfill characterization]) • Total metals[4] (USEPA Method 6010B and 7470 [mercury]) • Total cyanide (USEPA Method 9010) • Percent sulfur (USEPA Method D129-64) • British thermal units (USEPA Method D240-87)

In general, if no NAPL or obviously-impacted soil (based on odors or visual staining) is encountered at a waste characterization soil boring, a composite sample from the entire boring depth will be analyzed for landfill characterization. If NAPL of other obvious impacts are encountered, a composite from the potentially-impacted interval within the boing will be analyzed for LTTD characterization and a composite of the remaining soil intervals will be analyzed for landfill characterization. The characterization sampling plan may be adjusted based on the presence of NAPL or other impacts (or lack of) as observed in the field.

2.3 PDI Task 3 - Bench-Scale ISS Treatability Study

A bench-scale evaluation was previously completed in 2012 to support the development of the FS. The activities included collecting representative soil samples from three areas of the site and conducting bench-scale testing of various reagent mix designs to solidify MGP-impacted soil at the site. The goals of ISS treatability study were to evaluate site soil types with multiple mix designs to evaluate the feasibility of

[3] TCLP analysis preparation and extraction is performed by United States Environmental Protection Agency (USEPA) Method 1311.
[4] Total metals include antimony, arsenic, barium, beryllium, cadmium, chromium (total), lead, mercury, selenium, silver, thallium, vanadium, zinc

ISS at the site. The NYSDEC was notified of National Grid's plan to perform an ISS treatability study in August 2012. Based on the results of the 2012 evaluation, no additional PDI activities or ISS bench-scale testing is required to support the ISS design. Information collected as part of that evaluation will be presented in the PDI Report as presented in Section 2.7.

2.4 PDI Task 4 – Structural Review

Due to the proximity of structures to the planned remedial activities, Arcadis will conduct a structural review of Building #2 and the Vehicle Maintenance Building. The objective of the structural review is to identify information relative to the building structures (including the building structural components and foundation system) to support the design of excavation support systems.

Arcadis will provide a structural engineer to review existing building drawings and complete a visual review of accessible portions of the buildings to develop an understanding of structural components and foundation systems. The results of the review will be documented in a technical memorandum (included as an appendix in the PDI Summary Report). Any recommendations for structural support, structural monitoring, installation of excavation support, or completing excavations in close proximity to the buildings, will be incorporated into the Remedial Design..

2.5 PDI Task 5 – Groundwater Investigation

A groundwater investigation will be conducted as part of the PDI to:

- Collect groundwater samples for laboratory analysis to support the design of a temporary groundwater treatment system.
- Collect hydraulic data to facilitate an evaluation of dewatering that will be required during excavation.

A description of each of the groundwater investigation activities is presented below.

2.5.1 Groundwater Sampling

Groundwater samples will be collected and submitted for laboratory analysis to support the design of a temporary water treatment system, which is anticipated to be required to support soil excavation activities in the purifier waste area, based on the elevation of the water table and a review of the existing soil characteristics. A comprehensive monitoring well inventory will be conducted at site monitoring wells prior to the sampling, gauging, or hydraulic-testing activities. The integrity of each well will be evaluated during the inventory and wells will be repaired and/or redeveloped, as necessary.

Groundwater samples will be collected from up to eight overburden and shallow bedrock monitoring wells within and near the proposed excavation limits to characterize groundwater quality within the excavation area. The selected wells include MW-6S, MW-14, MW-8, MW-13, MW-27S, MW-27D, MW-28S, and MW-28D. However, the well list may change based on accessibility and condition of wells. Groundwater samples will be submitted for the following treatability parameters (regardless of NAPL presence):

- Total Toxic Organics
- Target Analyte List inorganics and cyanide (filtered and unfiltered samples)

- Oil and grease
- Total suspended solids
- Total dissolved solids
- Five-day biological oxygen demand
- Chemical oxygen demand
- Bioactivity (via iron-reducing, sulfate-reducing, and slime-forming bacteria)
- Total kjeldahl nitrogen
- Hardness
- pH

The parameters identified above may be modified (i.e., parameters may be added) based on criteria for discharging to the publicly-owned treatment works (POTW) via a nearby sanitary sewer. Analytical results will be used to evaluate and select components of a temporary water treatment system that will treat groundwater removed from the excavation area. Additional information regarding the design of the temporary water treatment system is discussed under Section 3.5.

2.5.2 Hydraulic Testing

Hydraulic data will be collected to support the design of a dewatering system to be used while excavating the purifier waste area. The hydraulic-testing activities will consist of measuring a synoptic round of groundwater levels at each existing accessible site monitoring well and conducting hydraulic conductivity tests at up to eight wells located near the excavation area (i.e., the same wells that will be sampled as described above). The hydraulic testing will consist of conducting specific-capacity tests at each well. Specific capacity testing is a field method used to estimate the hydraulic conductivity of a saturated geologic medium surrounding the screened or open interval of a well. The specific capacity testing will involve pumping groundwater from the wells at a constant rate and quantifying the pumping rate and magnitude of drawdown inside the tested well after a known duration of pumping. The hydraulic conductivity is calculated based on the pumping rate and drawdown measured inside the well and using a time-drawdown analysis with a semi-log data plot (Driscoll 1986).

The results of the hydraulic testing will be either incorporated into the existing MODFLOW model or used in analytical solutions to estimate dewatering-rates expected during the remedial excavation activities.

2.6 PDI Task 6 – Site Survey

Field survey activities will be performed as part of the PDI by a New York State-licensed Land Surveyor. The survey activities will be performed to accomplish the following:

- Locate and stake property boundaries near the remedial areas, as appropriate.
- Mark the proposed horizontal limits of the ISS treatment area, NAPL barrier wall alignment, and excavation area (for visual reference during implementation of the PDI field investigation activities).

- Establish grids needed for conducting the geophysical survey.
- Document locations of overhead and subsurface utilities (in and around the proposed soil remedial activities), as identified and marked in the field by the utility locators and personnel performing a geophysical survey (for later use during the utility location efforts and inclusion on Contract Drawings to be prepared as part of the Remedial Design).
- Document locations of subsurface structures/anomalies as identified by the geophysical survey (for later use during the utility location efforts and inclusion on Contract Drawings, as needed).
- Field-identify and mark proposed PDI soil boring locations based on coordinates obtained from mapping (to allow soil borings to be positioned in relation to the anticipated remedial limits, as shown on Figure 9 and Figure 10).
- Prepare topographic mapping to show ground surface elevation contours (1-foot contours) in and around the proposed remedial limits. This will also include verifying the locations for fence lines, roadways/sidewalks, and other site features.
- Document elevations and locations of subsurface utilities that are verified through intrusive field verification techniques (hand excavation, test pits, vacuum excavation, etc.).

The majority of the survey work is anticipated be performed prior to the implementation of intrusive field investigation activities. Follow-up survey work will be performed, as needed, to document final soil boring locations (if adjustments to the proposed locations are made based on field conditions encountered during the PDI) and to document subsurface utilities and structures/anomalies. The information obtained from the additional survey efforts will be used to update the site base map and other drawings for use during the remedial design efforts.

2.7 PDI Report

The results from the PDI will be documented in a *PDI Report* which will be submitted to the NYSDEC for review in conjunction with the development of the 50% Remedial Design. The *PDI Report* will include the following:

- A summary of the PDI work activities and results, including field observations, sampling results, changes made in response to field conditions, problems encountered and resolutions, and other pertinent information to document that the site activities were performed pursuant to this RDWP.
- A summary of the ISS bench scale treatability activities and results.
- Updated figures showing identified subsurface obstructions and verified utility locations in and around the proposed remedial areas and surveyed locations of soil borings completed as part of the PDI.
- Revised remediation limits, if necessary to accomplish the remedial goals.
- An analytical sample summary that identifies final sampling locations and corresponding laboratory analyses.
- Tables presenting geotechnical and groundwater sampling results.
- Soil boring logs.

- An updated schedule for preparing the Remedial Design.

Laboratory analytical data reports and data validation reports (for excavation limit soil samples and groundwater treatability testing samples) will be attached to the *PDI Report* in electronic format.

3 REMEDIAL DESIGN

This section presents a description of the remedial design activities to be completed as part of the design for the selected site remedy. Work activities associated with preparing the Remedial Design will be conducted under the following general tasks:

- Soil Excavation
- In-Situ Solidification
- Passive NAPL Collection Wall
- NAPL Collection and Monitoring Well Installation
- Temporary Water Treatment System
- Backfilling
- Site Cover

A description of each task associated with the preparation of the Remedial Design is presented below. Note that the Remedial Design will also present additional supporting remediation tasks (e.g., site preparation, waste management). The Remedial Design will also present:

- proposed locations for temporary remediation support structures, including staging/sequencing of remedial construction activities over multiple construction seasons
- requirements for soil and sediment erosion control
- monitoring and mitigating procedures for dust, odor, and vapors
- traffic control measures

3.1 Soil Excavation

Based on available information, an estimated 36,600 CY of material will be removed. Excavations will be completed as part of a variety of remedial construction activities, including the following:

- install temporary excavation sidewall support in the purifier waste area;
- prepare for ISS
- remove highly viscous NAPL, heavily NAPL-impacted soil, and NAPL-coated wood chips located in the purifier waste area
- remove surface material outside of the ISS area to install the soil cover system

The remedial areas are shown on Figure 8. The Remedial Design will detail excavation limits and depths. The excavation support system and excavation dewatering system will also be detailed in the Remedial Design.

Although it may be possible to excavate and re-locate select utilities to facilitate remediation, certain utilities may need to be left in-place and protected . The proposed approach for relocating and/or protecting utilities will be further evaluated during the Remedial Design based on the findings of the PDI and based on direct coordination with National Grid and the utility owner.

3.1.1 Excavation Support

Potential excavation support systems (e.g., engineered slopes, sheet pile walls, cofferdams, king piles, etc.) will be evaluated based on the results of the soil PDI activities to be conducted under PDI Task 2, respectively. Additionally, the dead and live loads associated with Building #2 and the railroad along the eastern portion of the North Albany Service Center will be evaluated to determine how these loads will affect the stability of the excavation.

The geotechnical data obtained as part of the PDI will be used to design an appropriate excavation support system to facilitate soil removal and backfilling activities at the site. The excavation support system(s) will be designed in manner that will accomplish the following:

- Protect utilities that may be affected by excavation and backfill activities.
- Maintain the integrity of the railroad track to allow for continued use during construction.
- Protect Building #2, the Vehicle Maintenance Building, and other structures located in proximity to the excavation areas.
- Control groundwater and surface water flow into the excavations during excavation and backfilling activities.

Additionally, Arcadis will evaluate the need to include a temporary fabric structure and associated vapor collection/treatment system over the proposed excavation area (e.g., Sprung structure) to reduce the potential for exposures and off-site migration of vapors and odors during excavation activities. As indicated in Section 5, the final type, locations, and design of the excavation support system will be presented in the remedial design documentation.

3.1.2 Excavation Area Dewatering

Based on the excavation depths, select remedial activities will be conducted below the water table. Groundwater will be removed from the excavation areas (as necessary) to facilitate remedial activities. Dewatering rates, appropriate means and methods to dewater excavation areas, and disposal/treatment options for water generated during dewatering activities will be evaluated based on the results of the PDI activities to be conducted under PDI Task 5, Subsection 2.5.2. Groundwater extraction and dewatering rates will be used to aid in the design of a temporary water treatment system as described in Section 3.5.

3.2 In-Situ Solidification

Based on available information, approximately 36,200 CY of saturated and unsaturated soil will be treated via ISS west and north of the Vehicle Maintenance Building. The Remedial Design will present detailed requirements for implementing the ISS work activities. ISS is a process that binds the soil particles in place by creating a low permeability mass. The anticipated horizontal limits of ISS are shown on Figure 8. However, the limits of the ISS may be modified based on the presence of subsurface utilities (as identified during the PDI).

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. An optimal mix design(s) will be identified using the bench-scale testing data.

ISS will be performed by mixing binding reagents (a fluid grout containing a combination of water, Portland cement, bentonite, and other pozzolanic materials) into a column of soil. ISS will be accomplished using a combination of bucket mixing, small diameter auger mixing, and/or jet grouting, based on the location of subsurface obstructions and utilities being evaluated as part of the PDI (Section 2.1). A description of mixing methods be considered for this site is below:

- Bucket Mixing – This involves using the bucket on an excavator to manually mix the fluid grout into the soil. Mixing will be performed by mechanically turning the soil with the excavator bucket until the grout is evenly distributed throughout the soil and a solidified mass (monolith) is created. In order to create continuous zones of treatment, the treatment areas of mixed soil and cement are overlapped to provide continuity. This method is appropriate for working around obstacles/obstructions (such as subsurface C&D debris) that would limit auger mixing. This method could be supplemented by jet grouting around obstacles/underground utilities as needed to achieve solidification.
- Small Diameter Auger Mixing – This involves using an excavator-mounted drill to turn a special mixing tool into the soil while the fluid grout is pumped through the tool and mixed into the soil. The resulting material is generally a homogeneous mixture of soil and grout that hardens to become a weakly-cemented material.
- Jet Grouting – This involves injecting a fluid cement-bentonite grout 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. Jet grouting will be used to form a panel of solidified soil in the vicinity of subsurface obstructions (e.g., utilities) to immobilize the soil without the need for excavation.

Excess materials will be generated during ISS treatment as a result of volume expansion (bulking) of soil when solidified by bucket/auger mixing or jet-grouting. The excess materials will consist of a mixture of soil, groundwater, and grout. The excess material volume is estimated to be 15 to 25% of the soil volume treated by the mixing tool method or 100% of the soil volume treated by the jet-grouting method. The volume expansion due to the ISS treatment will be evaluated during the Remedial Design based on the results of the treatability study, and will be variable based on the pre-ISS excavation depth (limited by the depth of the water table).

Quality assurance/quality control sampling frequency and parameters, which are currently anticipated to be unconfined compressive strength and hydraulic conductivity, will be presented in the Remedial Design.

3.3 Passive NAPL Barrier Wall

As indicated in the ROD, the remedy includes the construction of a passive NAPL barrier wall east of Genesee Street substation and along the hydraulically downgradient portion of the FMA (see Figure 8) to facilitate NAPL collection and recovery and prevent further migration of NAPL beyond the FMA. Information gathered during PDI Task 2 (described in Subsection 2.2.1) will be used to design the NAPL Barrier Wall.

The presence of subsurface gas and electrical utilities will obstruct the installation of the passive NAPL barrier walls in close proximity to the utilities. The management of utilities within the passive NAPL barrier wall will be evaluated based on findings of the subsurface structure/utility mapping PDI activities described in Section 2.1. Utility relocation, bypass, and or replacement will be detailed in the Remedial Design, as needed.

3.4 NAPL Collection and Monitoring Well Installation

The Remedial Design will include specifications for NAPL collection well construction. The PDI subsurface soil investigation described in Section 2.2 will help characterize bedrock to identify locations where NAPL is likely to pool such as low depressions, areas of weathered bedrock, and zones of increased fracture frequency or greater fracture apertures. The locations will further be evaluated during trenching for the passive NAPL barrier wall. Preliminary NAPL collection well locations are shown in Figure 8. As indicated in Section 7, the NAPL monitoring/recovery program will be fully developed in the SMP.

3.5 Temporary Water Treatment System

Details of the dewatering, water treatment, and discharge will be determined during preparation of the Remedial Design. The major temporary water treatment system components are anticipated to include influent equalization, oil-water separation, filtration, carbon adsorption, resin, final polishing (such as organo-clay filtration), and effluent equalization. A temporary water treatment system will be designed to treat groundwater removed from the soil removal area during excavation and backfilling activities. As indicated in Subsection 2.5.1, groundwater samples will be collected and submitted for laboratory analysis for various treatability parameters to evaluate and select appropriate treatment system components. Dewatering rates will be evaluated during the PDI, and specified in the Remedial Design as indicated in Subsection 3.1.2.

Post-treatment management of the water will also be evaluated as part of the Remedial Design. Post-treatment water management options include the following:

- Discharge to the Hudson River under a State Pollution Discharge Elimination System (SPDES) permit.
- Discharge to the local POTW via a nearby sanitary sewer with city approval.
- Containerize and transport to a privately or publicly-owned treatment facility, although based on the anticipated volume of water to be generated, this alternative is not likely to be used in the RD.

The final discharge/treatment method will be selected based on the feasibility of implementing each option and a comparison of the relative costs for implementing the options and may include use of one or a combination of the above-identified options. Typical monitoring parameters and associated daily maximum discharge criteria for discharging treated water generated in connection with the remedial activities will be determined during design.

3.6 Backfilling

Following the completion of soil removal activities, excavation and ISS treatment areas will be backfilled to final grade with stockpiled excavated material (where appropriate and supported by post-excavation sampling results) or with imported fill that meets the requirements set-forth in Section 5.4 of DER-10. Disturbed surfaces would be restored, in kind, with asphalt pavement, concrete, etc.

Appropriate materials to be used as backfill following the soil removal activities will be identified during the Remedial Design. Specifications (i.e. gradations, material types, and analytical criteria) for imported fill materials will be included in the Remedial Design to reflect existing site soils, as appropriate. Review of geotechnical data collected during the PDI activities will be used to identify the fill material(s) to be used during remedial construction. Backfilling and grading protocols (e.g., lift thickness, compaction requirements, etc.) will also be specified in the Remedial Design.

3.7 Site Cover

As indicated in the ROD, a site cover is required to allow for commercial use. The existing asphalt pavement and structures (such as buildings, sidewalks, etc.) that comprise the site currently serve as a cover. Hard surfaces (i.e., asphalt and concrete) removed/damaged during remedial construction will be restored in kind. Vegetated surfaces disturbed during remedial construction will be restored with a minimum of one foot of material that meets 6 NYCRR Part 375-6(d) SCOs for commercial use. Soil cover material will be placed over a demarcation layer and the upper six inches will be vegetated. As indicated in the ROD, areas subject to ISS treatment will be covered with a minimum of 4 feet of material that meets the 6 NYCRR Part 375-6(d) SCOs for commercial use. The Remedial Design will include specifications for the various surface cover materials and provide a grading plan for the final site cover.

4 PERMITS

The Remedial Design will be developed to meet applicable standards, criteria, guidelines, permits and approvals. In addition to NYSDEC approval of the Remedial Design, permits and approvals may be necessary to implement the NYSDEC-selected remedy. Potential permits and approvals include (but are not limited to):

- Access agreement and railroad work permit with CP Rail to work alongside railroad tracks.
- Additional access agreements to perform a comprehensive groundwater monitoring well inspection and install NAPL recovery wells in the OSDA.
- A temporary discharge permit from the City of Albany to discharge water to the local POTW or a NYSDEC/United Stated Army Corp SPDES permit to discharge water to the Hudson River. As indicated in Section 3.5, the final disposal/treatment method for treated groundwater will be evaluated as part of the Remedial Design.
- A traffic plan to minimize disruptions to local traffic during remedial construction.

Additional permits and approvals associated with implementing the remedial activities will be evaluated and identified in the Remedial Design.

5 DESIGN DOCUMENTS

The Remedial design will be submitted in phases and will include a Preliminary (50% Design), Draft Final (95% Design), and Final Design (100% Design). The schedule for preparing the Remedial Design is further discussed in Section 6.

The contents of each remedial design document are presented below.

5.1 Preliminary Remedial Design Report

The *Preliminary Remedial Design Report* will generally include the following information:

- An introductory section that will provide a brief overview of the Remedial Design, site background information, design report objectives, and report organization.
- A summary of the remedy with a basis of design that describes the proposed remedial design and presents information used to develop the design and construction components of the project (i.e., results obtained for the PDI and treatability study).
- A detailed description of the selected remedy organized by work activities.
- A description of site controls to protect the public health, safety, welfare and environment and to maintain the effectiveness of the remedial action.
- The regulatory and permitting requirements associated with implementing the activities described in the Remedial Design.
- A set of engineering design drawings that represent an accurate identification of existing site conditions and an illustration of the work proposed. The engineering design drawings submitted at this stage of the Remedial Design are anticipated to include the following:
  - Title Sheet – to include the title of the project, key map, date prepared, sheet index and NYSDEC project identification.
  - Existing Site Plan – to include pertinent property data including owners of record for all properties adjacent to the site (as necessary); site survey including the distance and bearing of all property lines that identify and define the project site; easements, right-of-ways and reservations (as necessary); existing buildings and structures, wells, facilities and equipment; a topographic survey of existing contours and spot elevations within the project limits of disturbance; all known existing underground and aboveground utilities; and location and identification of significant natural features, including, among other things, wooded areas, water courses, wetlands and flood hazard areas.
  - General Site Remediation Plan(s) – to include limits of the excavation, passive barrier wall alignment, ISS treatment area, and relocation of utilities (if any). The remediation plans will illustrate the general sequence of remedial construction activities (i.e., anticipated to be completed over multiple construction seasons).
  - General Restoration Plan(s) – to include limits of the final surface cover, location of new structures and/or wells, and other final restoration features.

   - Miscellaneous Details – to include details related to final surface cover surface water control, etc..

- Draft Technical specification for summary of work and table of contents (i.e., specification list).

5.2 A summary of the PDI activities and results. Draft Final Remedial Design Report

In addition to the items identified for the *Preliminary Remedial Design Report*, the *Draft Final Remedial Design Report* will include the following information:

- Revisions to the *Preliminary Remedial Design Report* based on NYSDEC comments, as appropriate.

- A set of engineering design drawings that represent an accurate identification of existing site conditions and an illustration of the proposed work. Each engineering design drawing will include a north arrow (where applicable), scale, legend, definitions of all symbols and abbreviations and sheet number. It is anticipated that the engineering design drawings will include, at a minimum, the following:

   - Existing Site Conditions – to include pertinent property data including owners of record for all properties adjacent to the site (as necessary); site survey including the distance and bearing of property lines that identify and define the project site; easements, right-of-ways and reservations (as necessary); existing buildings and structures, wells, facilities and equipment; a topographic survey of existing contours and spot elevations within the project limits of disturbance; known existing underground and aboveground utilities; and location and identification of significant natural features, including, among other things, wooded areas, water courses, wetlands, and flood hazard areas.

   - Site Remediation Plan – to include minimum requirements for temporary erosion and sedimentation controls, site facilities (parking areas, decontamination area, equipment/material lay down area), limits of the excavation, barrier wall alignment, ISS treatment area, and relocation of utilities (if any).

   - Site Preparation Plans – to illustrate the work limits, support areas, and site controls to be established for each phase of remedial construction (i.e., as remedial construction activities are anticipated to be completed over multiple construction seasons).

   - Excavation Support Profile and Details (if necessary) – to include a profile of excavation support systems, structural details related to the type of support to be used, and other miscellaneous details related to the excavation support systems.

   - Passive Barrier Wall Profiles and Details – to include the profiles for the passive NAPL barrier walls to be installed east of Genesee Street substation and along the hydraulically downgradient portion of the FMA.

   - ISS Profiles and Details – to include profiles of the soil removal and ISS indicating target depths and details for these remedial components.

  - Restoration Plan –final topographic survey (proposed contours and spot elevations) of the site, limits of the final surface covers, location of new structures and/or wells, and other final restoration features.
  - Water Treatment System Details – to include temporary water treatment system specifications and a piping and instrumentation diagram.
  - Miscellaneous Details – to include details related to the surface cover profiles, temporary erosion and sedimentation controls, material staging areas, decontamination area, and final surface water runoff and sedimentation controls
- Technical Specifications that generally include requirements for: site meetings; contractor submittals; support facilities; site and structural surveys; site monitoring and controls; waste handling and disposal; decontamination; ISS; excavation support, geotechnical and structural monitoring; excavation and fill; water management;, and site restoration.
- A general description of operation, maintenance, and monitoring activities to be undertaken following the completion of remedial construction activities. Details regarding post-construction monitoring will be presented in the SMP.
- A Waste Management Plan (WMP) that describes the characterization, handling, treatment, and disposal requirements for various waste materials to be generated as a result of the remedial activities.
- A Community Air Monitoring Plan (CAMP) that describes the monitoring activities that will be conducted to detect potential airborne releases of constituents of concern during the implementation of remedial activities.
- A Construction Quality Assurance Plan (CQAP) that describes the materials, procedures, and testing necessary for proper construction, evaluation, and documentation during remedial activities.
- A Citizen Participation Plan (CPP) which incorporates appropriate activities outlined in the NYSDEC's Draft Citizen Participation Handbook for Remedial Programs (DER-23) (NYSDEC, 2010b).
- Storm Water Pollution Prevention Plan (SWPPP) that describes the sedimentation and erosion control measures, as well as general site practices, to be implemented during the remedial construction activities.
- Preliminary remedial action schedule, which presents the anticipated schedule for implementing the final remedy.

The *Draft Final Remedial Design Report* will not be stamped and signed by Professional Engineer licensed in the State of New York.

5.3 Final Remedial Design Report

Following NYSDEC review and approval of the *Draft Final Remedial Design Report,* the *Final Remedial Design Report* will be produced. The *Final Remedial Design Report* will include biddable quality versions of the text, specifications, drawings, and plans. As required by DER-10, the *Final Remedial Design Report* will be stamped and signed by a Professional Engineer registered in the State of New York.

6 SCHEDULE

This section presents the anticipated schedule for implementing the proposed PDI and preparing the Remedial Design for the site. Work identified for the completion of these activities and the estimated milestone dates are as follows:

Schedule Component	Date
NYSDEC Approval of this RDWP	December 2016
Conduct PDI activities	Spring/Summer 2017
Submit PDI Report for NYSDEC	September 2017
Submit Preliminary Remedial Design Report to NYSDEC	December 2017
Receive NYSDEC comments	March 2018
Submit Draft Final Remedial Design Report to NYSDEC	August 2018
Receive NYSDEC comments	October 2018
Submit Final Remedial Design Report to NYSDEC	November 2018
Bid Document Preparation and Remedial Contractor Procurement	September 2018 – April 2019
Remedial Construction	Spring 2019

This schedule for conducting PDI activities and preparing remedial design documents is dependent on several factors, including time required to gain property access and receipt of NYSDEC comments on project submittals. Additionally, the timing of the Remedial Design and remedial construction components presented in the preliminary project schedule may be altered if additional PDI activities are required.

7 POST-CONSTRUCTION ACTIVITIES

This section outlines the requirements for institution controls and post-construction plans, including an institutional controls and SMP.

7.1 Institutional Controls

Institutional controls consisting of an environmental easement (EE) and SMP will be developed to address residual impacts remaining at the site following completion of the remedial activities. In accordance with the ROD, the EE will:

- Require the property owner to complete and submit to the NYSDEC, a periodic certification of instructional and engineering controls in accordance with 6NYCRR Part 375-1.8(h)(3).
- Allows the use and development of the site for commercial and industrial uses.
- Restricts the use of groundwater as a source of potable or process water; without necessary water quality treatment as determined by the NYSDOH or County DOH.
- Require compliance with the NYSDEC-approved SMP (described below).

7.2 Site Management Plan

The SMP will be developed primarily to address residual site impacts. As indicated in the ROD, the primary components of the SMP will consist of an *Institutional and Engineering Control Plan* and *Monitoring Plan*. Required institutional controls are discussed in Section 7.1 and engineering controls generally will include the ISS treatment and a NAPL monitoring/recovery program (to be developed during preparation of the SMP). The SMP will be prepared in accordance with requirements presented DER-10 and the NYSDEC Generic Template for Site Management Plans (available on the NYSDEC website).

The *Institutional and Engineer Control Plan* is anticipated to generally include the following:

- An Excavation Plan that details the provisions for management of future excavations in areas of remaining impacts.
- Provisions for further investigation and remediation if any of the existing structures are demolished in the future, or if the subsurface is otherwise made accessible. The nature and extent of MGP impacts in areas where access was previously limited or unavailable will be immediately investigated. Based on the investigations, a plan will be developed for the removal or treatment of remaining source areas, to the extent practicable, and any necessary remediation will be completed prior to redevelopment. This includes Building 2 and the Genesee Street Substation Area.
- Descriptions of the provisions of the environmental easement.
- A provision for the evaluation of the potential for soil vapor intrusion for any buildings developed on the site, in any currently unoccupied on-site buildings upon occupancy, or when site-related chemicals of concern are no longer in use in areas inside current on-site buildings. Provisions for implementing actions recommended to address exposures to soil vapor intrusion will be developed.

- Provisions for the management and inspection of engineering controls.
- Requirements for completing notifications to the NYSDEC.
- Requirements for completing periodic reviews and providing certification of the institutional and/or engineering controls.

The *Monitoring Plan* is anticipated to generally include the following:

- Requirements for monitoring groundwater to assess the performance and effectiveness of the remedial construction activities.
- A schedule for site monitoring and frequency of submittals to be provided to the NYSDEC.
- Requirements for vapor intrusion monitoring for any buildings developed on the site, in any currently unoccupied buildings that become occupied, or in existing on-site building, as required by the *Institutional and Engineer Control Plan*.

Additionally, the SMP will also include an *Operation and Maintenance* (O&M) *Plan* that is anticipated to consist of the following:

- Procedures for operating and maintaining the remedy.
- Compliance requirements for monitoring treatment systems to ensure proper O&M, as well as providing data necessary for any permit-related reporting requirements.
- Requirements for providing NYSDEC access to the site and O&M records.

8 REFERENCES

Arcadis, 2007a. *Pilot-Scale Treatability Testing Summary Report*, Prepared for National Grid, February 2007.

Arcadis, 2007b. *Yard Storage Area Interim Remedial Measure Summary Report*, Prepared for National Grid, November 2007.

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BBL, 2000a. *Closure Work Plan*, Prepared for Niagara Mohawk Power Corporation, Revision 4.0, January 17, 2000.

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NYSDEC, 2006. 6 NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives. December 14, 2006.

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TABLE

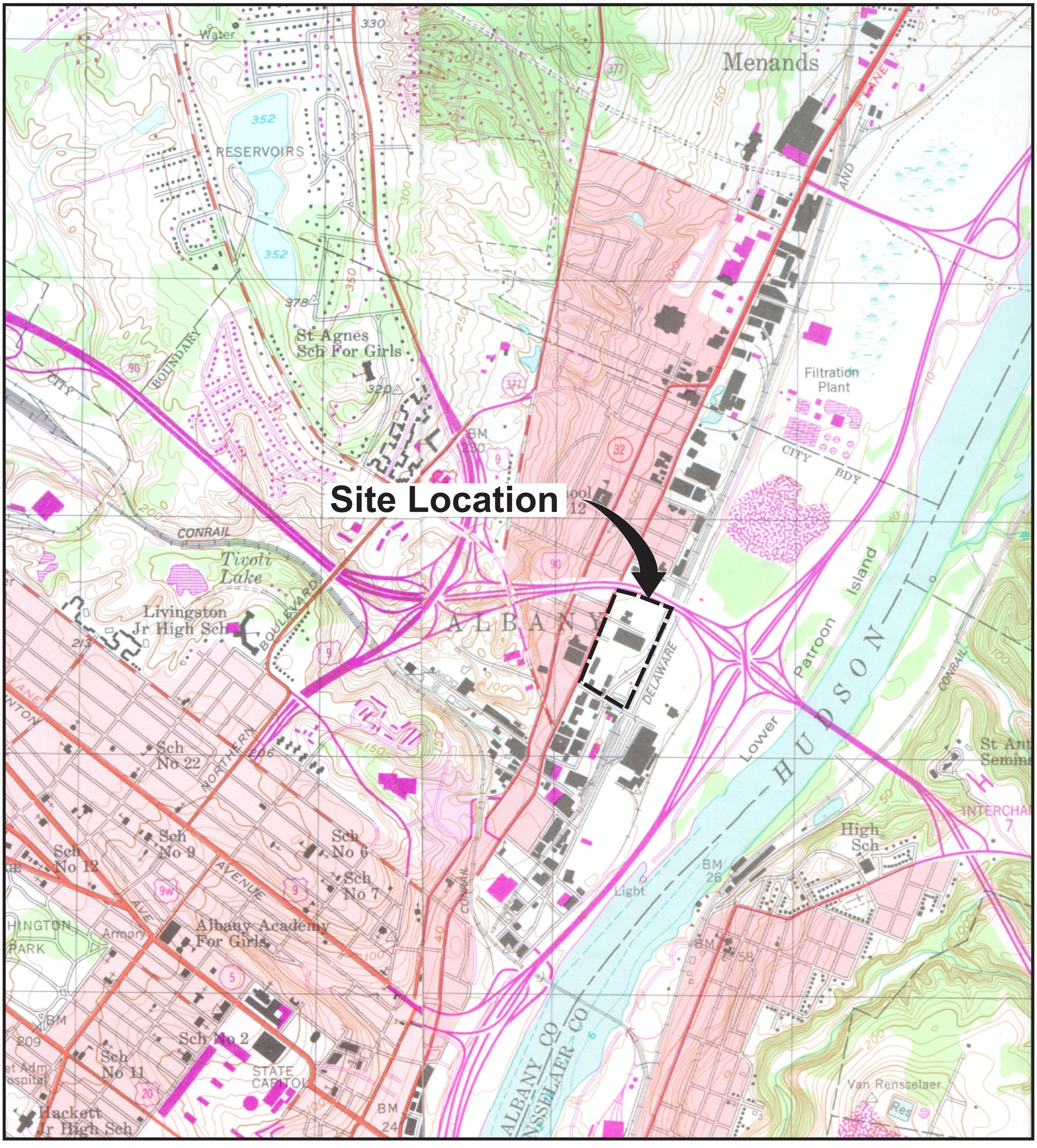
ARCADIS Design & Consultancy for natural and built assets

Table 1
Situ Waste Characterization Sampling Locations and Laboratory Analysis
National Grid - North Albany Former Manufactured Gas Plant Site - Albany, New York

Proposed Sample Location	Proposed Composite Sample Interval (ft bgs)		Proposed Laboratory Analyses Sets: Landfill Characterization	Proposed Laboratory Analyses Sets: LTTD Characterization
Pre-ISS Excavation[1]				
WC-1	1	6	X	X
WC-2	1	6	X	X
WC-3	1	6	X	X
WC-4	1	6	X	X
Purifier Waste Area[2]				
WC-5	1	7	X	
	7	14		X
WC-6	1	7	X	
	7	14		X
WC-7	1	7	X	
	7	14		X
WC-8	1	7	X	
	7	14		
WC-9	1	7	X	X
	7	14		
NAPL Barrier Wall[3]				
WC-10 / GT-2	1	12	X	X
	12	Bedrock		X
WC-11 / GT-6	1	12	X	
	12	Bedrock		X

Notes:
1. Pre-ISS excavation of soils will extend to a depth of approximately 6 feet. If no NAPL or obviously-impacted soil is encountered (based on odors or visual staining), a composite sample from 0 to 6 feet will be analyzed for landfill characterization. If NAPL of other obvious impacts are encountered, a composite from the potentially-impacted interval within the boing will be analyzed for LTTD characterization and a composite of the remaining soil intervals will be analyzed for landfill characterization.
2. Borings in the purifier waste excavation area will extend to a depth of approximately 14 feet or until confining silt/clay layer is encountered. Separate composite samples of purifier waste-containing soil (potentially hazardous from approximately 7 to 14 feet) and non-purifier waste-containing soil (from approximately 0 to 7 feet) will be collected for LTTD characterization and landfill characterization, respectively.
3. NAPL barrier wall borings will be completed to bedrock. At WC-10 location, NAPL impacted soils may be encountered at relatively shallow depth. Characterization sampling approach will be adjusted based on presence or absence of NAPL or obvious impacts.
5. Analyte lists for landfill and LTTD characterization are included in Subsection 2.2.4 of the RDWP Text.
6. Bedrock is anticipated to be encountered at 25 ft bgs.
7. bgs = below ground surface.
8. LTTD = Low Temperature Thermal Desorption.

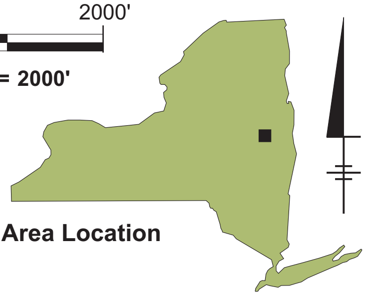
FIGURES



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

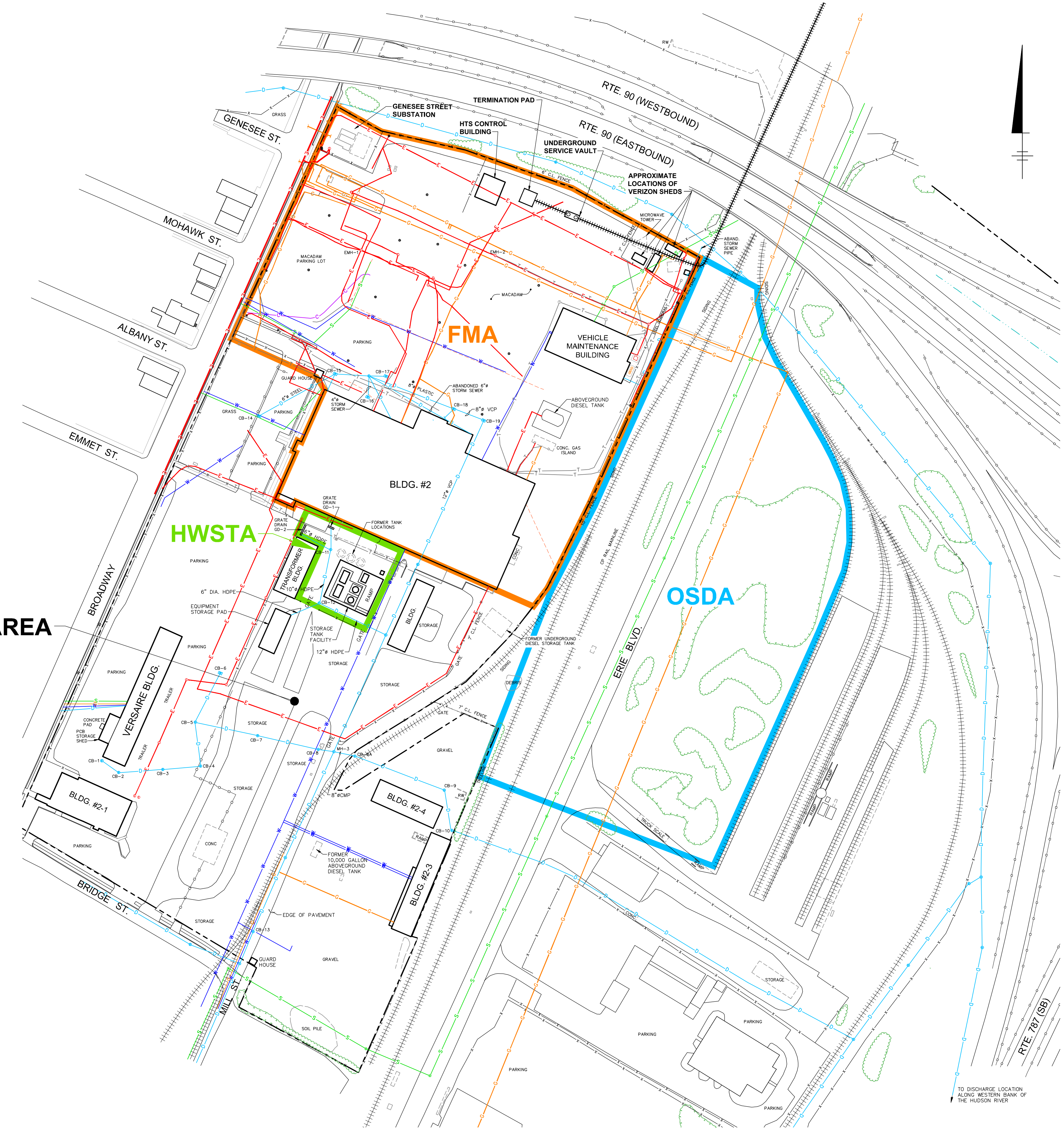
REMEDIAL DESIGN WORK PLAN

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1

08/01/2016 SYRACUSE, DIV/GROUP: ENV/IM-DV DJHOWES
B0036648/0014/00001/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
REMEDIAL DESIGN WORK PLAN

SITE PLAN

ARCADIS Design & Consultancy for natural and built assets

FIGURE
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: 8/31/2016 1:02 PM BY: ALLEN, ROYCE
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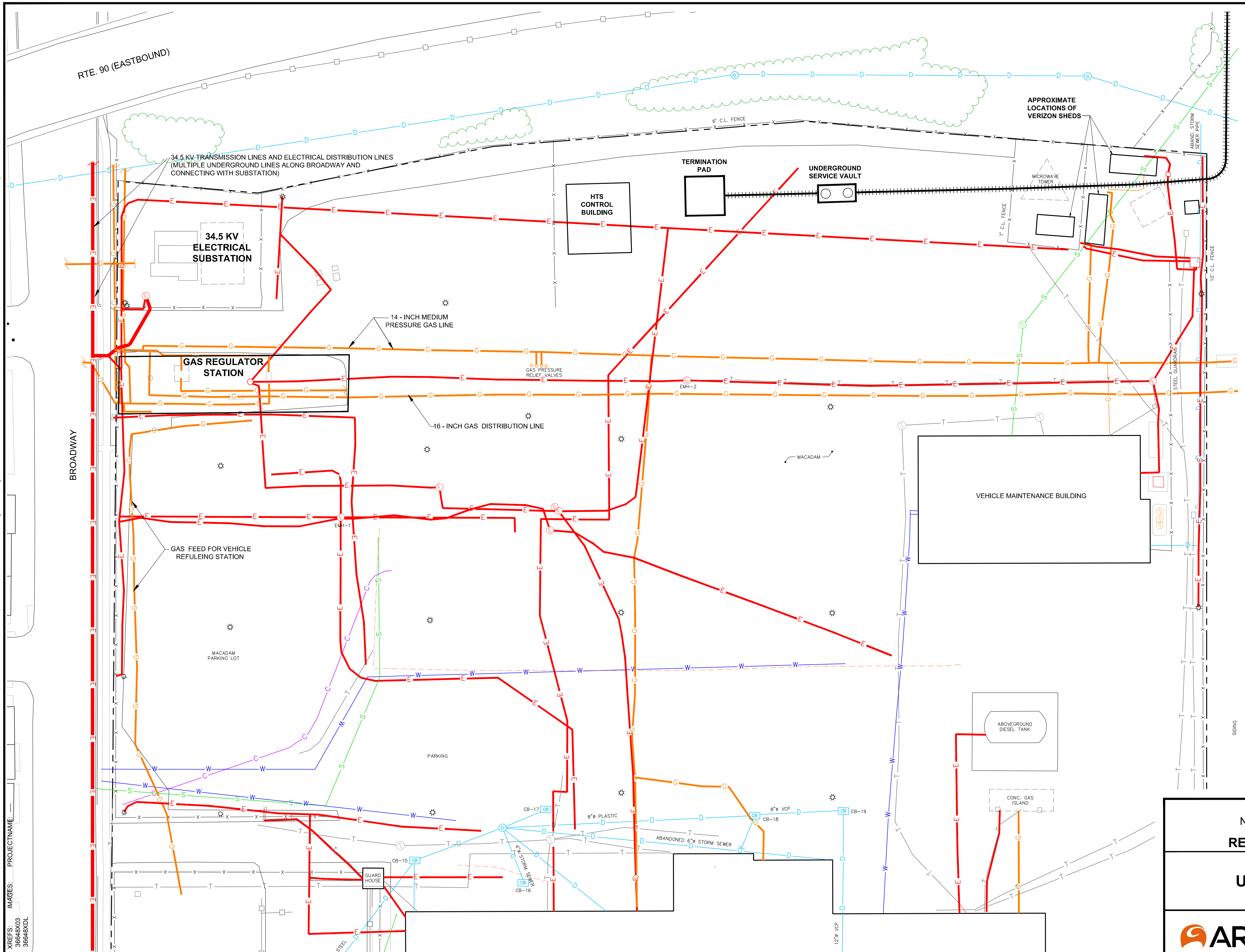

LEGEND:

- APPROXIMATE LOCATION OF HIGH TEMPERATURE SUPERCONDUCTIVE CABLE
- GUARD RAIL
- FENCE
- EXISTING RAILROAD
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- 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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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
REMEDIAL DESIGN WORK PLAN

UTILITY LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
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*
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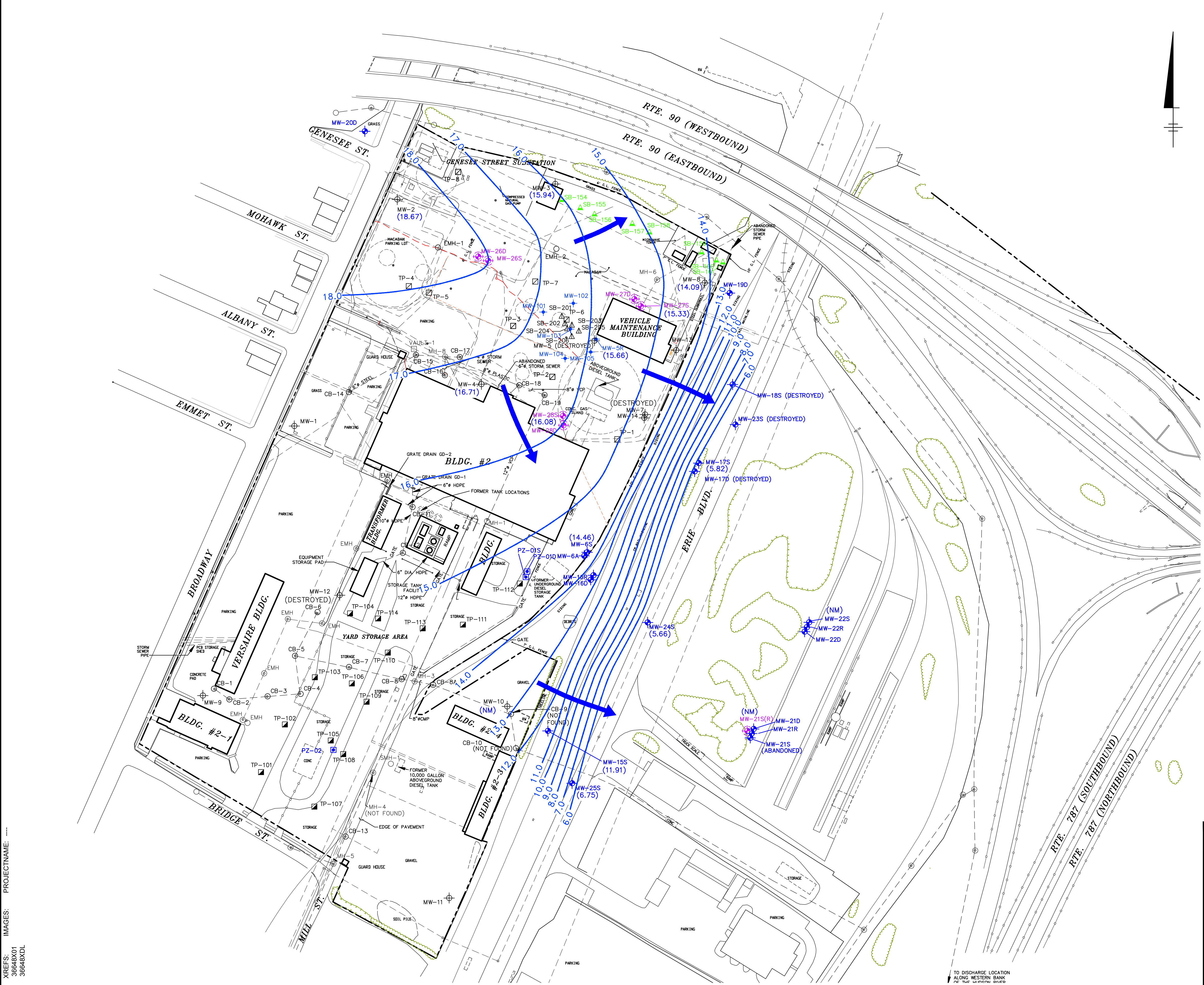

LEGEND:

- 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.
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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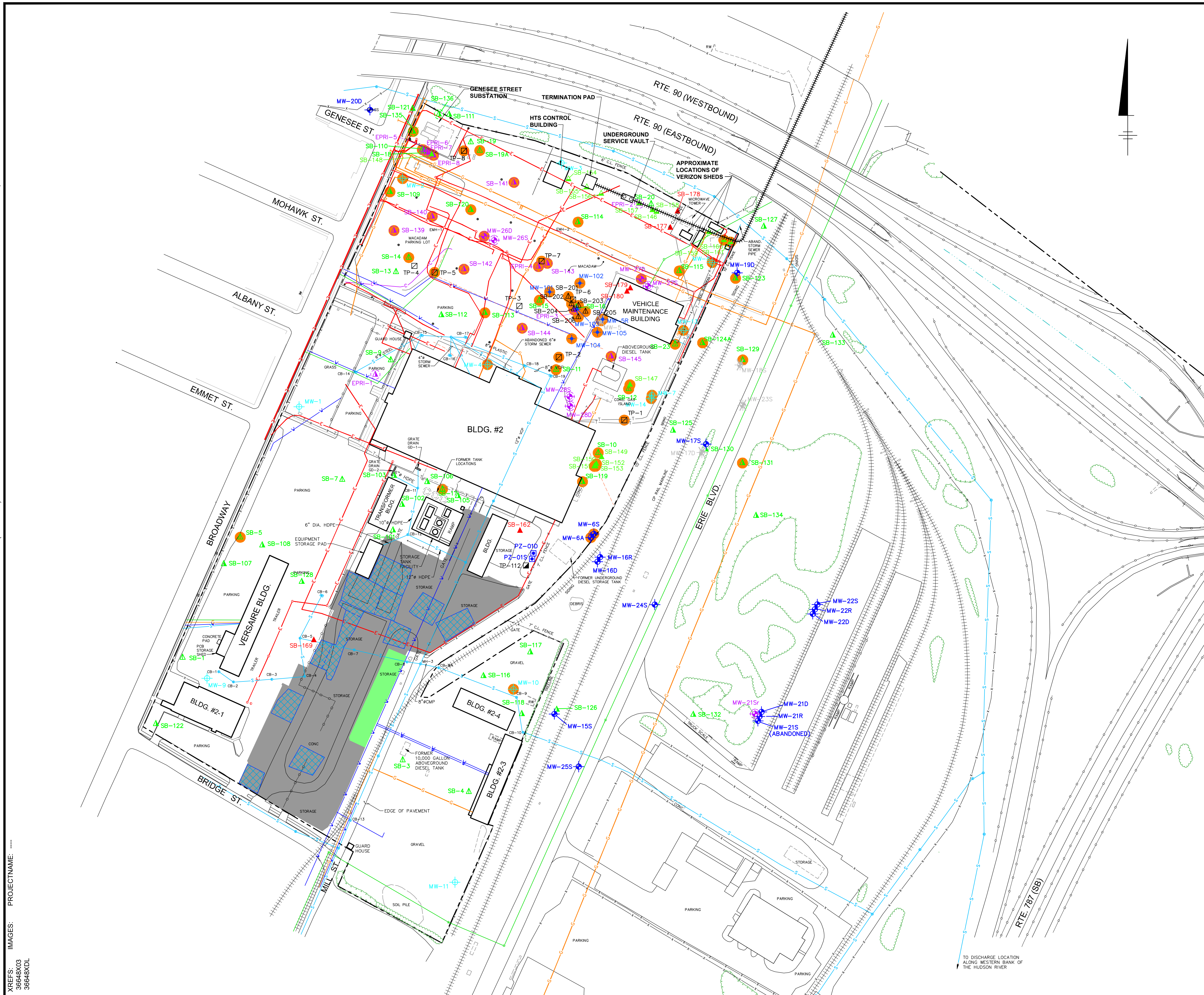
4. LOCATIONS OF OFF-SITE STORM AND SANITARY SEWERS WERE DIGITIZED FROM CITY OF ALBANY DRAWINGS AND ARE APPROXIMATE.
5. GROUNDWATER ELEVATION DATA OBTAINED FROM MONITORING WELLS MW-1, MW-7, MW-11, MW-12, MW-14, MW-21SR AND PZ-02 WERE NOT INCLUDED WHEN CREATING THIS CONTOUR MAP.
6. MGP = MANUFACTURED GAS 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 FORMER MGP SITE
ALBANY, NEW YORK
REMEDIAL DESIGN WORK PLAN

WATER TABLE ELEVATION MAP (DECEMBER 2011)

ARCADIS Design & Consultancy for natural and built assets

FIGURE 4



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
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:

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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
REMEDIAL DESIGN WORK PLAN

VISUAL EXTENT OF MGP- AND/OR PETROLEUM-RELATED MATERIALS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
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*
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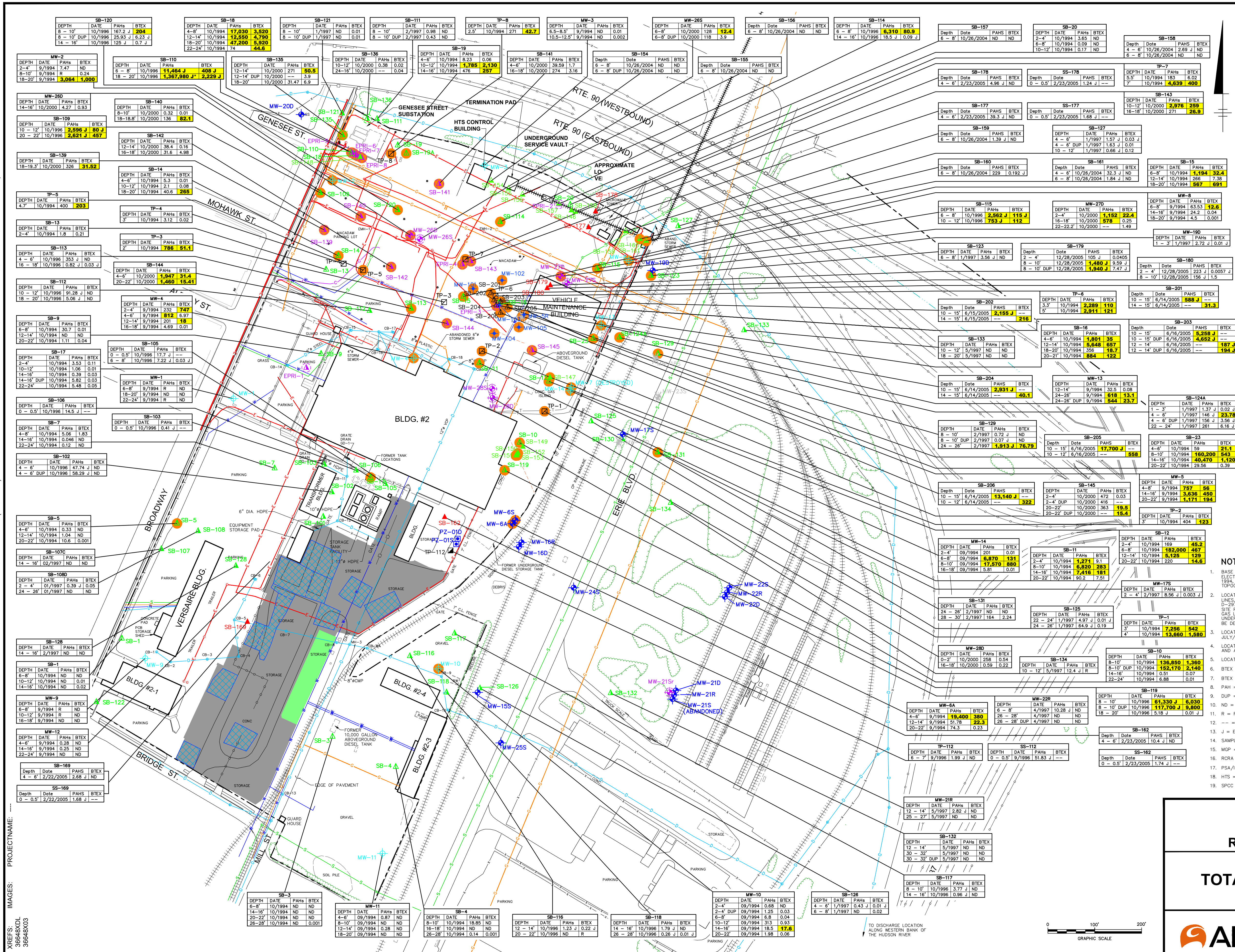

LEGEND:

- 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:

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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.
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NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK

REMEDIAL DESIGN WORK PLAN

TOTAL BTEX/PAHs IN SOIL (PPM)

ARCADIS Design & Consultancy for natural and built assets

FIGURE 6

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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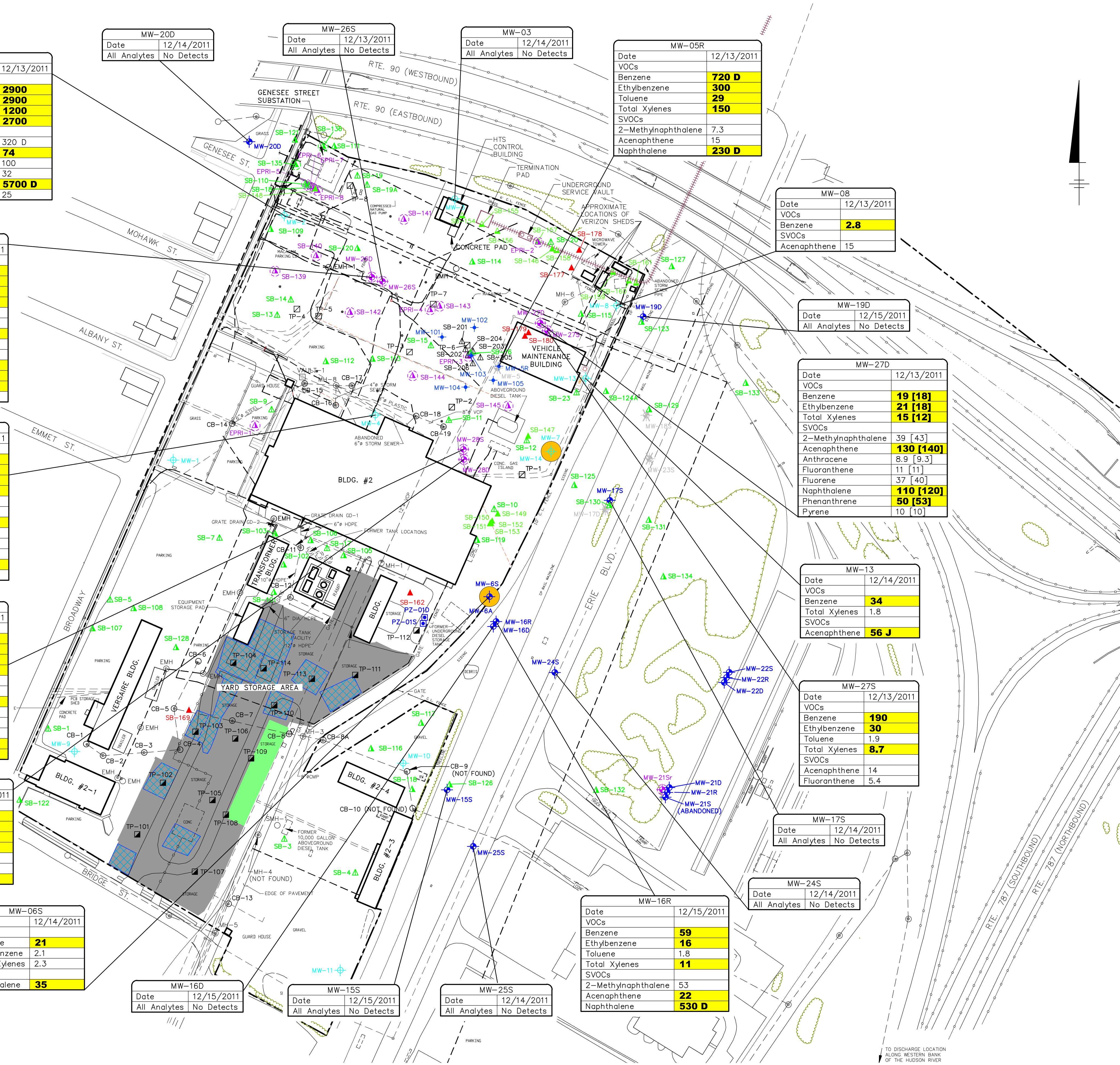

MW-02	
Date	12/13/2011
VOCs	
Benzene	**2900**
Ethylbenzene	**2900**
Toluene	**1200**
Total Xylenes	**2700**
SVOCs	
2-Methylnaphthalene	320 D
Acenaphthene	**74**
Acenaphthylene	100
Fluorene	32
Naphthalene	**5700 D**
Phenanthrene	25

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-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-08	
Date	12/13/2011
VOCs	
Benzene	**2.8**
SVOCs	
Acenaphthene	15

MW-19D	
Date	12/15/2011
All Analytes	No Detects

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-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-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-13	
Date	12/14/2011
VOCs	
Benzene	**34**
Total Xylenes	1.8
SVOCs	
Acenaphthene	**56 J**

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

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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.
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0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
REMEDIAL DESIGN WORK PLAN

DECEMBER 2011 GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs AND SVOCs (ppb)

ARCADIS Design & Consultancy for natural and built assets

FIGURE
7

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 (PURIFIER WASTE 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

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NATIONAL GRID
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ALBANY, NEW YORK
REMEDIAL DESIGN WORK PLAN

SELECTED SITE REMEDY

ARCADIS Design & Consultancy for natural and built assets

FIGURE
8

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* PLOTTED: 8/31/2016 2:06 PM BY: ALLEN, ROYCE
G:\ENVCAD\SYRACUSE\ACT\B0036648\1401\00001\DWG\RD-WP\36648B24.DWG LAYOUT: 8 SAVED: 8/31/2016 2:05 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB
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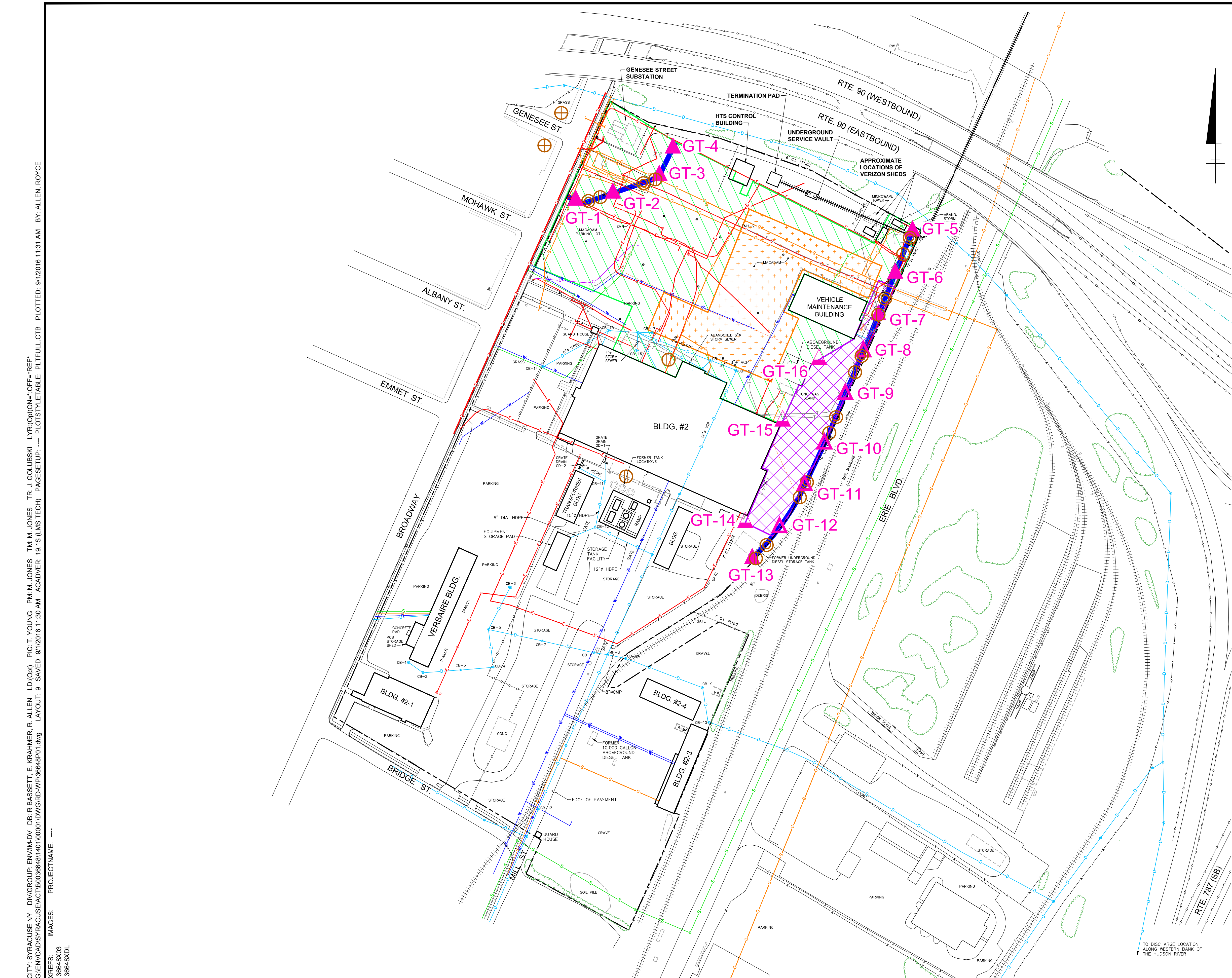
36648XDL



LEGEND:

- PROPOSED PASSIVE WALL BEDROCK BORING
- PROPOSED EXCAVATION SUPPORT BORING
- PROPOSED PASSIVE WALL BEDROCK AND EXCAVATION SUPPORT BORING
- 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 (PURIFIER WASTE 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:

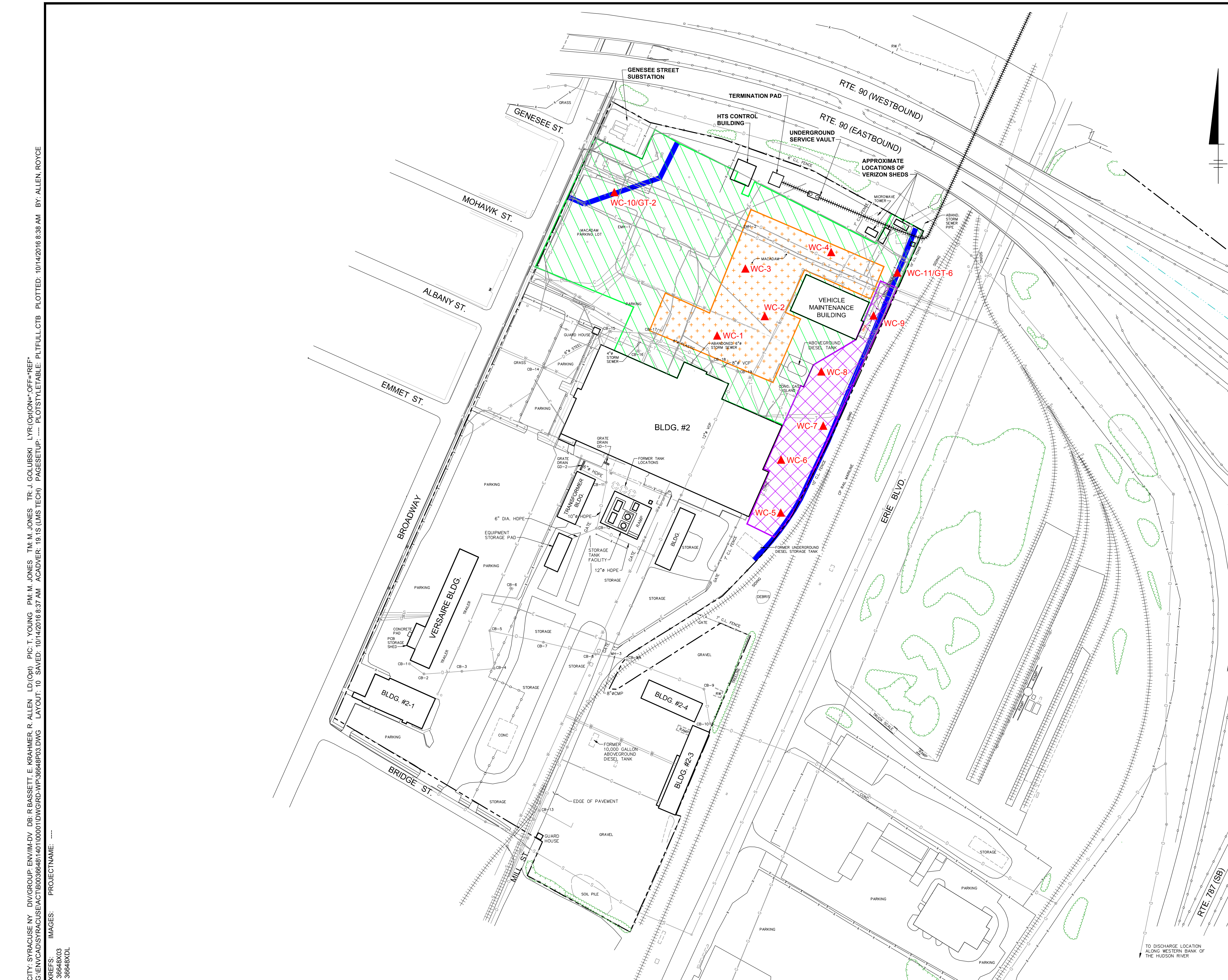
1. BASE MAP (INCLUDING BUILDING LOCATIONS) DEVELOPED FROM ELECTRONIC FILE OF NIAGARA MOHAWK POWER CORPORATION (NMPC) DRAWING NO. C–29736–C, DATED JULY 1994, ENTITLED NORTH ALBANY SERVICE CENTER HAZARDOUS WASTE MANAGEMENT PERMIT APPLICATION, TOPOGRAPHIC MAP – INDEX SHEET.
2. LOCATIONS OF UNDERGROUND UTILITIES (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. LNAPL = LIGHT NON–AQUEOUS PHASE LIQUID.
6. DNAPL = DENSE NON–AQUEOUS PHASE LIQUID.

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
REMEDIAL DESIGN WORK PLAN

PROPOSED PDI SOIL BORINGS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
9



LEGEND:

- PROPOSED WASTE CHARACTERIZATION SAMPLING LOCATION
- 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
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0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
NORTH ALBANY FORMER MGP SITE
ALBANY, NEW YORK
REMEDIAL DESIGN WORK PLAN

PROPOSED IN-SITU WASTE CHARACTERIZATION SAMPLING LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
10

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*
G:\ENVCAD\SYRACUSE\ACT\B0036648\1401\00001\DWG\RD-WP\36648P03.DWG LAYOUT: 10 SAVED: 10/14/2016 8:37 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 10/14/2016 8:38 AM BY: ALLEN, ROYCE
XREFS: 36648X03 36648XDL IMAGES: PROJECTNAME: ----

APPENDIX A

Field Sampling Plan from the *Generic Site Characterization/IRM Work Plan for Site Investigations at Former MGP Sites*

GENERIC
FIELD SAMPLING PLAN

FOR

SITE INVESTIGATIONS

AT

MANUFACTURED GAS PLANTS

Prepared for:

Niagara Mohawk
300 Erie Boulevard West
Syracuse, New York

Prepared by:

Foster Wheeler Environmental Corporation
One Park Place
300 South State Street, Suite 620
Syracuse, New York

NOVEMBER 2002

Site Specific
Revisions Attached: Supplement No. ___ Date

GENERIC
FIELD SAMPLING PLAN
TABLE OF CONTENTS

GENERIC
FIELD SAMPLING PLAN
TABLE OF CONTENTS (Cont'd)

Section 1 - Tables

Section 2 - Figures

Section 3 - Attachments

1.0 INTRODUCTION

This generic Field Sampling Plan (GFSP) has been prepared for Niagara Mohawk, a National Grid Company (NM) in response to the Voluntary Cleanup Order (VCO) (Index No. DO 0001 0011) between NM and the New York State Department of Environmental Conservation (NYSDEC). This document is intended to provide guidance for implementation of various types of environmental sampling activities that may be utilized during Site Investigation and/or Remedial Investigations, Interim Remedial Measures, Feasibility Studies, Remedial Designs, and/or Remedial Actions at MGP sites. The numbers and types of environmental samples to be collected are identified in the detailed respective Site-Specific Work Plans, to which this document is appended. If any discrepancy occurs between the Site Specific Work Plan and the Generic Work Plan/Field Sampling Plan then the Site Specific Work Plan will govern.

During the performance of any investigation, references in all work products to dense nonaqueous phase liquids (DNAPL) and/or other MGP impacted media (i.e. soil, water, sediments, etc.) will be made using the terminology and descriptions presented in the USEPA documents entitled ***Ground Water Issue - Dense Nonaqueous Phase Liquids*** (Huling and Weaver; March 1991) and included as Attachment B.

2.0 GENERAL FIELD GUIDELINES

2.1 Underground Utilities

All underground utilities, including electric, telephone, cable TV, sewers, water, natural gas, etc., will be identified prior to any drilling and subsurface sampling. Underground Facilities Protective Organization (UFPO) will be contacted by phone at least 72 hours prior to field activities so their underground utilities can be marked at the Site. Other potential on-site hazards such as sharp objects, known subsurface structures, overhead power lines, and building hazards will be identified during the Site reconnaissance visit.

2.2 Sample Identification

Each sample will be given a unique identification as shown in Table 1. With this type of identification, no two samples will have the same label. Labels or tags identified as shown in Table 1 will be attached to each sample container. Labels or tags will be rendered waterproof by either covering the label with clear plastic wrapping tape or utilizing waterproof material for the tag or label.

2.3 Sampling Equipment

The following is a general list of equipment, which may be necessary for sample collection:

- Stainless steel spoons and bowls for mixing soil and sediment samples;
- Appropriate sample containers (and coolers) provided by the laboratory;
- Sample bottles (kept closed and in the laboratory-shipped coolers until the samples are collected);
- Reagent-grade preservatives and pH paper or meter (or pre-preserved sample containers) for aqueous samples;
- Chain-of-Custody labels, tags, seals, and record forms;
- Logbook, field sampling records, and indelible ink markers;
- Laboratory grade decontamination detergents (such as Alconox, Liquinox, etc.), reagent-grade solvents, and deionized, organic-free water to be used for decontaminating equipment between sampling stations;
- Squirt Bottles;
- Ruler and measuring tape;
- Garbage bags;
- Paper towels and/or baby wipes;
- Buckets, wash basins, and scrub brushes to be used for decontaminating equipment;
- Digital camera or camera and film to document sampling procedures and sample locations;
- Stakes and flagging tape and/or spray paint to identify sampling locations;

- Shipping labels and forms;
- Knife;
- Vermiculite or other packing/shipping material for sample bottles;
- Strapping tape;
- Clear plastic tape;
- Duct tape;
- Aluminum Foil;
- Reclosable plastic bags;
- Ice;
- Portable field instruments, which may include but not be limited to a pH meter, conductivity meter, turbidity meter, dissolved oxygen (DO) meter or multi-parameter flow through cell, photoionization detector (PID), and water level indicator;
- Combustible gas indicator (CGI);
- Poly-sheeting;
- Driller's jars (for archiving samples);
- Polypropylene or stainless steel bailers;
- Poly propylene rope and/or Teflon line; and
- Submersible, peristaltic and/or centrifugal pump and associated tubing.

Other sampling materials and equipment may be utilized as warranted by field conditions encountered at time of sampling and media to be samples. Appropriate health and safety equipment and PPE, as per the Generic Environmental Health and Safety (EHS) Plan (Volume II) will be used.

2.4 Field Records

The Project Manager will control all field logbooks. Each field logbook will receive a serialized number and be issued to the field operations leader (FOL). Field logbooks will be maintained by the FOL and other team members while in the field to provide a daily record of significant events, observations, and measurements during the field investigation. All entries will be signed and dated at the bottom of each page.

Information pertinent to the field investigation and/or sampling activities will be recorded in the logbooks. The logbooks will be bound with consecutively numbered pages. Entries in the logbook will include, at a minimum, the following information:

- Name and title of author, date and time of entry, and physical/environmental/weather conditions during field activity;
- Purpose of sampling activity;
- Location of sampling activity;
- Name and address of field contact;
- Name and title of field crew members;

- Name and title of any Site visitors;
- Sample media (soil, sediment, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) collected;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;
- Preservatives used;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- Any field measurements made, such as pH, temperature, turbidity, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s);
- Information pertaining to sample documentation such as:
    - Bottle lot numbers
    - Dates and method of sample shipments
    - Chain-of-Custody Record numbers
    - Overnight Shipping Air Bill Number

All original data recorded in Field Logbooks, Sample Tags, and Chain-of-Custody records will be written with waterproof ink. None of these accountable, serialized documents will be destroyed.

If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a single line through the error, placing the initials of the individual making the correction and date next to the crossed out information and entering the correct information. The erroneous information will not be erased. All field personnel will be instructed as to the proper field logging techniques for maintaining the integrity of the documentation.

3.0 EQUIPMENT DECONTAMINATION

3.1 Drill Rig and Backhoe Decontamination

A decontamination pad will be constructed of high-density polyethylene sheeting, no less than 10-millimeters thick, on a prepared surface sloped to a sump. The sump must also be lined and of sufficient volume to contain at least 20 gallons of decontamination water. The size of the pad shall be of sufficient size to contain the fluids generated during the decontamination of on-site equipment. The decontamination pad will be no larger than the back of the drill rig, since the back of the drill rig will be the largest piece of equipment anticipated on-site. Sides of the pad will be bermed so that all decontamination water is contained. Upon completion of all field activities, the decontamination pad will be properly decommissioned. To accomplish decommissioning, all free liquids will be removed from the surface of the High Density Polyethylene (HDPE) sheeting, including the sump area, and allowed to air dry. The HDPE sheeting will then be cut to manageable size, folded or rolled, and placed in the waste container (usually a roll-off container or 55-gallon drum). The earthen material or wood timbers used to construct the containment berm will be inspected to ascertain if the material has come in contact with decontamination liquids during use. If they have, the materials will be disposed in the waste container for subsequent disposal at an appropriate facility. If the materials have not been in contact with decontamination liquids, they may be reused.

All equipment used in intrusive work including backhoe, drilling rig, augers, bits, tools, split-spoon samplers and tremie pipe will be cleaned with a high-pressure hot water or steam cleaning unit and scrubbed with a wire brush to remove dirt, grease, and oil before beginning field work and before leaving the project Site upon completion of the last sampling activity. All tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided. The back of the drill rig and all augers, rods, and tools will be decontaminated between each drilling location according to the above procedures. The backhoe bucket, arm, and any other part of the equipment, which may have contacted excavated soil, will be decontaminated between each test pit location. Tools, augers, and rods will be decontaminated between drilling monitoring wells.

Decontamination water collected in the sump of the decontamination pad will be at a minimum removed from the sump at intervals less than 90% of its capacity and prior to rain events. The liquids will be pumped to a 55-gallon drum and stored in an appropriate satellite storage area. All waste handling will be performed in accordance with waste handling regulations.

Unless sealed in manufacturers packaging, monitoring well casing and screens will be steam cleaned immediately before installation. The screen and casing shall then be wrapped in polyethylene plastic and transported from the designated decontamination area to the well location.

3.2 Sampling Equipment Decontamination

Prior to sampling, all non-dedicated/non-disposable equipment (i.e., bowls, spoons, and bailers) will be washed with potable water and a laboratory grade detergent (such as Alconox). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, 55-

gallon drums, etc. The sampling equipment will then be rinsed with potable water followed by a reagent-grade isopropanol rinse and finally a deionized water rinse. Additionally, all equipment used to collect samples for metals analysis will receive a nitric acid rinse followed by a deionized water rinse. Between rinses, equipment will be placed on polyethylene sheeting. At no time will decontaminated equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

4.0 SITE RECONNAISSANCE AND SCREENING

The following practices, procedures and methods will be utilized in carrying out all field activities if specified in the Site-Specific Work Plan.

4.1 Site Reconnaissance

Following the contact with UFPO and markout of subsurface utilities at the Site, Site reconnaissance will be performed. The Site reconnaissance will be attended by the NM Project Manager, the Consultant Project Manager and/or the FOL, and representatives of the NYSDEC and/or the NYSDOH. During this task, the NYSDEC-approved sampling locations, as outlined in the Site-Specific Work Plan, will be marked in the field with a wooden stake and/or spray paint. Conflicts with the NYSDEC-approved sampling locations, based on the utility markout, will be modified during this visit.

Prior to this Site visit, the property owner and/or company representative will be contacted by the NM Project Manager to meet at the Site. The property owner and/or company representative will be asked if subsurface structures exist on the property and will be asked to identify their locations. Subsurface structures will consist, but are not limited to the following: septic tanks, cesspools, underground irrigation lines, water supply wells, vaults, leaching fields, propane, oil, and/or fuel tanks, underground utilities installed by the owner, drainage lines, etc.

4.2 Metal Detector Survey

A metal detector survey may be conducted using the magnetic cable locator model MAC-51B (or equivalent); to locate unidentified underground utilities and possible buried drums or tanks. The area around each proposed subsurface investigation point may be checked with the MAC-51B (or equivalent) prior to any subsurface investigation. Initially, the locator will be tested on known locations of underground utilities to verify that it is functioning properly.

If there is no indication of buried utilities, drums, or tanks, then subsurface sampling will proceed. However, if the locator indicates the presence of a buried object, activities will not proceed in that location until the type of buried object is determined. If the object cannot be identified from surface or shallow digging, a test pit may be required to determine the identity of the buried object. If a test pit is required, the procedure and scope will be reviewed with the NM Project Manager prior to conducting the work.

The NM Project Manager will keep the property owner or company representative informed of planned Site activities.

4.3 PAH Field Screening

PAH screening of soil samples may be used to determine the extent of PAHs in soil and to optimize the location of samples for confirmatory laboratory analysis.

If PAH field screening is conducted at any Site, then adequate facilities will be provided for proper use of the PAH-specific immunoassay test. The individual responsible for conducting the immunoassay test in the field shall receive instruction in the proper use and storage of the test kit. The instructions for the PAH Field Screening Kit are provided as Attachment A of the Generic

Quality Assurance Project Plan (QAPP) (Volume II). The test is a simple procedure designed to test any type of soil sample for PAHs. The test uses a semi-quantitative, colorimetric method that incorporates immunoassay technology. The test is performed using tubes, which are coated with a chemical that specifically reacts with PAHs. To perform the test, the standards, samples and reagents are added in a step-wise manner to the coated tubes. The procedure results in a color change within each tube inversely proportional to the concentration of PAHs. The color in the tubes is read by inserting the tubes in a standardized color photometer. The test consists of the following three steps:

1. Sample Preparation: First, PAHs are extracted from the soil using a solvent. The extract is clarified using a disposable 0.45-micron filter tip.
2. Testing: After sample preparation, the PAH standards and the sample and the enzyme are added to the coated tubes. After 10 minutes incubation, the tubes are rinsed and color-developing reagents are added. Within a few minutes, color development occurs in the tubes.
3. Results Interpretation: The color of the sample tube is compared against the color of the standard tube using a photometer to determine if PAHs are present in the sample. The result will indicate concentrations in three ranges; less than 1 ppm, between 1 and 100 ppm, and over 100 ppm.

4.4 PCB Field Screening

Polychlorinated biphenyls (PCBs) screening of soil samples may be used to determine the extent of possible PCBs in soil and to optimize the location of samples for confirmatory laboratory analysis. The field screening may be conducted using a PCB-specific immunoassay test. The individual responsible for conducting the immunoassay test in the field shall receive instruction in the proper use and storage of the test kit. The instructions for the PCB Field Screening Kit are provided as Attachment A of the Generic Quality Assurance Project Plan (QAPP) (Volume II). The test is a simple procedure designed to test any type of soil sample for PCBs. The test uses a semi-quantitative, colorimetric method that incorporates immunoassay technology. The test is performed using tubes, which are coated with a chemical that specifically reacts with PCBs. To perform the test, the standards, samples and reagents are added in a step-wise manner to the coated tubes. The procedure results in a color change within each tube proportional to the concentration of PCB. The color in the tubes is read by inserting the tubes in a comparative photometer. The test consists of the following three steps:

1. Sample Preparation: First, PCBs are extracted from the soil using a solvent. The extract is clarified using a disposable 0.45-micron filter tip.
2. Testing: After sample preparation, the PCB standards and the sample are added to the coated tubes using dropper bottles. After 10 minutes incubation, the tubes are rinsed and color-developing reagents are added. Within a few minutes, color development occurs in the tubes.
3. Results Interpretation: The color of the sample tube is compared against the color of the standard tube using a photometer to determine the concentration of the sample.

The result will indicate concentrations in 3 ranges; less than 5 ppm, between 5 and 50 ppm, and over 50 ppm. Also, with a dilution samples can be tested for over 500 ppm.

PCB specific screening with the eminase test kits will be utilized on-sites, which have historically been associated with either electrical equipment from a certain time period that employed the use of PCB oils or when records may reflect the use of PCBs at that facility. The test kits will be used as part of an overall analytical program, which will include laboratory analysis of on-site soils.

4.5 Private Water Supply Inventory

If off-site groundwater impacts are detected through the sampling program, or if specifically requested by the NYSDEC, than an inventory of private water supply sources within a one-half mile radius around the project Site will be researched. The research will be conducted by contacting the municipal Water Department (if one exists), the municipal engineer, the NYS Department of Health and consulting the *Atlas of Community Water System Sources*, and/or the United States Geologic Society (USGS).

5.0 SUBSURFACE BORING PROTOCOL

5.1 Drilling Methods and Sample Collection

Overburden

Soil borings, in general, will be drilled with hollow-stem augers or flush-joint casing. When advancing a soil boring, re-entry of the split-spoon sampler into the previously sampled interval shall not be permitted. Hollow-stem augers with center plug will be advanced at two-foot intervals, consistent with the split-spoon sampling pace. Alternative methods may be used at the geologist's discretion with the authorization of NM and NYSDEC. Split-spoon sampling will be conducted in accordance with ASTM Specification D-1586-84 for standard penetration test and split barrel sampling, unless otherwise authorized by the field geologist. Split-spoons will be decontaminated after each sample is collected.

A plywood sheet or other suitable basin (during mud or water rotary drilling) will be placed around the augers during drilling to contain soil cuttings/mud drilling and prevent them from contacting the ground surface. Soil cuttings will be placed in a 55-gallon steel drum or a roll-off container for subsequent sampling and disposal. Decontamination water and drilling mud/water will be placed in tanks and/or 55-gallon steel drums for proper disposal.

Boring Completion Methods

All soil borings will be completed by adding cement/bentonite grout, via tremie pipe, from the bottom of the borehole up to the ground surface as the augers are withdrawn. The grout will be mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite.

Geoprobe® Coring

If prescribed in the Site-Specific Work Plan, Geoprobe® coring will be performed in accordance with the manufacturer's specifications. An assembled Geoprobe Macro-Core® open-tube soil sampler, with a one use dedicated liner, will be driven one sampling interval (approximately 4 feet) into the subsurface then retrieved using a Geoprobe® soil probing machine. The collected soil core will be removed from the sampler along with the liner. The field geologist will classify and sample the soil located within the liner. Upon completion, the excess soil will be placed into a 55-gallon drum for disposal and the inner liner properly disposed. After decontamination, the Macro-Core sampler will be reassembled using a new liner. The clean sampler will then be advanced back down the same borehole to collect the next soil core interval.

Upon completion of sampling, the borehole will be grouted from the base of the borehole to ground surface. As the Geoprobe® piping is removed from the borehole, grout will be place in the Geoprobe® piping and allowed to flow out, via gravity, into the void left by the piping.

Procedures for geologic logging and field classification will be as presented in Section 5.2.

Shelby Tube Sampling

Shelby tube samples will be collected in accordance with the latest revision of ASTM D/587. When the desired sampling depth is reached, the hollow-stem auger or casing will be cleaned out using whatever method is preferred so as not to disturb the material to be sampled. The Shelby tube will be lowered to the bottom of the borehole, then advanced (pushed) via pressure without rotation by a continuous relatively rapid motion until 24 inches of penetration is achieved. At the discretion of the field geologist, a period of approximately 10 minutes, measured from the time of insertion, will be allowed to provide for sample adhesion to the tube walls. Prior to removal, the tube may be rotated two complete revolutions to shear the bottom of the sample from the native material.

Upon removal, the field geologist will log the tops and bottoms of the sample for soil classification. Samples recovered via Shelby tube will be preserved in conformance with the latest revision of ASTM D 4220. To preserve the natural moisture content of the samples, the tube ends will be sealed with a minimum of 0.50 inch of paraffin wax. Plastic slip caps will be applied at the ends of the sample tube, taped, then dipped and sealed in wax.

Rock Coring

Conventional or wire-line HX or NX coring will be used if rock drilling is specified in the Site-Specific Work Plan. Prior to drilling at such locations, a minimum 4-inch diameter, temporary steel casing or equivalent will be placed or locked into the top of bedrock. Rock coring will be conducted in accordance with the latest version of ASTM D2113. Upon retrieval, the core will be placed in a core box labeled as follows:

Outer Core Box and/or End Panels

1) Project/Site name
2) Site location
3) Boring/well number
4) Box number
5) Core run number and footage interval
6) Date

Inside Core Box Cover (in columns)

1) Boring/well number
2) Run number
3) Depth interval
4) Actual recovery
5) Rock quality degree (RQD) in percent
6) PID screening results where applicable
7) Comments

In addition, a geologist will be on-site during the drilling operations to fully describe each core, including:

1) Color
2) Thickness of bedding
3) Rock type
4) Additional petrographic information
5) Texture
6) Weathering state
7) Structure
8) Detailed description of discontinuities and fillings
9) Formation name
10) Detailed description of visible impacts
11) Miscellaneous observations

Sample descriptions, PID readings, and drilling locations will be recorded in the field logbook.

5.2 Geologic Logging, Soil Classification and Documentation

The field geologist will log borehole geology in the field logbook and on field forms. All samples collected from the borehole will be classified in accordance with ASTM standards D2487 Standard Method for Classification of Soils for Engineering Purposes and D2488 Standard Practice for Description and Identification of Soils or using the Burmeister Method and classifying the soils using the Unified Soil Classification System. The field geologist will be on-site during the drilling operations to classify/log each sample in the field logbook and/or field forms including:

- Site;
- Boring number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Drilling Company's Name;
- Soil type;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;

- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

If no recovery, or limited recovery, is observed in the sample, then a description regarding the lack of sample recovery should be provided on the log of boring, if evidence of an obstruction or equivalent can be identified. If no observable evidence is identified then no opinion or guess should be entered on the log of boring.

Figure 1 presents an example of a log of boring form to be completed. If this form is not utilized, the form used should be approved by the Consultant’s Project Manager as well as NM's project manger.

Photo documentation

Photo documentation of the Site activities will be conducted consistently throughout the implementation of the field program. A photographic log will be created and maintained as part of the overall field program. Visually impact materials and/or distinct stratigraphic changes in the soil column will be included in the photographic documentation for the individual Sites.

6.0 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells will be installed at the locations identified in the Site-Specific Work Plan. After the completion of drilling and monitoring well installation, all wells will be developed prior to the collection of groundwater samples. The following procedures will be used to install and develop all monitoring wells.

6.1 Monitoring Well Specifications

Monitoring wells installed in unconsolidated deposits that do not penetrate a presumed confining layer will be constructed according to the following specifications:

- PVC or stainless steel 2-inch diameter threaded, flush-joint casing and screens with O-rings will be installed.
- Wells will be screened in the unconsolidated deposits. Screens will be approximately 10 feet in length, and slot openings will be 0.020 inch. Alternatives may be used at the discretion of the field geologist, based on Site-specific geologic conditions.
- A sump, up to 2 feet in length, may be attached to the bottom of the screen to collect dense nonaqueous phase liquids (DNAPLs), if appropriate. A sump will not be installed if DNAPL is not observed in the boring.
- The top of the casing will extend to approximately 2 to 3 feet above ground surface where possible, given Site-specific considerations. Otherwise, flush-mount casings will be used.
- Where appropriate, the annulus around the screens will be backfilled with silica sand (#1 Morie or equivalent), based on Site-specific geologic conditions and screen slot size, to a minimum height of 2 feet above the top of the screen.
- A bentonite pellet/chip seal or slurry (30 gallons water to 25 to 30 lbs. bentonite, or relative proportions) will be placed above the sand pack. The bentonite pellet/chip seal will be installed via gravity and allowed to hydrate for at least 1 hour before placement of grout above the seal. If the bentonite slurry method is used for installation of the seal, then a side discharging tremie pipe will be utilized for the installation of the bentonite seal. Where possible, the bentonite seal will be a minimum of 24-inches in depth, except in those instances where the top of the well screen is in close proximity to the ground surface. In these instances, the well will be completed in accordance with specifications provided by the field geologist, which will incorporate an adequate surface seal into the well design.
- A fine sand pack (Morie 00 or equivalent) approximately 1 foot thick will be placed above and below the bentonite seal to isolate it and to prevent mixing of components.
- The remainder of the annular space will be filled with a cement-bentonite grout up to the ground surface. The grout will be pumped from the bottom up. The grout will be mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite. The grout will be allowed to set for a minimum of 48 hours before wells are developed.

- Each monitoring well will have an expansion plug or plumbers plug and a 4-inch diameter, steel casing with a hinged, locking cap placed over the monitoring well. The protective casing will extend approximately 2 feet below ground surface and be cemented in place. In some areas, it may be necessary to provide flush mounted casings. All wells will have keyed-alike locks and the keys will be maintained by the NM project manager.
- A concrete surface pad (2 ft x 2 ft x 6-inch) will be sloped to channel water away from the well casing.
- A weep hole will be drilled at the base of the protective standpipe casing to allow any water between the inner and outer casing to drain. If a flush mounted protective casing is installed then a small diameter drainage tube will be installed in the side of the casing discharging to the surrounding subsurface soils.
- The flush mounted monitoring well protective casing will be a minimum 8-inch diameter box or equivalent. All flush mounted well risers will be capped with an expansion plug or plumbers plug.
- The top of the PVC well casing will be permanently marked/notched and surveyed to 0.01 foot, and elevations will be determined relative to a fixed benchmark or datum. The measuring point on all wells, the permanent mark/notch will be on the innermost PVC casing.
- Each outer casing will be permanently labeled using a steel hand stamp or equivalent (i.e. MW-4).

Modification of the above installation procedure will be subject to changes in the field. All field-executed changes will be communicated to the NYSDEC for their discussion and approval, if appropriate.

Based on field conditions and evaluation of the best methodology to ensure the integrity of the seal, the field geologist will select the best method (i.e. bentonite pellet via gravity or bentonite slurry via tremie) to install the bentonite seal above the sand pack.

Figure 3 shows details of an overburden monitoring well construction diagram for wells installed in unconsolidated material. Figure 2 shows details of a monitoring well installed with a flush mounted protective casing.

Figure 4 shows details of a typical double-cased monitoring well construction diagram for wells installed in unconsolidated soils that <u>do</u> penetrate a presumed confining layer. The decision to install double-cased wells will be made on a boring-specific basis by the field geologist. Double-cased wells will be installed when the boring for the monitoring well penetrates a presumed confining layer. The confining layer shall be defined as a minimum five (5) foot thick, predominantly clay unit which has been shown to be laterally continuous across the Site. In the event the field geologist and NM and NYSDEC Project Managers decide a reasonable possibility exists for contamination to be deposited in deeper, clean zones during the drilling and installation of a monitoring well, the well will be double-cased. The purpose of the steel protective casing will be to minimize the possibility that residual contamination is deposited at the depth of the screened interval during the drilling process.

Monitoring wells that penetrate confining layers will be installed according to the following specifications:

- 6-inch inside diameter (ID) steel outer casings will be installed to a depth of at least 2 feet below the lower limit of observed or measured contamination and/or the confining layer. This casing will be grouted in place with cement to inhibit downward migration of contamination.
- The 6-inch casing will be installed through 6.25-inch ID hollow-stem augers. The augers will be filled with grout prior to their removal to ensure the integrity of the borehole and the grout seal. Then, the 6-inch casing will be installed into the grout and hydraulically pushed approximately 1-foot beyond the bottom of the boring. A 3–foot thick grout plug will be installed at the base of the 6-inch diameter pipe through which the borehole will be advanced. Potable water will be tremied to the bottom of the inside of the casing to dilute the grout, thereby allowing the grout to be more easily pumped out of the casing. The grout, pumped out of the casing, will be drummed and staged with other investigation-derived waste (IDW).
- The cement-bentonite grout remaining in the annulus between the casing and the formation will be allowed to set for at least 24 hours before drilling is continued. The drilling will then continue using 4-inch diameter flush-joint spin casing and potable water. All lubricant water will be containerized.
- The well will be constructed of 2-inch diameter PVC or stainless steel riser pipe and screen, sand pack, bentonite seal, grout, and surface casing as specified for single cased monitoring wells discussed above and in accordance with NYSDEC requirements. The bentonite seal may consist of pellets or a bentonite slurry mixture in proportions relative to 30 gallons of water to 25-30 pounds of bentonite. The grout mix will consist of 30 gallons water to three 94-pound bags of cement and 25 pounds of granular bentonite.

Monitoring wells to be installed as open holes in bedrock will be installed according to the following specifications:

- Advance each boring to the top of the bedrock surface. Borehole advancement will be conducted using 6¼-inch inner diameter (ID) continuous flight hollow-stem augers in 2-foot intervals, to permit the continuous collection of subsurface soil samples with carbon steel split-spoon samplers in accordance with Section 5.1. Confirmation of the bedrock surface depth will be based upon split-spoon and hollow stem auger refusal.
- Overbore the borehole to a 12-inch diameter borehole, in which to install a temporary 10-inch carbon steel overburden casing to bedrock, utilizing an appropriately sized tri-cone roller bit or thin wall bit. A 3–foot thick grout plug will be installed at the

base of the 10-inch diameter pipe through which the borehole will be advanced, if appropriate.

- Subsequent to temporary casing installation, continue borehole advancement into the bedrock to a depth of 5 feet below the bedrock surface, first using the rock coring method for logging (see Section 5.1) and then overboring with a 9-inch outer diameter (OD) tri-cone roller bit via the water rotary method.
- Set a permanent 6-inch carbon steel casing 5-feet into the competent bedrock by the spin casing method.
- Backfill the annular space around the well casing with bentonite/cement slurry to the surface. The ratio of cement to bentonite for grouting will be approximately 30 gallons of water to three 94-pound bags of cement to every 25 pounds of granular bentonite.
- Remove the 10-inch temporary casing during pressure grouting. Allow grout to cure for at least 24 hours.
- Continue coring and then drilling in the borehole to the maximum anticipated total depth (i.e. 10 feet below the point where groundwater was encountered) and/or the depth where fracture zones indicate sufficient yield, first using the rock coring method and then overboring utilizing the water rotary method and a 5-inch OD tri-cone roller bit or equivalent.
- Complete the open hole monitoring well with a protective locking stick-up or flushmount box installed in a concrete pad as per Section 6.1.
- If the borehole extends to a depth greater than 25 feet below the bottom of the surface casing (due to depth and/or yield of groundwater), construct the monitoring well using 10 feet of 2-inch diameter Schedule 40 PVC or Schedule 5 stainless steel wire wound screen (0.010-inch slot or a slot size appropriate to the formation) and 2-inch diameter Schedule 40 PVC or Schedule 5 stainless steel riser pipe. For non-flushmounted wells, at least 2 to 3 feet of riser pipe must extend above the ground surface. Flushmounted wells will only be installed in high traffic areas, such as roadways, sidewalks, etc.
- Backfill the annular space to a minimum height of 2 feet above the top of screen with a sand pack. The sand pack shall be Morie #1 silica sand or equivalent (based on Site-specific geologic conditions and screen slot size). The remaining annular space will be filled with bentonite/cement grout up to the ground surface. The ratio of cement to bentonite for grouting will be approximately 30 gallons of water to three 94-pound bags of cement to every 25 pounds of granular bentonite.
- Complete the constructed monitoring well as described with a protective locking stickup or flushmount box installed in a concrete pad as per Section 6.1.

Modification of the above installation procedure will be subject to changes in the field. All field-executed changes will be communicated to the NYSDEC for their discussion and approval, if appropriate.

Characteristics of each newly installed well will be recorded on the appropriate well construction diagram. Each well will be identified with a well number placed on the inside of the well cap and on the outside of the protective casing or outside flush-mount cover. Each separate source of potable water used for the drilling process will be sampled once for TCL/TAL compounds.

6.2 Monitoring Well Development

After a minimum of 24 hours after completion, the monitoring wells will be developed by one or a combination of the following techniques:

- Surging;
- Bailing;
- Using a centrifugal pump and dedicated polyethylene tubing;
- Positive displacement pumps and dedicated polyethylene tubing, and/or
- Other methods recommended by the field geologist and approved by the NM and NYSDEC Project Managers.

Development water will initially be monitored for organic vapors with a PID. In addition, the development water will be observed for the presence of non-aqueous phase liquids (NAPLs) or sheens. The development water will be contained in a tank and/or 55-gallon steel drums on-site. The purge water will be disposed of in accordance with NYSDEC requirements. The wells will be developed until the water in the well is reasonably free of visible sediment (<50 NTU if possible) or until pH, temperature and specific conductivity stabilize, assuming a minimum of 10 well volumes of water has been removed from the monitoring well during development. In no case will well development exceed 8 hours per well. Following development, wells will be allowed to recover for at least one week before groundwater is purged and sampled. All monitoring well development will be overseen by a field geologist and recorded in the field logbook.

6.3 In-Situ Hydraulic Conductivity Testing

In-situ hydraulic conductivity testing may be performed on selected monitoring wells as indicated in the Site-Specific Work Plan to obtain estimates of groundwater velocities and potential groundwater recovery rates for the aquifer. The objective of the hydrogeologic testing is to determine the hydraulic properties of the aquifer in the vicinity of the Site.

Slug tests may be conducted in selected monitoring wells utilizing the rising or falling head slug test technique. Rising head tests can be performed in unconfined and confined aquifers. Falling head tests should only be performed in confined aquifers. The slug tests will be performed by subjecting water-bearing units in the screened interval to a stress caused by the sudden displacement of the water level within the well. The rising head tests will be conducted as follows:

- Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 3.2.
- Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electric

sounder (water level indicator) and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.

- A weighted slug of known volume will be inserted gently into the well below the water table. The water level will be measured until the water level returns to static conditions.
- The slug will be suddenly withdrawn from the well and the water level recovery will be monitored at appropriate intervals until recovery is complete and stabilized.
- Wells, which were bailed dry during development, may not be able to provide meaningful data through slug tests. Tests will be terminated in wells which do not recover significantly (>80% of static level) within a certain amount time, at the discretion of the field geologist. These wells will be bailed dry and their recovery measured with an electronic water level indicator.

The falling head tests will be conducted as follows:

- Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 3.2.
- Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electronic sounder (water level indicator) and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
- A weighted slug of known volume will be quickly inserted into the well below the water table. The water level will be measured until the water level returns to static conditions.
- The test will be terminated in wells which do not recover significantly (>80% of static level) within an unspecified time, at the discretion of the field geologist.

The slug test data will be analyzed using the Cooper, Bredehoeft, and Papadopulos (1967) type curve method or the Bouwer and Rice (1976, 1989) method. The Cooper et al. analysis assumes that the well penetrates a confined aquifer, and the Bouwer and Rice method applies where unconfined conditions are prevalent.

6.4 Well Abandonment

Unconsolidated monitoring wells will be abandoned in the following manner:

- Remove the protective casing and concrete pad.
- Over drill the well casing using hollow-stem augers or casing to at least one foot below the depth of the boring/well as indicated in the soil boring log.
- Remove the well casing from the hole. If the casing cannot be removed while the augers are in place, cutoff the casing at least two feet, and if possible five feet, below the ground surface.

- Add cement/bentonite grout via tremie pipe from the bottom of the augers as the augers are withdrawn.
- If the well casing cannot be overdrilled and removed, the well casing will be filled with cement/bentonite grout from the bottom up using a tremie pipe. The grout mixture will be as specified for the well installation (see Section 6.1).
- Add grout to the point where the casing was cut off. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

Consolidated (bedrock) monitoring wells or open holes will be abandoned in the following manner:

- Remove the protective casing and concrete pad.
- Add cement/bentonite grout via tremie pipe from the bottom of the well up to the ground surface. The grout mixture will be as specified for the well installation (see Section 6.1).
- Add grout to the point where the casing was cut off. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

6.5 Packer Testing

Attachment A presents the packer test procedures to be used in the event the hydraulic conductivity of a discrete bedrock zone is required for the purpose of determining the well screen interval of bedrock wells. Down-hole packer equipment will be decontaminated following the procedures in the FSP (see Section 3.1) prior to use at each location and prior to demobilization.

7.0 TEST PIT EXCAVATIONS

When specified in the Site-Specific Work Plan, test pits will be excavated using a rubber-tired or track backhoe. In the event deep excavations are anticipated, a track hoe will be utilized. Locations of test pits, if proposed in the Site-Specific Work Plan, will be finalized in the field, based on the location of potential source areas and existing underground utilities. If the prospective test pit location is covered by asphalt or concrete, the area will be saw cut prior to excavation. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the Generic EHS Plan (Volume II). Test pit materials will be logged, as well as photographed for future reference. Material removed from the test pit will be placed on polyethylene sheeting. Should sampling of excavated material be performed, samples will be collected with a decontaminated or a new disposable sampling tool, or equivalent, from the center of the backhoe bucket. Upon completion, the materials from the test pit will be placed back in the excavation in the reverse order in which it was excavated. The location and size of the test pit will be measured and described in the field logbook.

Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils will be used to cover the impacted soils/source materials when placed back in the excavation. At a minimum, the top two feet of back filled soil will be visually clean. If the original (top) two feet of soil is impacted or some portion of it is impacted then the soil will be replaced and/or supplemented with certified clean fill. Test pits will be backfilled as soon as possible after completion and in general prior to the cessation of activities at the end of the day. The closure of individual test pits, prior to work cessation at the end of the day, will be performed on a case by case basis utilizing criteria for the maintenance of safe working and overall Site conditions. For gravel roadways and parking areas, the backfill will be tamped down in 18-inch lifts. A 6-inch layer of clean run-of-crush gravel will be tamped in-placed as the final lift. For test pits located in asphalt-covered areas, the surface will be replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Test pits located in grass covered areas will be returned to original grade and reseeded. Following restoration of the excavation, the test pit will be staked/marked to facilitate subsequent location by surveying crews.

7.1 Underground Utilities

Potential for encountering underground utilities is part of any subsurface investigation, where test pitting will be utilized as part of the investigation. When performing test pitting in areas of suspected live underground utilities the test pits will be advanced by hand digging to a depth of five (5) feet below ground surface to confirm the location of the live utility. If investigation of abandoned underground utilities is required, then the parameters of the investigation will be specified in the Site Specific Work Plan.

If an abandoned under ground pipe/structure, associated historically with the former MGP operations, is encountered during the test pitting operation, then excavation activity will cease until the pipe or underground structure can be adequately investigated. The investigation of the piping will include the description of the pipe/structure construction, material, condition, orientation, dimension, and contents of the pipe/structure, if possible. If the piping/structure interior can not be readily accessed then penetration of the underground utility may be necessary. Penetration of any underground utility should be conducted with the utmost care and consideration given for the utilization of proper tools (spark proof, beryllium coated, etc) for the task at hand. Once the interior of the pipe is accessible then a sample will be taken of the pipe contents, and sent to a laboratory for analysis.

If prior to initiation of test pitting activities, a live underground utility is identified in the area of anticipated test pitting, then the live underground line, if feasible, will be shut down. Consideration must be given to impacts to the facility operations prior to shutting down any active utility. (See the lockout tag out procedure section of the Generic HSP).

If during test pitting activities an unexpected live underground utility is encountered, excavation will cease, the orientation and dimensions of the underground utility will be recorded, and if possible, the live utility will be shielded from damage and test pitting will continue. If shielding is not possible then the test pit will be back filled and a new test pit attempted in the general vicinity of the initial location. When performing excavation activities next to a live underground utility, care will be taken not to undermine or impact the operation of the live underground utility. If a pipe or underground utility is accidentally severed, the owner of the utility, then NM, will immediately be notified. Liquid flows or electricity will be shut off immediately and appropriate repairs initiated as soon as possible. If a release of liquid occurs, the Consultant PM will notify NM who will then notify NYSDEC. All appropriate response actions will be implemented.

8.0 GROUNDWATER SAMPLING

The following is a step-by-step sampling procedure to be used to collect groundwater samples from the monitoring wells. Well sampling procedures will be recorded on the form shown in Figure 5. Sample management is detailed in the Generic QAPP (Volume II).

- Groundwater samples will not be collected until at minimum, one week following well development.
- Prior to sampling, measure the static water level from the surveyed well elevation mark on the top of the PVC or stainless steel casing with a decontaminated water level probe. The elevation of nearby surface water bodies will also be recorded using bulkheads, culverts, or other convenient structures as reference points in which the elevation is known. These relative measurements will be used to aid with interpreting the relationship between observed surface water and groundwater fluctuations. Record time, date, and measurement to nearest 0.01 foot and record in the field logbook.
- Decontaminate all field test equipment and meter probes prior to use on-site.
- Prior to collecting a round of groundwater elevations an oil/water interface probe will be used to determine the presence of LNAPL and DNAPL in the well.
- A round of groundwater elevations will be collected prior to the start of sample collection. The measurement at each well location will be made from the top of the PVC or stainless steel casing with a water level probe. The measurements will be made in as short a time frame as practical to minimize temporal fluctuations in hydraulic conditions.
- Place a plastic sheet on the ground to prevent contamination of the bailer rope and/or the tubing associated with the purging (pump) equipment.
- Purge the well by removing a minimum of 3 well volumes or at least one volume of saturated sand pack, whichever is greater or use the low flow sampling procedures below. Purging will be conducted with a teflon, stainless steel or disposable polyethylene bailer, or a centrifugal, submersible, peristaltic, or whale pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist, and with the prior approval of NM and NYSDEC. Purging of the well to stabilized parameters may be performed at between 100 to 500ml/min. If the well goes dry before the required volumes are removed, the well may be sampled when it recovers sufficiently.
- Collect volatile organic analyte (VOA) or BTEX samples with Teflon, stainless steel or dedicated polyethylene bailers lowered by a dedicated polypropylene and/or Teflon line or other methods as indicated. TCL SVOCs, PAHs, pesticide/PCBs, TAL metals, natural attenuation parameters, and other non-conventional parameters may be collected with Teflon, stainless steel, or dedicated polyethylene bailer or a submersible, or peristaltic pump using the low-flow sampling technique. Low flow well sampling will be at a rate less than or equal to 100ml/min.

Low-flow sampling procedures may be utilized to collect samples for metals analysis if sample turbidity is excessive. Low flow sampling will be performed according to USEPA (1998) guidance. The pump should be capable of throttling to a low flow rate suitable for sampling.

- Measure temperature, pH, turbidity, DO, and conductivity, at 5 to 10 minute intervals. When the parameters stabilize over 3 consecutive readings, sampling may commence. Record results in the field logbook prior to sample collection.
- Fill sample containers for VOCs or BTEX first. Sample containers for SVOCs and other analytes are then filled.
- After all samples are collected, dispose of polypropylene line and bailer, or other dedicated disposable sampling equipment.

9.0 SURFACE WATER SAMPLING

Surface water samples will be collected at the locations indicated in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). A decontaminated stainless steel or glass cup may be used to collect the water for these samples or the sample bottles may be directly dipped into the water. At no time will a sample jar, which contains preservative, be submerged in the sampling media. The sample should be collected from mid-depth by submersing the sampling device or sample container to a mid-depth position and opening the container and allowing it to fill. If this methodology does not work effectively then an alternative sampling device (i.e. bacon bomb etc) can be utilized. The stainless steel or glass cup will be decontaminated following the procedures outlined in Section 3.2. Surface water samples will be collected downstream first, and then progressing in an upstream direction. If sediment sampling is to be performed in conjunction with surface water sampling at corresponding locations, the surface water sample will be collected prior to the sediment sample.

Surface water flow measuring techniques will vary greatly based upon the existing field conditions. A discussion regarding the investigative techniques for collection of surface water flow measurements will be discussed in detail in the Site Specific Work Plan.

All Field data will be recorded in the logbook and on the sample log sheet (Figure 6).

10.0 SURFACE SOIL SAMPLING

Surface soil samples will be collected at the locations indicated in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). Samples will be collected using decontaminated stainless steel equipment or disposable sampling equipment. If the selected sampling location is in a vegetated area, the vegetation will be removed over a one square foot area prior to sample collection. The sample will be collected from within the top 2-inches of the exposed ground surface. Samples will be collected by hand digging into the soil with a pre-cleaned stainless steel trowel or a disposable sampling tool. All samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory. Sample containers for volatile organic analysis will be filled first. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated steel trowel or disposable scoop. This composite sample will be analyzed for all remaining parameters identified in the Site-Specific Work Plan.

All samples collected for analysis will be placed immediately into laboratory sample jars and properly stored in a cooler with ice to 4°C before transport to the laboratory.

Duplicate samples will be collected at the frequency detailed in the Generic QAPP by alternately filling two sets of sample containers. Composite samples may be required to obtain a sufficient soil volume.

In addition, surface soil samples will be described by including:

- Site;
- Location number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Soil type;
- Color;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

11.0 SUBSURFACE SOIL SAMPLING

11.1 Samples for Laboratory Analysis

Subsurface soil samples selected for laboratory analysis will be obtained from a standard 2-foot split-spoon or Geoprobe® samplers and placed in the appropriate containers provided by the laboratory. The soil samples will be collected from the 2-foot sampling interval (assuming full recovery) of the split-spoon. Additionally, the Geoprobe® methodology will utilize the standard 2-foot sampling interval. Sample containers for volatile organic analysis will be filled first. Samples for volatile analysis will be collected or biased toward the collection of that portion of the sample that exhibits the highest PID reading or as otherwise detailed in the Site-Specific Work Plan. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated stainless steel trowel or disposable scoop.

All samples collected for analysis will be placed immediately into sampling containers provided by the laboratory and properly stored on ice to 4°C before transport to the laboratory. Sample management is detailed in the Generic QAPP (Volume II). In addition, a geologist will be on-site during the drilling operations to fully describe each sample including:

- Soil type and sorting;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations.

Duplicate samples will be collected at the frequency detailed in the Generic QAPP by alternately filling two sets of sample containers.

11.2 Geotechnical Testing

When identified in the Site-Specific Work Plan, laboratory geotechnical testing will be performed on selected soil samples in accordance with appropriate ASTM standards. Geotechnical analysis will be performed on soil samples collected in Shelby tubes or in glass sampling containers including, but not limited to, the following tests: grain size and sieve analysis, total organic carbon, permeability, specific gravity, Atterberg Limits, porosity, moisture content, and bulk density.

12.0 SEDIMENT SAMPLING

Proposed sediment sampling locations are identified in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). Sample locations in surface waterways will be marked along the bank prior to sampling. For all sample locations, the distance from the waterline to the sample location will be measured and recorded in the field logbook. Sediment samples will be collected from the furthest downstream point, progressing toward the furthest upstream sampling location. Following the completion of sampling the sediment locations will be marked along the shoreline for subsequent location by a survey crew.

12.1 Shallow Sediment Samples

Shallow sediment samples collected in shallow water will be collected with a Wildco core sampler, clam shell, lexane tubes, hand auger, vibracore or split-spoon sampler. Where possible, rocks and vegetative material will be discarded, and care will be taken to retain fine materials, which tend to disperse when disturbed. Sampling personnel will stand downstream of the sampling point to minimize disturbance of the bottom sediments during collection. Equipment will be decontaminated between samples following procedures outlined in Section 3.2. Field data will be recorded on the field sampling records. Surface sediment samples will be collected from a depth interval of 0 to 6 inches (0 to 15 cm) using these same procedures as outlined above. Sediments, which are located near shore and are not submerged, will be collected with a decontaminated trowel or disposable sampling tool.

12.2 Deep Water Sediment Samples

Sediment sampling in deeper water and samples requiring retrieval from deeper depths will be obtained using a barge-mounted drilling system or similar watercraft. Either a tripod and cat-head assembly or a Vibracore system will be used on the barge to advance the sampling apparatus into the bottom sediments. The tripod and cat-head assembly will be equipped either with a five-foot long "California" split-spoon sampler or a standard 2-foot long split-spoon sampler for sample collection. Split spoon samplers can be fitted with a sediment sampling head or shoe to ensure adequate recovery of the sample. To keep the hole open for subsequent samples and to minimize cross-contamination, 3-inch spin casing will be advanced, with plug, into the sediment. The spin casing will be advanced in 2-foot increments prior to sampling. The sediment sampler will then be pushed ahead or below the base of the 3-inch spin casing. The spin casing will be pumped free of sediment after each sample is collected. When the casing is free of sediment, it will be advanced 2 additional feet in preparation for the next sample collection.

The Vibracore uses a vibrating motion to advance a barrel and flexible plastic liner to achieve sample collection. A “core catcher” retains the sediment sample upon retrieval. Samples will be obtained by cutting the plastic liner longitudinally using a knife, then the sediment samples will be placed in sampling jars, based on sampling interval compensating for compression.

Sediment samples will be visually classified for texture and screened for the evolution of organic vapors with a PID. Samples will be collected or biased toward the collection of that portion of the sample that exhibits the highest PID reading or as otherwise detailed in the Site-Specific Work Plan.

The sediment samples will be collected from the 2-foot sampling interval (assuming full recovery) of the split-spoon. Visible staining or contamination will be noted in the field logbook.

12.3 Sediment Probing

When identified in the Site Specific Work Plan, sediment probing will be utilized to evaluate the presence of NAPL in the stream bedding. The near-shore sediment probing will be performed on a Site by Site basis. In keeping with NYSDEC standard protocols requiring the observance of sheens on the adjacent water bodies during site investigations, with out disturbance by probing, will not be changed as a result of the implementation of a sediment probing investigation.

Implementation of a sediment probing investigation will involve the use of multiple sections of 3/8-inch to ½-inch threaded rod and associated threaded female couplings. The threaded rod will be pushed into the sediment at multiple locations in an attempt to disturb the near surface sediments as well as deeper sediments. Upon detection of any sheen a stake will be located along the shoreline to provide a marker for the subsequent location by a survey crew, if require by the Site specific Work Plan. Sediment probing can also be used to provide information on the depth of competent material below the soft surface sediments.

Personnel will stand downstream of the sampling point to minimize disturbance of the bottom sediments prior to utilizing the probe. Equipment will be decontaminated prior to use in the stream and post use, following procedures outlined in Section 3.2. Field data regarding the location, depth, odor, and description of the sheen will be recorded on the field logbook.

Sediment probing in deeper water and samples requiring retrieval from deeper depths will be obtained by utilizing a rowboat or similar watercraft.

13.0 AIR MONITORING

13.1 Ambient Air Monitoring

Air monitoring will be conducted with a photoionization detector (PID) and combustible gas indicator (CGI) during all drilling and intrusive activities. The PID will be used to monitor for organic vapors in the breathing zone, borehole, and along the Site's perimeter and to screen samples for analysis. The CGI measures the concentration of combustible gas or vapor in air, indicating the results as a percentage of the lower explosive limit (LEL) of the calibration gas. Action levels are identified in the Generic EHS Plan (Volume II).

PID and CGI readings will be recorded in the field logbook and on the soil-boring log during drilling activities. The PID and CGI are calibrated at least once each day and more frequently if needed with the manufacturer specified calibration gas. The detailed procedures for the PID and CGI operation and calibration are included in the Generic EHS Plan (Volume II).

13.2 Perimeter Air Sampling

Perimeter air sampling may be required during field activities at the Site. Air sampling may be required during test pit excavation and/or during soil excavation/removal associated with an IRM. The basis for such sampling will be outlined in the Site-Specific Work Plan.

Prior to the collection of air samples, air-sampling stations, commonly one (1) upgradient and two (2) downgradient will be set up at the Site perimeter. The location of these stations is based on daily wind direction during the field activities. A sample station would be setup so that the sample media (Summa canister, high volume sampler, whole air sampler or absorbent tube, etc.) would draw in air from approximately 2 to 4 feet above the ground surface. The sampling media would remain in place a maximum 24-hour period before it is shipped overnight to a laboratory for testing. Air samples are commonly analyzed for BTEX via Method TO-15 (summa canister using a whole air sampler) or TO-17 (using an absorbent tube) and PAHs via Method TO-13 (using a high volume sampler).

13.3 Building Interior Air Sampling for Volatile Organic Compounds (VOC)

When identified in the Site Specific Work Plan, building air sampling will be performed in the on-site buildings during follow up investigations. Interior air sample collection will be performed in the basement and on the first floor of buildings potentially impacted by on-site contaminants. Various collection techniques will be used based on the type of contamination anticipated and the requirements set forth in the USEPA ERT SOP # 1704, #2121, and # 2119. Interior air sampling will conform to NYSDOH indoor air sampling regulations and the off-site Laboratory will have the New York State Environmental Laboratory Approval Program (ELAP) certification.

The following procedure will be used for air sampling of VOCs, based on USEPA ERT SOP #1704:

I. *Subatmospheric Pressure Sampling Using a Fixed Orifice, Capillary, or Adjustable Micrometering Valve*

- Complete the appropriate information on the Canister Sampling Data Field Sheet.
- A canister, which is evacuated to 0.05 mm Hg and fitted with a flow restricting device, is opened to the atmosphere which contains the VOCs for sampling. The pressure differential causes the sample to flow into the canister.
- This technique can be used to collect grab samples having a duration of 10 to 30 seconds or time-integrated samples having a duration of 12 to 24 hours. The sampling duration is depends on the degree to which the flow is restricted.
- As the pressure approaches atmospheric pressure, a critical orifice flow regulator will cause a decrease in the flow rate.
- Record data on an appropriate data sheet and/or in the field logbook.

The following procedure will be used for air sampling of VOCs, and is based on USEPA ERT SOP #1704:

II. *Subatmospheric Pressure Sampling or Pressurized Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Andersen Sampler Model 87-100)*

- Complete the appropriate information on the Canister Sampling Data Field Sheet.
- Open a canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, to the atmosphere, which contains the VOCs for sampling.
- A whole air sample will be drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly. A small portion of this whole air sample is drawn from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.
- The initially evacuated canister is filled by the action of the flow controlled pump to near atmospheric pressure (subatmosphereic pressure sampling) or a positive pressure not to exceed 25 psig (pressurized sampling).
- A digital time program is used to pre-select sample duration and start and stop times.
- Record data on an appropriate data sheet and/or in the field logbook.

The following procedure will be used for air sampling of SVOCs and/or pesticides/PCBs, and is based on USEPA ERT SOP #2121:

- Using a calibrated sampler, place the sampler in the desired location. The polyurethane foam (PUF) sampler should be in the breathing zone in order to prevent elevated results. It should be located in an unobstructed area, at a distance of twice the height of any obstruction to air flow but no closer than two meters to the obstacle.

- Assemble the sampling system by attaching the legs and magnehelic panel to the platform. Connect the motor to the platform, making sure that the gasket is placed between the motor and the platform. Plug the motor into the timer located on the magnehelic panel. Connect the magnehelic to the venturi with tubing. Adjust the exhaust hose to face downwind of the sampler.
- Put on clean surgical gloves.
- Place the loaded sampling module into the quick release fitting and engage by locking the two levers down securely. Remove the metal cover.
- Record the pump number, location, sample start time, time/counter at the start, and other pertinent information on an appropriate data sheet and/or in the field logbook.
- Plug in the unit. If necessary, adjust the magnehelic gauge by turning the ball valve in order to achieve the reading required to reach the target flow rate. Wait approximately two minutes for the magnehelic reading to stabilize.
- Allow the sampling system to operate for the predetermined duration. If the sampling system is in use for more than 24 hours, the initial calibration should be audited every 24 hours. If the resultant value for the check is +/- 7 percent of the initial calibration, the sampling system must be recalibrated.

The following procedure will be used for air sampling of metals, and is based on USEPA ERT SOP #2119:

- Record the actual flow rate. Insert Assemble the sampling trains with clean filter cassettes. Verify the pump calibration by removing the inlet plug from the cassette, attaching a rotameter with Tygon tubing and turning on the sampling pump. Check to make sure all the connections are tight.
- Record the actual flow rate on an appropriate data sheet and/or in the field logbook. Replace the inlet plug until ready to sample.
- Set the sampling pump timer (low volume pumps) for the predetermined sampling time, or record the elapsed timer on the data sheet/logbook. This will be determined based on the type of pump being used.
- Deploy sampling pumps at sampling locations. Remove the cassette cap or inlet plug from the cassette. Sampling for elements can be conducted with the cassettes open-faced (cassette cap removed) or closed-faced (only inlet port plug removed). Open-faced is preferred because it allows even loading of the filter cassette and should be used whenever high particulate concentrations are expected in order to allow greater particulate loading of the filter. Closed-faced sampling is performed when there is a possibility that the sample may be shaken and particulates may be lost.
- Turn on the sampling pump and let it run for the predetermined sampling period.
- After the sampling period is over, verify the sampling period by reading the sample run time (low volume pumps) or by checking the elapsed time on the counter

(medium volume pumps). Record the length of sampling time on the data sheet and/or in the field logbook. Turn off the pump.

- Verify the pump calibration by attaching a rotameter with Tygon tubing and turning on the sampling the inlet plug.
- Remove the sampling cassette from the sampling train and insert the outlet plug. Calculate sample volume.

14.0 GEOPHYSICAL AND SOIL GAS SURVEYS

When specified in the Site Specific Work Plan, geophysical and soil gas surveys will be carried out at the site with the primary objective being to delineate areas of possible subsurface impacts from former MGP operations. Delineation of impacted areas will allow for a more focused and efficient sampling program during subsequent phases. Sampling locations may be located downgradient of potential historical MGP operations areas to determine if these areas act as contaminant sources. Also, boring locations can be adjusted to avoid large subsurface metallic bodies, thereby minimizing the potential for release of hazardous material from buried containers, and avoiding the expense associated with multiple boring attempts due to subsurface refusal. Furthermore, additional valuable subsurface information may be derived from this study, including:

- Delineation of underground structures(i.e. holder, and tar well);
- Mapping of existing site utilities and former MGP utilities; and,
- Detection of underground storage tanks (USTs) and/or other potential contaminant source areas.

If potential historical MGP operations areas prove to act as contaminant sources, the results of the geophysical investigation may also provide important information necessary for an Interim Removal action.

14.1 Geophysical Survey GPR and TDEMI

Two geophysical methods can be used for the geophysical survey: Time-domain Electromagnetic Induction (TDEMI) and ground penetrating radar (GPR). TDEMI can detect ferrous and non-ferrous metallic objects, such as a single 55-gallon drum, at a depth of up to 3 m (10 ft) bgs; GPR can detect both metallic and non-metallic subsurface targets at depths varying from several centimeters up to 20 m (65 ft bgs) or more, dependent upon frequency of induced waves, soil conductivity, and presence of extremely reflective interfaces. GPR can also be utilized to locate void spaces, detect disturbed soil or differential fill, and map Site Stratigraphy.

The TDEMI system utilized at the site will be the Geonics EM61 High Sensitivity Metal Detector or similar equipment. The EM61 is a one-person portable system designed primarily for industrial site assessment. The EM61 is relatively insensitive to nearby surface cultural interferences such as buildings, powerlines, and fences, and has the ability to record digital data at 0.17 second intervals, which translates to a spatial sample density of approximately 0.17 m (0.55 ft) along the ground surface.

The GPR system utilized at the site will be the Geophysical Survey Systems, Inc. (GSSI) SIR-2, or equivalent and will be equipped with both 200 and 500 MHZ antennas. The GSSI SIR-2 is a monostatic GPR system, in which a single antenna is used as the transmitter and receiver. The antennas are shielded to ensure a high proportion of the energy produced is focused into the subsurface, decreasing noise from surrounding fences, buildings, and other features. The GPR reflection section is displayed in real time as data is acquired, and an analog record is output by an in-the-field printer. Data is also digitally logged to a high-capacity drive at a rate of 32 scans/second, which translates to a spatial sample density of approximately 0.03 m (0.1 ft) along the ground surface.

Geophysical Survey Ground Penetrating Radar (GPR) and Time-Domain Electromagnetic Induction (TDEMI)

The geophysical investigation will encompass all areas suspected of former MGP operations. The survey area will be run over both paved and vegetative cover and will be divided into four (4) subplots ranging in size from 0.2 to 0.5 acres. The EM61 data will be acquired using a Leica system 530 Global Positioning System (GPS), or equivalent equipment, for navigational control. GPS data will be captured in one second intervals, utilizing the real-time kinematic (RTK) mode, which provides centimeter-grade positional accuracy. GPR data will be acquired along a pre-established orthogonal grid system, with line and station spacing appropriate for detection of targets of interest.

Concurrent with geophysical data acquisition, cultural features maps will be developed which will detail the location of potential interferences such as buildings, fences, utilities, etc. These maps will be utilized in the interpretation stage to more accurately assess the significance of geophysical anomalies observed in the data.

TDEMI data will be processed and interpreted using manufacturer-supplied software. TDEMI data will be interpolated to accurate State Name Planar coordinates with appropriate shifts and filters applied, and data extrapolated to a regularly spaced grid system using accepted mathematical methods. These data will then be displayed as high-resolution color maps. Proprietary software will then be utilized to isolate and characterize subsurface anomalies potentially related to steel structures or buried drums.

GPR data will be processed and interpreted using WINRAD and/or GRADIX software packages or equivalent. Processing may include “rubber sheeting” of data to appropriate coordinates, application of appropriate gains and filters, display of color-coded GPR sections, and advanced processing techniques, such as migration and deconvolution. Diffraction hyperbolas or other discrete anomalies will be identified and characterized and compared with locations of EM61 anomalies. GPR anomalies, which occur in areas free of EM61 anomalies can be attributed to non-metallic targets, and may be associated with plastic barrels.

A final report including description of data collected, maps of the geophysical data, and interpretation of these data will be included in the Final Report.

Geophysical Survey [Ground Penetrating Radar (GPR) and Time-Domain Electromagnetic Induction (TDEMI) Procedure

The geophysical survey will be conducted using the following procedure:

1. Clear the surface of the area to be surveyed (performed by clearing and grubbing subcontractor). This may include cutting underbrush to a height less than 0.3m (1 foot), removing trees less than 7.5 cm (3 inches) in diameter, removing brush, and mowing grasses greater than 0.6m (2 feet) in height. A sweep for metal objects on the ground surface will be conducted, and surficial metal identified will be noted and removed from the area of investigation.

2. Establish survey control within the investigation area. Survey markers will be installed both within and around the boundary of the survey area, and these points will be utilized to establish and calibrate the GPS base station.

3. Acquire data from each instrument from a test line prior to commencement of each day's activities. This test line will be performed over a known subsurface object or over a pre-placed object (such as a steel pipe).

4. Obtain GPS reading at a known survey point.

5. Begin survey at the southwest corner of the investigation area (or a subdivision of the investigation area) and progress northward (or eastward) until the area boundary or a major obstruction is encountered. TDEMI data will be acquired at a sampling rate of approximately 6 samples per second, which translates to a sample density of 1 sample every 0.17 meters (0.55 feet) based on an average walking pace. GPS data will be acquired concurrently with TDEMI data, at a rate of [1 sample] per second. GPR readings will be acquired at a sampling rate of approximately 32 scans per second, which translates to a sample density of 1 sample every 0.03 meters (0.1 feet) based on an average walking pace.

6. After reaching the grid boundary or obstruction, reverse direction, and acquire survey data in the opposite direction along a parallel line at the following line spacing**:** 1 meter (3 ft) for TDEMI readings and 2-meters (6 ft) for GPR readings.

7. Continue acquiring data in opposing directions, until the entire investigation area has been covered.

8. Acquire several lines of TDEMI data over a known linear metallic object placed upon the ground surface. This procedure will allow for accurate time shifting of geophysical data necessary for merging the geophysical and GPS data.

9. Acquire data from the test line subsequent to each day's activities, for quality assurance comparison.

10. Obtain GPS reading at known survey point for QA comparison.

14.2 Geophysical Survey Magnetometer and FDEMI

A geophysical investigation to delineate areas of possible subsurface impacts can be performed by utilizing two geophysical methods: magnetometry and frequency-domain electromagnetic induction (FDEMI).

Geophysical data will be collected using two instruments: a Geometrics G-858G magnetometer (configured as a vertical gradiometer and including a continuous-recording base station) and a Geonics EM31-MK2 ground conductivity meter or equivalent equipment. Positional data will be verified by utilizing a Leica System 530 GPS system, or equivalent, for navigational control. GPS data will be captured at one second intervals, utilizing the real-time kinematic (RTK) mode, which provides centimeter-grad positional accuracy**.**

<u>Geophysical Survey Magnetometry and Frequency-Domain Electromagnetic Induction (FDEMI) Procedure</u>

The geophysical survey will be conducted using the following data collection procedure:

1. Clear the surface of the area to be surveyed (performed by clearing and grubbing subcontractor). This may include cutting underbrush to a height less than 1 foot, removing trees less than 3 inches in diameter, removing brush, and mowing grasses greater than 2 feet in height. A sweep for metal objects on the ground surface will be conducted, and surficial metal identified will be noted and removed from the area of investigation.

2. Establish survey control within the investigation area. Survey markers will be installed both within and around the boundary of the survey area, and these points will be utilized to establish positional control, as well as calibrate the GPS base station.

3. Acquire data from a test line prior to commencement of each day's activities. This test line will be performed over a known subsurface object or over a pre-placed object (such as a steel pipe).

4. Set up magnetometer base station.

5. Begin survey at the southwest corner of the investigation area (or a subdivision of the investigation area) and progress northward (or eastward) until the area boundary or a major obstruction is encountered. Magnetometry data will be acquired at a sampling rate of approximately 10 samples per second, which translates to a sample density of 1 sample every 0.1 meters (0.33 feet) based on an average walking pace. FDEMI conductivity readings will be acquired at a sampling rate of approximately 2.5 samples per second, which translates to a sample density of 1 sample every 0.4 meters (1.3 feet) based on an average walking pace. GPS data will be acquired concurrently with geophysical data, at a rate of 1 sample per second.

6. After reaching the boundary or obstruction, reverse direction, and acquire survey data in the opposite direction along a parallel line at the following line spacing: 1 meter for magnetometer readings and 2 meters for conductivity readings.

7. Continue acquiring data in opposing directions, until the entire investigation area has been covered.

8. Acquire several lines of geophysical data for a known linear metallic object placed upon the ground surface. This procedure will allow for accurate time shifting of geophysical data necessary for merging the geophysical and GPS data.

9. Repeatedly (at least 3 times per day) revisit a calibration station and collect data with the EM31, in order to provide for an instrument drift correction.

10. Acquire data from the test line subsequent to each day's activities, for quality assurance comparison.

The geophysical data will be processed and interpreted using manufacturer-supplied software. Data will be interpolated to NYS State Plane coordinates, filtered as appropriate, extrapolated to a grid system, and displayed on maps of the Site.

14.3 Downhole Geophysics

Downhole gamma-ray geophysical logging, if required in the Site Specific Work Plan, will be conducted by a utilizing existing wells or soil borings as they are completed. Gamma-ray logging may be conducted in cased as well as uncased boreholes, and, because clays typically contain a higher percentage of gamma emitting minerals, can be useful for identification and correlation of clayey zones. The gamma-ray log can provide information on stratigraphic changes in the subsurface soils.

1. Be certain that the well has ample clearance for the gamma probe to pass without obstruction or binding. A dummy cylinder with the same diameter as the gamma log tool may be lowered downhole as a test for obstructions. Downhole may be performed if significant uncertainty exists. Wear appropriate health and safety equipment.

2. Set the tripod over the wellhead and park the mobile unit at a convenient location.

3. Slowly and carefully lower the probe to the bottom of the well with the logger recording the counts per second (cps) of gamma radiation. The descent is a "dry" run until the well bottom is attained.

4. Set the plotter so the gamma-ray logging is recorded on a graph. Set the upward speed at a constant rate. Bring the probe to the surface.

5. If the graph is successfully plotted, perform appropriate decontamination on the probe and the line and proceed to the next logging location.

14.4 Soil Gas Survey

A soil gas survey, if required by the Site Specific Work Plan, will be performed around the Site to delineate areas of possible subsurface impacts and potential source areas. A sampling grid of approximately 100 feet by 100 feet or depending on the size of the investigation area, will be utilized across a majority of the Site, with soil gas samples collected at the grid nodes. Additional soil gas samples will be collected at 25 foot by 25 foot grid nodes in the vicinity of the potential test pit locations, at 50 foot by 50 foot grid nodes around the east-northeast Site buildings, and at any other additional areas determined during the field investigation (e.g., elevated levels present during real-time sampling, etc.). Actual sampling locations will be adjusted in the field to ensure sample targeting of all suspected areas of subsurface impacts. A field gas chromatograph (GC) will be used to determine sample screening concentrations of volatile organic compounds (VOCs). Water table, barometric, and temperature changes can vary the results.

The FOL or his designee, will be present on-site during active soil gas collection activities. The following soil gas survey activities will occur:

- Location of the soil gas survey locations;
- Comparison of the field GC data with applicable quality assurance data to determine acceptability of results;
- Determination of the need for additional or a reduction in the number of soil gas survey points;
- Supervision of the topographic surveying to locate the sampling points;
- Review of the data analysis and evaluation from the soil gas survey report; and
- Recommendation for movement of the proposed field investigation sampling locations based on the soil gas survey results.

Soil Gas Survey Procedure

1. Record ambient air temperature and barometric pressure.

2. Drill a hole into the soil either by hand auger, rotary hammer, or driven rod (as conditions dictate), to roughly 4 to 5 feet in depth. The depth may be reduced based upon conditions at the Site at the time of sampling; all changes will be noted on Field Change Requests (see Section 13.0 of the QAPP).

3. Insert a probe, slightly smaller in diameter than the borehole, into the hole, and the hole will be sealed by packing soil around the expansion bulb at the probe top. The probe assembly will be selected by the soil gas crew and FOL, to provide the best probe assembly for the Site conditions. A typical assembly would consist of a 1/4-inch O.D. stainless steel probe, approximately 5-feet in length, and Teflon tubing, with a reducing tee and cap attached to the fitting.

4. Ensure/test vacuum with a gauge attached to the probe.

5. Extract soil gas through the probe via a vacuum pump connected to the tubing. Purge approximately 3 to 5 sample volumes prior to sampling to remove any introduced ambient contamination.

6. Remove the soil gas sample with a 500 uL gas-tight syringe or equivalent device, inserted into the tubing in front of the pump. This volume is adequate for achieving the required detection limit of 25 ug/L. If necessary, due to field conditions, the sample can be stored in a pressurized container.

7. Immediately inject the sample into the calibrated GC (see Step 8), and plot the chromatogram. Identify and quantify, based on standard peaks, any contaminants present in the soil gas sample.

8. Calibrate the GC prior to sample analysis. Initial instrument calibration should consist of a minimum of 3 concentration points (5 points are preferred), to demonstrate the working range and linearity. Linearity will be assumed if the ratio of the area response to the amount injected is constant over the working range (i.e., less than 20 percent Relative Standard Deviation). In addition, an initial verification of a less than 25 ug/L detection limit shall be run.

9. Check the sample probe for contamination between each sample location, by drawing ambient air through the probe via the pump, and checking that the response is not greater than background levels. If necessary, decontaminate the probes using methanol and deionized water, and then air drying.

Calibration standards will be run at the beginning and end of each sampling day, and a method blank shall be analyzed every 12 hours and after any highly contaminated samples to check for carry-over. In addition, an environmental field duplicate will be chosen and analyzed every 20 samples.

15.0 FIELD INSTRUMENTS

All field analytical equipment will be calibrated immediately prior to each day's use and more frequently if required. A calibration log will be created on which all equipment calibration will be recorded. Further details on calibration, precision, accuracy, etc. are provided in the Generic QAPP (Volume II). The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. If an equipment malfunction is identified during calibration then the malfunctioning equipment will be within 24-hours or applicable fieldwork will be terminated as necessary until the malfunctioning equipment is repaired or replaced. Records of all instrument calibration will be maintained by the Field Operations Leader (FOL) and will be subject to audit by the Project Quality Assurance Manager (PQAM). Copies of all of the instrument manuals will be maintained on-site by the FOL.

15.1 Portable Photoionization Detector

The photoionization detector (PID) will be equipped with a minimum 10.6 eV lamp. The PID should be capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the NYSDEC ASP Target Compound List. Calibration will be performed at the beginning and end of each day of use with a standard calibration gas specified by the manufacturer. If the unit experiences abnormal perturbation or erratic readings, additional calibration will be required. All calibration data will be recorded in field logbooks and on calibration log sheets to be maintained on-site by the FOL.

A battery check will be completed at the beginning and end of each working day. If erratic readings are experienced, the battery will be checked for proper voltage. This information will also be recorded in field logbooks and on the calibration log sheets.

15.2 pH Meter

Calibration of the pH meter will be performed at the start of each day of use, and after very high or very low readings. National Institute of Standards and Technology - traceable standard buffer solutions, which bracket the expected pH range, will be used. The standards will most likely be pH of 7.0 and 10.0 standard units. The use of the pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The pH meter readings during calibration must be within 0.1 of the reference solution. The calibration data will be recorded on calibration sheets maintained on-site by the FOL.

15.3 Specific Conductivity Meter

Calibration checks using the conductivity standard will be performed at the start of each day of use, after five to ten readings or after very high or low readings. The portable conductivity meter will be calibrated on a daily basis using a reference solution specified by the manufacturer. Readings must be within 5 percent to be acceptable. The thermometer of the meter will be calibrated against the field laboratory thermometer on a weekly basis.

15.4 Turbidity Meter

Calibration using a turbidity standard will be performed at the start of each day of use and after very high or low readings. The portable turbidity meter will be calibrated using a reference solution specified by the manufacturer. The turbidity reading must be within ±2 NTU of the standard to be acceptable.

15.5 DO Meter

Calibration using a DO standard will be performed at the start of each day of use. The portable DO meter will be calibrated using a calibration solution specified by the manufacturer. The DO reading must be within 5% of the standard to be acceptable.

15.6 Combustible Gas Indicator

Calibration of the CGI will conform to the procedures prescribed in the Generic Environmental Health and Safety Plan (Volume II). Calibration will occur at the start of each day of use. The CGI

16.0 MANAGEMENT OF INVESTIGATION DERIVED WASTE

During the implementation of field activities, investigation derived wastes (IDW) will be generated at the Site. These IDWs will include the following: soil drilling mud/water, development and purge water, decontamination wash water, PPE, polysheeting, spent decontamination fluids, etc. Following the generation of these IDWs, they will be properly containerized in 55-gallon drums, frac tanks, agricultural poly tanks, and/or roll-off containers. PPE will be bagged and placed in 55-gallon drums. The containers will be properly labeled with the date of generation, the Site name, client name and address, contents of the containers, etc. Upon generation the IDW will be immediately containerized. The containers will be secured at the end of each day at the Site. The containers will be segregated on-site in a temporary fenced area and signs stating "Do Not Enter" will be posted on the fencing. Upon completion of the field activities, the containers will be sampled for disposal characteristics. IDW materials will be will be removed from the Site within 90 days of generation. Waste handling procedures and regulations will be strictly adhered to during all phases of waste handling.

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TABLES

Table 1
METHOD FOR IDENTIFYING AND LABELING SAMPLES

LLLL*	LL*	NN*	NN/NNNN*
Site	Sample Type	Sample Location	Depth/Time

Site :

Sample Type: Monitoring Well (MW), Surface Soil (SS), Subsurface Soil (SB), Sediment (SD), Surface Water (SW), Waste Water (WW), Solid Waste (WA)

Sample Number: Number referenced to a sample location map illustrated in the Site-Specific Work Plan.

* L = Letter
* N = Number

FIGURES

Figure 1

	LOG OF BORING (Page 1 of 1)

PROJECT: PROJECT NO.: LOCATION:	DATE STARTED: : DATE COMPLETED: : GEOLOGIST: : DRILLER: : DRILLING METHOD: :	GW DEPTH: : ELEVATION: :

Depth in feet	RECOVERY	USCS	GRAPHIC	DESCRIPTION	TIME	DATE	PID (ppm)	Sample I.D.	COMMENTS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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Notes:

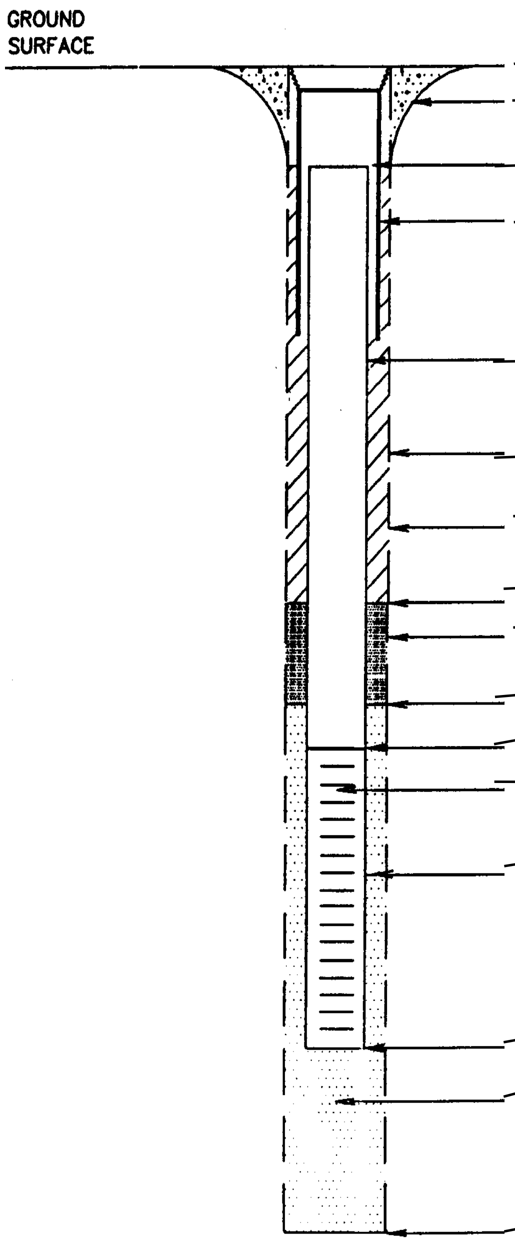
10-18-2001 P:\Front Street\Boring Logs\Blank BOR

Figure 2

UNCONSOLIDATED
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ____________

PROJECT ____________	DRILLER ____________
PROJECT NO. ____________	DRILLING METHOD ____________
DATE ____________ BORING NO.: ____________	DEVELOPMENT METHOD ____________
ELEVATION ____________	
LOGGED BY: ____________	



ELEVATION OF TOP OF SURFACE CASING: ________
TYPE OF SURFACE SEAL: ____________
GROUND SURFACE ELEVATION: ________
ELEVATION OF TOP OF RISER: ________

I.D. OF SURFACE CASING: ____________
TYPE OF SURFACE CASING: ____________
____

RISER PIPE I.D. ____________
TYPE OF RISER PIPE: ____________

BOREHOLE DIAMETER: ____________

TYPE OF BACKFILL: ____________
____

ELEVATION/DEPTH TOP OF SEAL: ________
TYPE OF SEAL: ____________
____

ELEVATION/DEPTH TOP OF SAND PACK: ________
ELEVATION/DEPTH TOP OF SCREEN: ________

TYPE OF SCREEN: ____________
SLOT SIZE X LENGTH: ____________
TYPE OF SAND PACK: ____________
____

ELEVATION/DEPTH BOTTOM OF SCREEN: ________

ELEVATION/DEPTH BOTTOM OF SAND PACK: ________
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____________
____

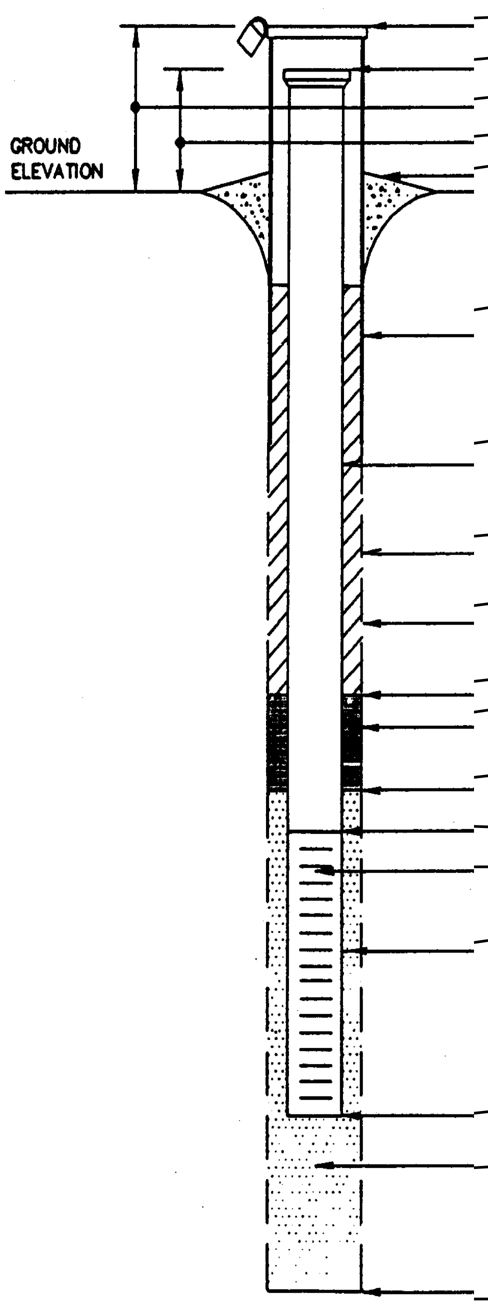
ELEVATION/DEPTH OF HOLE:

Figure 3

OVERBURDEN
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ____________

PROJECT ____________	DRILLER ____________
PROJECT NO. ____________	DRILLING METHOD ____________
DATE ____________ BORING NO.: ____________	DEVELOPMENT METHOD ____________
ELEVATION ____________	
FIELD GEOLOGIST ____________	



ELEVATION OF TOP OF SURFACE CASING: ________

ELEVATION OF TOP OF RISER PIPE: ________

STICK-UP TOP OF SURFACE CASING: ________

STICK-UP RISER PIPE: ________

TYPE OF SURFACE SEAL: ________

I.D. OF SURFACE CASING: ________

TYPE OF SURFACE CASING: ________

RISER PIPE I.D. ________

TYPE OF RISER PIPE: ________

BOREHOLE DIAMETER: ________

TYPE OF BACKFILL: ________

ELEVATION/DEPTH TOP OF SEAL: ________

TYPE OF SEAL: ________

DEPTH TOP OF SAND PACK: ________

ELEVATION/DEPTH TOP OF SCREEN: ________

TYPE OF SCREEN: ________

SLOT SIZE X LENGTH: ________

TYPE OF SAND PACK: ________

ELEVATION/DEPTH BOTTOM OF SCREEN: ________

ELEVATION/DEPTH BOTTOM OF SAND PACK: ________

TYPE OF BACKFILL BELOW OBSERVATION WELL: ________

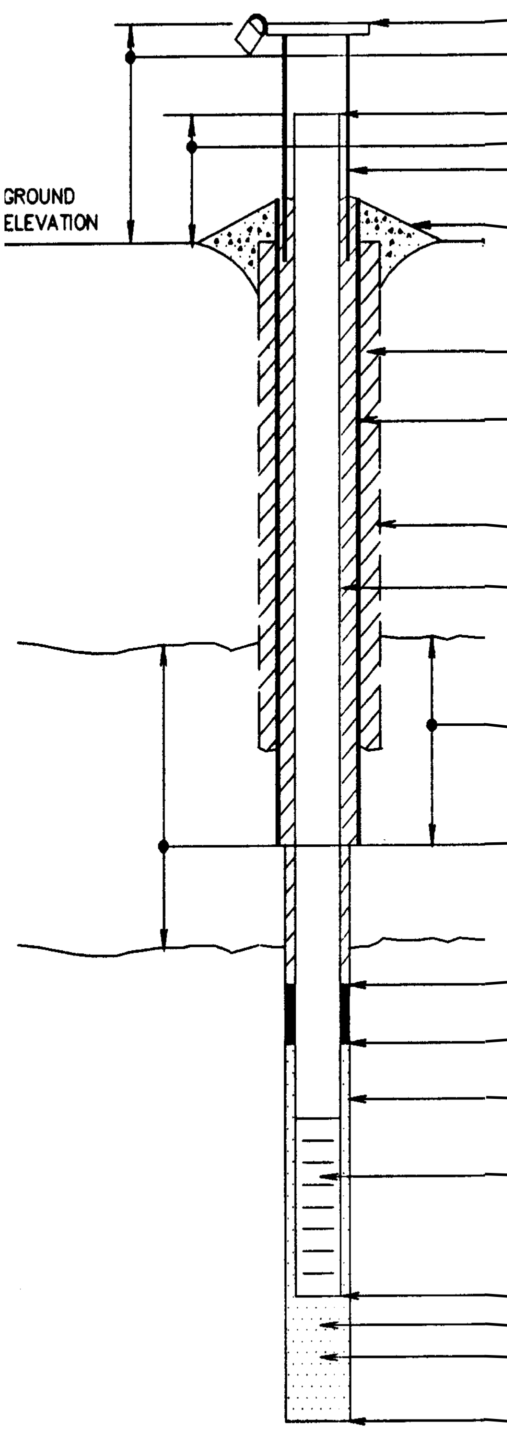
ELEVATION/DEPTH OF HOLE: ________

NOT TO SCALE

DOUBLE CASED
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ______________

PROJECT ______	DRILLER ______
PROJECT NO. ______	DRILLING METHOD ______
DATE ______ BORING NO.: ______	DEVELOPMENT METHOD ______
ELEVATION ______	
FIELD GEOLOGIST ______	



ELEVATION OF TOP OF CASING: ______

STICK-UP OF CASING ABOVE GROUND SURFACE ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK-UP RISER PIPE: ______

I.D. OF SURFACE CASING: ______

TYPE OF SURFACE CASING: ______

TYPE OF SURFACE SEAL: ______

TYPE OF BACKFILL: ______

I.D. OF UPPER AQUIFER CASING: ______

TYPE OF UPPER AQUIFER CASING: ______

BOREHOLE DIAMETER/DEPTH: ______

I.D.OF RISER: ______

TYPE OF RISER: ______

DEPTH CASING IS SET IN CONFINING LAYER: ______

APPROXIMATE THICKNESS OF CONFINING LAYER: ______

ELEVATION/DEPTH TOP OF SEAL: ______

TYPE OF SEAL: ______

DEPTH TOP OF SAND PACK: ______

TYPE OF SAND PACK: ______

BOREHOLE DIAMETER: ______

TYPE OF SCREEN: ______

SLOT SIZE X LENGTH: ______

I.D. OF SCREEN: ______

ELEVATION/DEPTH BOTTOM OF SCREEN: ______

ELEVATION/DEPTH BOTTOM OF SAND PACK: ______

TYPE OF BACKFILL BELOW OBSERVATION WELL: ______

ELEVATION/DEPTH OF HOLE: ______

NOT TO SCALE

Figure 5

WELL PURGE DATA SHEET

PROJECT NAME: ______________________________
PROJECT No.: ______________________________
DATE: ______________________________

Well I.D.: ____________________

Casing Volume

Well Diameter (d) = __________ ft

Well Radius (r_w) = __________ ft

Well Depth (TD) = __________ ft

Static Water Level (WL)= ___________ ft

Filter Pack Volume

Borehole Diameter (d_b) = ____________ ft

Borehole Radius (r_b) = ______________ ft

Depth to Top of Filter Pack (D_f) = ______ ft

P = estimated porosity of filter pack

Height of Water in Well (T):

T = TD (ft) - WL (ft)
T = ________ - ________
T = ________ ft

Height of Water in Filter Pack (T_F)

T_F = TD - WL[1](or TFP[2])
T_F = _________ - _________
T_F = _________ ft

Gallons of Water per Well Volume (Casing):

$V_C = 0.163 \times T(ft) \times r_w(in)^2$
$V_C = 0.163 \times$ ___ x ___ ^{2}
V_C = ______ gallons

Gallons of Water per Filter Pack Volume

$V_F = (0.163 \times r_b^2 - 0.163 \times r_w^2) \times T_F \times P$

$$\mathbf{V_T = V_C + V_F}$$

Total Volume Purged: **Design = ________ gallons**
Actual = ________ gallons

Water Quality:

	pH (SU)	Spec. Conduct (umhos/cm)	Temp. (°C)	Eh (mV)	D.O. (ml/L)
Initial	____________	____________	____________	____________	____________
Volume 1	____________	____________	____________	____________	____________
Volume 2	____________	____________	____________	____________	____________
Volume 3	____________	____________	____________	____________	____________
Volume 4	____________	____________	____________	____________	____________
Volume 5	____________	____________	____________	____________	____________

Purge Method: ____ Suction Pump ____ Submersible Pump ____ Bailer ____ Other____________

Notes/Observations: ____
____
____

Sampler(s) Present: ____

1. From Top of Inner Casing
2. Top of Filter Pack - used if entire filter pack saturated

Figure 6

SAMPLE LOG SHEET

I. SAMPLE IDENTIFICATION

Project: ______________________________ Project No.:
Client: ______________________________ Project Manager: ________________
Sample Name/Number: ________________ Date: ________ Time: ______ Hrs
Sampling Location/Depth: ________________ Type: _____ Grab _____ Composite
Sample Matrix: _______ Surface Water ________ Groundwater _______ Sediment
_______ Soil ________ Waste
_______ Other (Specify) ________________________________

Sampled By: ____

II. SAMPLE SOURCE

_______ Well _______ Outfall _______ Leachate
_______ Drum _______ Boring _______ River/Stream
_______ Bldg/Structures _______ Tank _______ Impoundment
_______ Test Pit/Trench _______ Other (Specify) ________________

Source Description ____
____

III. FIELD OBSERVATIONS/MEASUREMENTS

Appearance/Color: ____
Volatile Organic Analysis (VOA): ______ HNU ______ OVA ______ Other
VOA Readings: Off Sample ____________ Respiratory Zone ____________
$LEL/O_2/H_2S$ Readings: LEL ________ O_2 ________ H_2S ________
Radioactivity (mR/hr): ____
pH: ____________ Conductivity: ______________ Temperature: ______________
Salinity: ______________ Other: ______________________
Observations: ____

IV. SAMPLE DISPOSITION

Preservation: ____
Laboratory Name: ____
Laboratory Location: ________ On-Site ________ Off-Site
Forwarded to Laboratory: Date: __________ Time: __________ Hrs
Laboratory Sample No.: ____
Chain of Custody No.: ________________ Airbill No.: ________________

V. ADDITIONAL REMARKS

ATTACHMENTS

ATTACHMENT A

ATTACHMENT B

PACKER TEST PROCEDURES

I. Introduction

Packer testing is a method used to estimate the hydraulic conductivity of discrete bedrock zones within an open-bedrock corehole or open-bedrock well/piezometer. A packer test involves tightly sealing off a selected interval in the bedrock hole, pumping clean water into the test interval under a specified head for a specified duration, and recording the volume of water pumped into the formation during the test duration. To allow interpretation of the flow characteristics (e.g., laminar or turbulent), the rock fracture response (e.g., dilation, washout, or void filling) and the representative conductivity value for the tested bedrock interval, five test increments are performed at three different head conditions. The hydraulic conductivity is calculated based on the observed test pumping rates, the total applied head values, the geometry of the tested interval, and the pattern of pumping rates achieved during each of the five test increments.

The following presents methods for both single and double packer testing.

II. Materials

The equipment used for packer testing consists of two assemblies:

(1) A packer apparatus consisting of inflatable rubber packer(s) and a length of perforated pipe; and
(2) A water system, including a water meter, pressure gauge and valves to adjust and maintain the water pressure and flow.

The following list of equipment to be used for packer testing is meant to serve only as a guide because actual site and borehole conditions may require modifications. The driller may provide much of the equipment. Typical equipment and materials used to perform packer testing include:

- Drill rig to install and remove the packer and water pipe;
- Packer (pneumatic or hydraulically actuated);
- Water pipe, ranging from 1 to 2 inches in diameter, depending on the permeability and surface area of the test section;
- Flow meter of the same diameter as the water pipe above;
- Pump, capacity to approximately 50 gpm;
- Storage tanks of appropriate volume for holding clean water for injection into test interval;
- Two pressure transducers, sized in accordance with the depth of the test interval and the excess injection pressure to be applied during the test;
- Compressed gas cylinders, regulators, and tubing for inflating pneumatic packers or alternative pressure source if hydraulically-actuated packers are used;
- Water swivel or elbow;
- Hose or piping of the same diameter as the water pipe;
- Electronic data logger for recording transducer output;

- Water level indicator or equivalent oil/water interface meter with 0.01 foot increments;
- Stopwatch;
- Constant-head injection data sheets (an example is provided in Figure 1);
- Personal Protective Equipment (PPE) as required by the Site-specific EHS Plan;
- Decontamination supplies (as needed); and
- Field logbook.

III. Packer Apparatus Configurations

Either single-packer or double-packer configurations may be used to perform the packer test. The single-packer test typically is performed after each core run during the drilling of corehole. The packer is seated at the top of the interval of rock core just removed, and the newly exposed section of bedrock is tested. To remove sediment from the corehole wall, the corehole may be bailed, surged or swabbed prior to packer testing. The test should not be initiated, however, until the water level in the drill casing returns to the static level.

Single-packer tests may provide more reliable results than double-packer tests because if water leaks past a single, upper packer, the leak may be discerned by the recognition of a rising water level in the corehole or drill casing above the packer or by the appearance of water in the casing at the ground surface. In contract, if a double-packer configuration is used, leakage past the lower packer may enter a permeable corehole section below the lower packer without being recognized as leakage.

The double-packer configuration is used if discrete rock intervals are to be tested in a previously-drilled long open corehole. Two packers are placed in the corehole and inflated with the perforated portion of the pipe between the packers. The spacing between the packers, corresponding to the test interval length, typically is 5 to 0 feet. Specified bedrock intervals are tested starting from the bottom of the hole and working upwards at intervals selected by the supervising geologist/engineer.

IV. Water System

The water system typically is assembled with a bypass valve and line connected to the main water line before the water meter valve. The purposes of the bypass valve are (1) to dampen the surge of water produced by the action of the pump, thus providing a relatively constant flow rate and water pressure; and (2) to allow a pressure bypass so that relatively low pressures may be applied to the tested rock interval, if appropriate. A surge suppression tank may also be plumbed into the water system before the bypass line to help dampen pump surge affects.

A water meter valve and the water meter follow the bypass valve and line. Flow to the tested rock interval passes through the water meter valve and is recorded by the water meter. The bypass and water meter valves are used simultaneously to maintain the water in the line at the desired pressure. The maximum water pressure for a particular pumping rate is achieved with the meter valve fully opened and the bypass valve fully closed. The bypass valve should be used as much as possible, however, to utilize its surge damping effect.

The remainder of the water system apparatus consists of a check valve, a relief valve and line, a water pressure gauge, and finally a length of riser pipe connecting the perforated pipe and packer assembly to the water supply apparatus. The pressure gauge indicates the water pressure in the apparatus at that location, rather than the pressure applied to the tested rock interval. The total head applied during a test consists of the gauge pressure plus the elevation head (the vertical distance between the pressure gauge and the static water level in the corehole), minus the frictional head loss between the pressure gauge and the perforated pipe where the water exits the apparatus and enters the tested rock interval. The magnitude of frictional head loss depends on the length of riser pipe used and the pumping rate, and is best determined empirically by calibrating the test assembly in the field. Alternately, frictional losses may be estimated based on hydraulics equation such as the Hazen-Williams equation (Meritt, 1983), which relates head loss to pipe geometry and flow rate.

V. Packer Test Apparatus Calibration

The frictional head loss in the riser pipe assembly should be determined in the field by a calibration process to obtain a reliable estimate of the total head applied to the test interval. The calibration is performed by pumping water through the apparatus at a constant pressure and flow rate for a specified duration, typically a few minutes. The gauge pressure, total flow volume, pumping duration, and riser pipe length are recorded, and the procedure is repeated at a different flow rate. The process is repeated at several flow rates that span the representative range of flow rates achievable by the pump.

The calibration is performed with the water system and packer apparatus laid out horizontally along the ground surface. The packer(s) remain deflated during the calibration procedure to avoid rupturing. The perforated section of pipe is supported slightly above the ground surface so that water may drain freely during pumping through the test assembly. The perforated pipe section and the pressure gauge are situated at approximately equal elevation during the calibration to eliminate the elevation head between the pressure gauge and the perforated pipe section. Because the elevation head is zero, the pressure gauge measurements obtained during calibration indicate only the frictional head loss in the pipe assembly.

The calibration process should be repeated and a separate set of gauge pressure versus pumping rate data generated for each total length of riser pipe used during actual packer testing. The calibration procedure may be performed after the appropriate riser-pipe lengths are identified by the performance of packer tests. The data of gauge pressure versus pumping rate are later plotted on a X-Y axis. A best-fit power-law regression curve is calculated for each data set to determine the mathematical relationship between pumping rate and frictional loss. During hydraulic conductivity calculation, frictional head loss for each observed flow rate is estimated from the plot of calibration data corresponding to the length of riser pipe used during the test.

VI. Test Gauge Pressure Calculation

Appropriate test pressures to be used during each of the five test increments are calculated as follows:

(1) Calculate the maximum gauge pressure, to be used during test increment #3 as:

P_3 (psi) = 0.75 x Depth of Test Section Midpoint (feet)

(2) Calculate the gauge pressures to be used during the other test increments as:

$P_1 = P_5 = 0.4 \times P_3$ and

$P_2 = P_4 = 0.7 \times P_3$.

VII. Packer Test Procedures

Prior to testing a given bedrock interval, the corehole identification number, the depth of the test interval, the static depth to water in the corehole, the gauge height above ground surface, and the length of riser pipe used in the apparatus are recorded on a packer test data log. After the packer(s) have been seated at the desired interval, the remainder of the test is performed as follows:

1. Open the bypass valve completely with the water meter valve closed.

2. Start the pump or open other water supply.

3. Open the meter valve slowly to allow water to flow and pressure to build. If this valve is completely opened and additional pressure is still needed, it may be obtained by slowly closing off the bypass valve, thus forcing more water through the water meter valve.

4. After the desired pressure for a desired given test increment has been achieved, record the time and volume form the totalizing water meter.

5. To perform a test increment, record the water meter reading at one minute intervals for 5 to 10 minutes of continuous pumping. Check the gauge to ensure the pressure remains constant throughout the test increment, and adjust the flow valves as needed to maintain constant pressure.

6. Adjust the valves in the water system to achieve the calculated appropriate pressure for the next test increment, and repeat steps #4 and #5 above.

7. If the appropriate test interval gauge pressure cannot be achieved due to a highly-permeable tested bedrock interval, the maximum achieved gauge pressure and the pumping rate data for the five minute test increment should be recorded.

8. The packer test for a given bedrock interval is complete after all five test increments have been performed.

9. Record the test data on the packer test data log.

VIII. Packer Test Data Reduction

Packer test data are reduced to develop estimates of hydraulic conductivity for each tested interval based on standard data reduction procedures (United States Bureau of Reclamation, 1974; Houlsby, 1976). Data are entered into an automatic packer-test data reduction spreadsheet program. The spreadsheet calculates the hydraulic conductivity from each of the five test increments for each tested bedrock interval as:

$$K = Cp\ Q/H$$

where:

K = hydraulic conductivity (feet per year);
Q = flow rate (gallons per minute);
H = total head applied during test (feet); and
Cp = packer coefficient.

Based on equations published in the Earth Manual (United States Bureau of Reclamation 1974), the packer coefficient can be calculated from:

$$Cp = [70267 \ln (L/r)] / 2\pi L$$

where:

L = length of the tested bedrock interval (feet); and
r = radius of tested bedrock corehole (feet).

In addition to the hydraulic conductivity value, the packer test reduction spreadsheet calculates a Ludgeon value (Houlsby, 1976) for each of the five test increments. The five Ludgeon values are evaluated to interpret the type of flow and bedrock formation response and most representative calculated hydraulic conductivity value for the tested bedrock interval from the following list:

(1) Laminar Flow

Indication: Ludgeon values are approximately equal.
Conductivity: Average of values from five test increments.

(2) Turbulent Flow

Indication: Ludgeon value from increment #3 is less than those from the lower pressure increments, which are approximately equal in value.
Conductivity: Value from increment #3.

(3) Dilation of Bedrock Fractures

Indication: Ludgeon value from increment #3 is greater than those from the lower pressure increments which are approximately equal in value.
Conductivity: Average value from increments #1 and #5.

(4) Wash-out of Fracture Filling Materials

Indication: Progressive increase in five Ludgeon values without any return to lower values during increments #4 and #5.

Conductivity: Value from increment #1.

(5) Void Filling

Indication: Progressive decrease in five Ludgeon values without any return to values during increments #4 and #5.

Conductivity: Value from increment #5.

REFERENCES

Houlsby, A.C., 1976, Routine Interpretation of the Ludgeon Water-Test, Q. Jl. Engng. Geol. Vol. 9, pp. 303-313.

Meritt, F.S., 1983, Standard Handbook for Civil Engineers, McGraw-Hill, New York.

United States Bureau of Reclamation, 1974, Earth Manual, 2nd Edition, Department of the Interior, Denver, Colorado, pp. 573-578.

FIGURE 1
TYPICAL CONSTANT-HEAD INJECTION TEST DATA SHEET

SITE:	ENV. CONSULTING FIRM:
BOREHOLE NO.:	FIELD PERSONNEL:
LOCATION:	DATE:
	TEST NO:
Pilot hole diameter:	Pretest water level:
Top of test section:	Product layer thickness:
Bottom of test section:	Reference point:
ID of water pipe:	Elevation of reference point:
Packer type:	Transducer type:
Length of packer:	Transducer calibration:
Depth to packer bottom:	Flowmeter:
Pretest water pressure (Po):	Start reading:
Packer inflation pressure:	End reading:

S#	Pt	t	Q	delta Q
Step No.	Test Section Pressure (psi)	Time from Start of Test (min)	Flow Rate (gpm)	Change in Flow Rate between Readings (gpm)

APPENDIX B

Quality Assurance Project Plan from the *Generic Site Characterization/IRM Work Plan for Site Investigations at Former MGP Sites*

GENERIC
QUALITY ASSURANCE PROJECT PLAN

FOR

SITE INVESTIGATIONS

AT NON-OWNED FORMER MGP SITES

Prepared for:
Niagara Mohawk
300 Erie Boulevard West
Syracuse, New York

Prepared By:
Foster Wheeler Environmental Corporation
One Park Place
300 South State Street, Suite 620
Syracuse, New York

NOVEMBER 2002

Reviewed and Approved by:
(Project Quality Assurance Manager)   (Signature)   (Date)

Site Specific
Revisions Attached: Supplement No. _____   Date

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GENERIC QUALITY ASSURANCE PROJECT PLAN

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1.0 GENERAL

This Generic Quality Assurance Project Plan (QAPP) has been prepared to specify procedures that will provide data of known, documented quality, and which will be legally defensible, should the need exist. This document specifically supplements the Generic Field Sampling Plan (FSP), also attached as an appendix to the Site-Specific Work Plan. To the extent discrepancies exist between this Generic QAPP and the Site-Specific Work Plan, the Site-Specific Work Plan shall control.

2.0 PROJECT DESCRIPTION

The project sites are Former Non-owned Manufactured Gas Plant (MGP) sites. The purpose of the investigations is to gather sufficient data to enable the New York State Department of Environmental Conservation (NYSDEC) and Niagara Mohawk, a National Grid Company (NM) to characterize chemical substances which are or may be present at the Sites and to enable the NYSDEC and NM to determine whether such substances pose a significant threat to public health or the environment.

The data collected as a result of these investigations will be used to support the Site Characterizations and Remedial Investigation/Feasibility Studies (RI/FS) as described in the Site-Specific Work Plans. The types, numbers, and locations of environmental samples to be collected are also described in the Site-Specific Work Plans. Field procedures for all environmental sampling activities are detailed in the FSP.

3.0 PROJECT ORGANIZATION

The project organization is described in detail in the Site-Specific Work Plan. The project organization describes the relationship between the NM Project Manager, NYSDEC Project Manager, NM's Engineering Consultant, and subcontractors (e.g. laboratories, data validators, drillers, etc.).

For the purpose of quality control, the Engineering Consultant's Project Quality Assurance Manager (PQAM) will be responsible for review of data upon receipt from the analytical laboratory. The PQAM will assure that data validation screening is performed by trained and experienced data validators using the applicable criteria specified in the NYSDEC 2001 Analytical Services Protocol (ASP). For the purposes of this document, all references to ASP indicate the 2001 NYSDEC Analytical Services Protocol. The specific requirements for data validation screening are given in Section 9.3. The PQAM will be responsible for ensuring that all analytical data are in conformance with requirements of this QAPP.

4.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

The overall quality assurance (QA) objective for the project is to develop and implement procedures which will provide data of known, documented quality. Field and laboratory quality assurance/quality control (QA/QC) requirements defined in the NYSDEC ASP and other applicable guidelines ensure acceptable levels of data quality will be maintained throughout the sampling and analysis program.

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. The data reduction, validation, and reporting scheme is presented in Figure 1. The quality assurance samples to be collected (type and frequency of collection) are specified in the Site-SpecificWork Plans.

4.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common. For this project, precision will be evaluated by recording duplicate measurements of the same parameter on similar sample aliquots under the same conditions and calculating the relative percent difference (RPD) between the values. The formula for calculating RPD is presented in Section 13.2.

RPDs can only be calculated when the duplicate samples both contain detectable concentrations of the analyte. If an analyte is considered not detected at the detection limit, then RPD cannot be calculated. Instead, the results of the analysis of the two-spiked laboratory samples will be used to determine precision.

Measurement data for this project will include field data as well as laboratory analytical data. Laboratory precision will be performed according to the requirements described in the associated analytical methods. The field measurement data may include immunoassay polycyclic aromatic hydrocarbon (PAH) and/or polychlorinated biphenyl (PCB) screening, pH, conductivity, temperature, turbidity, organic vapor readings, and water level measurements. The objective for precision of field data collection methods is to take replicate (minimum of two for every 20 samples) measurements for field parameters to determine the reproducibility of the measurements.

Precision of the immunoassay screening will be evaluated by the field analysis of replicate samples as equivalent levels of PAHs/PCBs. As the screening is not quantitative (i.e., the screening determines if the constituents are present above or below standard values and does not provide a numeric result), RPDs cannot be calculated on the field-analyzed samples. Therefore, measurement of equivalent levels of constituent (i.e., detected below the same standard or within the same range of two standards) will be considered as denoted precision of the screening test.

For the pH meter, precision will be tested by multiple readings in the medium of concern.

Consecutive readings should agree within 0.1 pH units after the instrument has been field calibrated with standard buffers before each use. The thermometer will be visually inspected prior to each use to ensure its condition is satisfactory. Consecutive measurements of a given sample should agree to within 1°Celsius. After calibration, the conductivity meter will be tested for precision at ± 1% of full-scale, depending on the meter/scale. The organic vapors will be measured using a Photovac Microtip (or equivalent) photoionization detector (PID). Daily background and upwind readings of drilling and sampling activities will be measured prior to commencing work and at periodic intervals throughout each day's activities. The natural variation/fluctuation in measurements at background or upwind locations will be used for baseline background values, and the variability will be noted. Water level indicator readings will be precise within 0.01 feet for duplicate measurements or additional water level measurements will be collected to determine whether the difference is due to operator or instrument error. Turbidity measurements will be calibrated to a precision of ± 2% nephelometric turbidity units (NTUs).

4.2 Accuracy

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity, which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes that are close to the detection limits are less accurate because they are affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument or other variables and thus will be more accurate.

The accuracy of laboratory-measured data will be evaluated by determining the percent recovery of both matrix and blank spike samples as described in Section 13.1. For the measurement of organics by gas chromatography (GC) or GC/mass spectroscopy (MS), the recovery of a surrogate spiked into each sample, blank, and standard will also be used to assess accuracy.

Accuracy between the immunoassay screening and the laboratory analytical results will be evaluated by the confirmatory testing of 10 percent (i.e., one in ten) of the environmental samples at the off-site laboratory. The rate of potential false positives and negatives should be less than 15 percent. Screening samples will not be spiked in the field by the addition of known parameter concentrations. However, the confirmatory samples sent to the off-site laboratory will undergo surrogate spiking and recovery evaluation and, to the extent possible, may be chosen as the site-specific matrix spike sample(s) for additional accuracy determination.

The objective for accuracy of the other field measurements is to achieve and maintain factory equipment specifications for the field equipment. Field measurements cannot be assessed for accuracy by spiking the medium with the analytical parameter and measuring the increase in response; therefore, these instruments can only be assessed for accuracy by the response to a known sample (such as a calibration standard) used to standardize them. The pH meter, conductivity meter, and turbidity meter are calibrated with solutions traceable to the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards).

All volatile organic detectors (such as the PID) will be calibrated to an appropriate standard daily prior to use.

4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, or analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the FSP. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 5.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated through the analysis of field duplicate samples, coded to ensure the samples are treated and analyzed as separate samples. The analytical laboratory will make every reasonable effort to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received. Many means of homogenization expose the sample to significant risk of contamination or loss through volatilization, and these should be avoided if possible.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank/duplicate and chain-of-custody procedures are presented in Sections 5.3 and 6.1.

4.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. The QC objective for completeness is generation of valid data for 100 percent of the analysis requested. Any data deficiencies and their impact on project goals will be evaluated during data validation and discussed in the Data Usability Summary Report (DUSR) (see Section 9.3.2).

4.5 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Ensuring traceability of all analytical standards and/or source materials to USEPA or NIST;
- Verifying all calibrations with an independently prepared standard from a source other than that used for calibration;
- Using standard reporting units and reporting formats including the reporting of QC data;
- The validation of all analytical results, including the use of data qualifiers in all cases where appropriate; and
- The requirement that all validated flags be used any time an analytical result is used for any purpose whatsoever.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

5.0 SAMPLING PROCEDURES

5.1 Sampling Program

The objective of the sampling program is to provide current data concerning the presence and nature and extent of contamination of groundwater, surface water, soils (surface and subsurface), and/or sediment. Sampling and analysis may include as identified in the Site-SpecificWork Plan:

- groundwater samples
- surface water samples
- sediment samples
- surface and/or subsurface soil samples
- air samples

5.2 Sampling Procedures and Handling

<u>Sample Container Preparation</u>

Sample containers will be properly washed and decontaminated by the factory or laboratory prior to use. All preservatives will be added to containers prior to shipment by the laboratory. The types of containers and preservation techniques are shown in Table 1. Records of the sources of bottles and preservatives will be kept by the analytical laboratory.

<u>Methods of Sampling</u>

As a minimum, sampling procedures will be in accordance with the most recent NYSDEC or USEPA guidelines and/or regulations, as appropriate. Alternate techniques will be utilized when such guidelines and/or regulations are inappropriate or non-existent. Alternate techniques will be implemented only after consultation with NYSDEC, whenever possible.

Referenced sampling procedures are listed below. All procedures will be the latest in effect as of the date of this Generic QAPP.

- USEPA - 600-4-79-020, "Methods for Chemical Analysis of Water and Wastes"
- National Water Well Association - "Manual of Ground-water Sampling Procedures"
- USEPA - 600-4-83-040, "Characterization of Hazardous Waste Sites - a Methods Manual: Volume II. Available Sampling Methods"
- USEPA - OSWER - 9950.1 "RCRA Ground-water Monitoring Technical Enforcement Guidance Document"
- USEPA - 540/S-95/504, “Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures”

- NYSDEC – "Technical and Administrative Guidance Memoranda" (TAGMs)

All sampling methods are explained in detail in the FSP.

5.3 Quality Assurance Samples

<u>Field Quality Control Samples</u>

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. The blanks will include:

> **Trip Blank** - A trip blank will be prepared by the laboratory, and will consist of 40-ml volatile organic analysis (VOA) vials containing distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for which analysis for Target Compound List (TCL) volatiles or benzene, toluene, ethylbenzene and total xylenes (BTEX) is planned. The trip blank will be analyzed for TCL volatile organic compounds or BTEX to assess any contamination introduced as a result of sampling and transport, , handling and storage.

> **Equipment Blank** - Equipment blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix as specified in the Site-SpecificWork Plan. Equipment blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory, which has passed through or over the sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to collecting a sample. The equipment blanks will be analyzed for the same parameters as the matrix being sampled.

In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike (MS)/matrix spike duplicates (MSD)/matrix duplicates (MD).

The duplicates will consist of:

> **Field Duplicate** - To determine the reproducibility and homogeneity of samples, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise. The frequency of collection of these samples is one per 20 field samples as specified in the Site-SpecificWork Plans. The criteria for assessing coded field duplicates are given in Section 6.0.

> **Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate (MS/MSD/MD) -** MS/MSD/MD samples (MSD for organics; MD for inorganics) will be collected at a frequency of one pair per 20 field samples per seven day sample delivery group (SDG). The reproducibility and homogeneity of the samples can be assessed by determining the

RPD for both spike and non-spike compounds as described in Section 13.0. The MS, MSD, and MD samples should be Site-Specific, unless otherwise authorized by the Engineering Consultant's Project Manager and/or PQAM after consultation with NM and NYSDEC personnel whenever possible.

6.0 SAMPLE TRACKING AND CUSTODY

Sample chain-of-custody (COC) will be initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples will be minimized.

In-situ or on-site monitoring data will be controlled and entered in permanent logbooks. Personnel involved in the COC and transfer of samples will be trained on the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity will be provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 2. A sample will be considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

6.1 Field Sample Custody

A COC record will accompany the sample from time of collection to receipt by the analytical laboratory. If samples are split and sent to different laboratories, COC records will be sent with each sample. Figure 3 is a typical example of a chain-of-custody record. The "remarks" column will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and analyses to be performed. Two copies of this record will accompany the samples to the laboratory. The laboratory will maintain one file copy, and the completed original will be returned to the Engineering Consultant’s Project Manager.

Individual sample containers, provided by the laboratory, will be used for shipping/couriering samples. The shipping containers are insulated, and ice will be used to maintain samples at approximately four degrees Celsius until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container will be individually labeled and controlled.

Each sample shipping container will be assigned a unique identification number by the laboratory, and will be marked with indelible ink on the outside of the shipping container. This number will be recorded on the COC record. The field sampler will indicate each individual sample designation/location number in the space provided on the appropriate COC form for each sample collected. The shipping container will then be closed, and a seal provided by the laboratory affixed to the latch. This seal must be broken to open the container. Tampering may be indicated if the seal is broken before receipt at the laboratory. The laboratory will contact the FOL or Engineering Consultant's Project Manager, and the associated samples will not be analyzed if tampering is apparent.

6.2 Laboratory Sample Custody

The FOL will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The laboratory sample program will meet the following criteria:

- The laboratory will designate a sample custodian who is responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of any discrepancy in documentation, the laboratory will immediately contact the Engineering Consultant's Project Manager and/or PQAM as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. That assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately four degrees Celsius until analyses are to commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking form will accompany the laboratory report and will become a permanent part of the project records.

6.3 Sample Tracking System

A sample tracking system will be implemented to monitor the status of sampling events and laboratory analysis of samples. Sample numbers, types, analytical parameters, sampling dates, and sample delivery group (SDG) designations for samples, and required due dates for receipt of analytical results will be entered into the system. The Engineering Consultant's Project Manager will use the tracking system to monitor the project sampling schedules and the status of analytical reports, and to implement any penalty clauses for late delivery per standard laboratory subcontracts when necessary.

A description of the sample tracking system follows:

1. For each day that samples are collected, the Field Operations Lead (FOL) or designee will complete a COC form (Figure 3) and a Daily Status and Monitoring Report (Figure 4) listing all appropriate samples.
2. The FOL or designee will retain the client copy of the COC, and forward the laboratory copy of the COC with the sample shipment.
3. The FOL or designee will fax copies of the completed COC form and Daily Status and Monitoring Report to the Engineering Consultant's PM. The Engineering Consultant's PM or a designated employee will confirm sample shipment with the laboratory and resolve any sample transfer issues.
4. The status of analytical results will be tracked by the Engineering Consultant's PM or designee using the information provided on the completed COC form and Daily Status and Monitoring Report. The information shall be summarized in a computerized database, as warranted.

Upon receipt of the analytical results from the laboratory, the Engineering Consultant's PM or designee will review the data package for completeness and contract compliance. The Engineering Consultant's PM will then forward the result package to the data validator for validation. The data validator shall be required to submit a complete set of validated data to the Engineering Consultant's PM within 60 days of receipt of the data package report.

The Engineering Consultant's Project Manager or a designated representative will maintain day-to-day contact with the laboratory concerning specific samples and analyses directly or by assignment.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 Field Instrumentation Calibration

The FOL will be responsible for ensuring that instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to their specific calibration protocols/procedures.

All field measurement instruments must be calibrated according to the manufacturer's instructions prior to the commencement of the day's activities. Exceptions to this requirement shall be permitted only for instruments that have fixed calibrations pre-set by the equipment manufacturer. Calibration information shall be documented on instrument calibration and maintenance log sheets or in a designated field logbook. The calibration information (log sheet or logbook) shall be maintained at the site during the on-site investigation and, once the field work is completed, shall be placed in the Engineering Consultant's project files. Information to be recorded includes the date, the operator, and the calibration standards (concentration, manufacturer, lot number, expiration date, etc.). All project personnel using measuring equipment or instruments in the field shall be trained in the calibration and usage of the equipment, and are personally responsible for ensuring that the equipment has been properly calibrated prior to its use.

In addition, all field instruments must undergo response verification checks at the end of the day's activities and at any other time that the user suspects or detects anomalies in the data being generated. Verification checks may also be performed at the request of NM or NYSDEC representatives. The checks consist of exposing the instrument to a known source of analyte (e.g., the calibration solution), and verifying a response. If an unacceptable instrument response is obtained during the check (i.e., not within specifications), the data shall be labeled suspect, the problem documented in the site logbook, and appropriate corrective action taken.

Any equipment found to be out of calibration shall be re-calibrated. When instrumentation is found to be out of calibration or damaged, an evaluation shall be made to ascertain the validity of previous test results since the last calibration check. If it is necessary to ensure the acceptability of suspect items, the originally required tests shall be repeated (if possible), using properly calibrated equipment, to acquire replacement data for the measurement in question.

Any instrument consistently found to be out of calibration shall be repaired or replaced within 24 hours or field work will be terminated until the malfunctioning equipment is repaired/replaced.

7.2 Laboratory Instrumentation Calibration

Personnel at the laboratory will be responsible for ensuring that analytical instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to specific protocols/procedures.

Off-site laboratory equipment shall be calibrated using certified/nationally recognized standards and according to the applicable methodologies and the laboratory Standard Operating Procedures

(SOPs). In addition, these methods/procedures specify the appropriate operations to follow during calibration or when any instrument is found to be out of calibration.

8.0 ANALYTICAL PROCEDURES

All off-site laboratory samples will be analyzed according to the methods provided in Exhibit D of the NYSDEC ASP. QA/QC procedures given in Exhibit E and I of the ASP will be followed. Regardless of the method used, all analytical and extraction holding times must meet the NYSDEC ASP requirements for that analytical group (i.e., volatile analyses, including BTEX, have a holding time of seven days, if unpreserved). Holding times will be calculated from verified time of sample receipt at the laboratory. For NYSDEC ASP, samples must be received at the laboratory within 48 hours of sample collection. The analytical laboratory chosen for the project will be certified, and must maintain certification, under the New York State Department of Health's Environmental Laboratory Approval Program for analyses of solid and hazardous waste. The breakdown of investigative samples is detailed in the Site-Specific Work Plan. Laboratory analytical methods and quantitation limits are presented in Tables 2 and 3 of this Generic QAPP. The method detection limits (MDLs) for the analytes will be specified by the laboratory selected for the project based on its most recent MDL studies, and subject to approval by the NYSDEC.

Field screening samples will be analyzed according to the NYSDEC ASP and the manufacturer's instructions. Unless site-specific requirements dictate a change in concentration limits (which would be explained within the Site-Specific Work Plan), the standard levels for the PAH and PCB screening will be 1 ppm and 10 ppm. The test system user shall be technically qualified individual who has received training in the immunoassay analysis requirements, procedures and potential risks prior to field screening of samples. Use of the field screening test kits will only occur in a controlled environment, following the storage and handling procedures outlined in the NYSDEC ASP and the manufacturer's instructions. Additional technical information on the field screening testing are presented in Attachments 1 and 2.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the ASP.

The data package provided by the laboratory will contain all items specified in the ASP, as appropriate to the analyses performed. Category B reporting will be used.

9.1 Chain-of-Custody Records

Completed copies of the COC records accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the report of analytical testing.

9.2 Data Handling

One complete copy and one additional copy of the analytical data summary report will be provided by the laboratory. One set of the analytical data will be forwarded directly to the data validator by the laboratory. The Engineering Consultant’s Project Manager will immediately arrange for filing of the complete package, after the QA/QC reviewer checks the package to ensure all deliverables have been provided. The second data summary report will be used to generate summary tables. These tables will form the foundation of a working database for assessment of the site contamination condition.

The Engineering Consultant’s Project Manager will maintain close contact with the QA/QC reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA/QC review has been completed, the Engineering Consultant’s Project Manager may direct the team leaders or others to initiate and finalize the analytical data assessment.

9.3 Data Validation

9.3.1 Full Data Validation

Data validation is a basic step in the control and processing of the project data generated by the laboratory. The data validation process will consist of a systematic review of the analytical results and QC documentation, and will be performed in accordance with the guidelines identified in Section 9.3.1. All off-site laboratory data will undergo full validation, unless otherwise stated in the Site-Specific Work Plan. On the basis of this review, the data validator will make judgments and express concerns and comments on the quality and limitations of specific data, as well as on the validity of the overall data package. The data validator will prepare documentation of his or her review and conclusions in a Data Usability Summary Report (DUSR; see Section 9.3.2).

The data validator will inform the Engineering Consultant’s Project Manager of data quality and limitations, and assist the Project Manager in interacting with the laboratory to correct data omissions and deficiencies. The laboratory may be required to rerun or resubmit data depending on the extent of the deficiencies, and their importance in meeting the data quality objectives within the overall context of the project. The validated laboratory data will be reduced into a computerized tabulation which will be suitable for inclusion in the Site Characterization and RI Reports and will be designed to facilitate comparison and evaluation of the data. The data tabulations will be sorted by classes of constituents and by sample matrix. Each individual table will present the following information:

- Sample matrix, designations, and locations;
- Sample dates;
- Constituents for which positive results were obtained;
- Reported constituent concentrations in the field and/or trip blanks associated with the samples;
- Constituent concentration units;
- Name and location of laboratory which performed the analyses;
- Data qualifiers provided by the laboratory; and
- Data qualifiers and comments provided by the data validator, if any.

9.3.2 Data Usability Summary Report (DUSR)

A Data Usability Summary Report (DUSR) will be prepared after reviewing and evaluating the analytical data. The parameters to be evaluated in reference to compliance with the analytical method protocols includes all sample chain-of-custody forms, holding times, raw data (instrument print out data and chromatograms), calibrations, blanks, spikes, controls, surrogate recoveries, duplicates and sample data. If available, the field sampling notes should also be reviewed and any quality control problems should be evaluated as to their effect on the usability of the sample data.

The DUSR will describe the samples and analysis parameters reviewed. Data deficiencies, analytical method protocol deviations and quality control problems will be described and their effect on the data will be discussed in the DUSR.

Resampling/reanalysis recommendations, if applicable, will be made. Data qualifications are documented for each sample analyte following the NYSDEC ASP guidelines.

This work will be performed by trained and experienced data validators who meet the NYSDEC approval criteria. The Environmental Scientist preparing the DUSR must submit a resume to the NYSDEC Quality Assurance Unit documenting relevant experience in environmental sampling and analysis methods and data review and documentation of a Bachelors Degree in Natural Science or Engineering. The results of the data validation screening (i.e. missed holding times or data rejected due to blank contamination) will be incorporated into the data summary tables used in the final investigative report. The DUSR identifies data gaps caused by non-compliant or rejected data, and will indicate what steps have been or will be taken to fill these gaps.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 Quality Assurance Batching

Each set of samples will be analyzed concurrently with calibration standards, method blanks, MS, MSD or MD, and QC check samples (if required by the protocol). The MS/MSD/MD samples will be designated by the field personnel. If no MS/MSD/MD samples have been designated, then the laboratory must contact the Project Quality Assurance Officer (PQAO) or Engineering Consultant's Project Manager for corrective action.

10.2 Organic Standards and Surrogates

All standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or earlier based upon data indicating deterioration.

10.3 Laboratory Quality Control Samples

The quality control samples included are detailed below.

Method Blanks/Preparation Blanks: Analyses for organic compounds (method blank) and inorganics (preparation blank) include a blank analysis of the laboratory reagent water. The blank is analyzed with each set of samples or more often as required to verify that contamination has not occurred during the analytical process. The concentration of target compounds in the blanks must be less than or equal to the method detection limits specified in the ASP for the selected method of analysis.

Matrix Spike/Matrix Spike Duplicate Analysis - This analysis is used to determine the effects of matrix interference on analytical results. Spikes of analytes are added to aliquots of sample matrix in the manner specified in the ASP. Selected samples are spiked to determine accuracy as a percentage recovery of the analyte from the sample matrix and precision as RPD between the MS and MSD samples. A matrix duplicate is prepared in the same manner as the matrix spike sample.

Analytical Duplicate Samples - Replicate samples are aliquots of a single sample that are split on arrival at the laboratory, or upon analysis. Significant differences between two replicates, split in a controlled laboratory environment, will result in flagging the affected analytical results.

Surrogate Spike Analyses - Surrogate spike analyses are used to determine the efficiency of recovery of organic analytes in the sample preparations and analyses. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method.

Laboratory Control Sample/ (Spike Blank) - For each method which requires a laboratory control sample (LCS) or spike blank, a LCS spike blank will be prepared with each quality control batch and analyzed according to criteria specified in the ASP. These samples support an assessment of the ability of the analytical procedure to generate a correct result without matrix effects or interference affecting the analysis.

11.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

Quality assurance audits may be performed by the Project Quality Assurance Manager (PQAM) or personnel designated by the PQAM. The PQAM and his or her designees function as an independent body and report directly to Engineering Consultant's quality assurance management. The PQAM may plan, schedule, and approve system and performance audits based upon the Engineering Consultant's procedure customized to the project requirements. These audits may be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). At times, the PQAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits.

Formal audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by lead auditors after gathering and evaluating all resultant data. Items, activities, and documents determined by lead auditors to be in noncompliance will be identified at exit interviews conducted with the involved management. Noncompliances will be logged, documented, and controlled through audit findings which are attached to and are a part of the integral audit report. These audit finding forms will then be directed to management to satisfactorily resolve the noncompliance in a specified and timely manner. All audit checklists, audit reports, audit findings, and acceptable resolutions must be approved by the PQAM prior to issue. QA verification of acceptable resolutions will be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the PQAM will close out the audit report and findings.

It is the Engineering Consultant's Project Manager's overall responsibility to verify that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Engineering Consultant's Project Manager within 15 days of completion of the audit. Serious deficiencies must be reported to the Engineering Consultant's Project Manager within 24 hours.

Serious deficiencies identified during an audit will be reported to NM and NYSDEC as part of the DUSR or Site investigation and/or RI Reports.

11.1 System Audits

System audits, performed by the PQAM or designated auditors, may encompass evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Engineering Consultant's Project Manager requests the PQAM to perform unscheduled audits, these activities will be instituted.

11.2 Performance Audits

In accordance with the requirements for NYSDOH ELAP CLP certification, the laboratory will participate in all performance evaluation testing.

Also, one field audit may be performed by the PQAM or designated auditor during collection of the field samples to verify that field samplers are following established sampling procedures. Performance of a field audit will be based on the type of investigation activities being performed, the length of the field project, and any available information concerning prior inspections of the project or sampling team. The Site-Specific Work Plan will provide details on the performance of a field audit.

12.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

12.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators. Analytical instruments will be serviced at intervals recommended by the manufacturer. An instrument repair/maintenance log book will be kept for each instrument, and this log will be available on-site during field activities and, at the completion of the investigation, be placed in the project files. Entries include the date of service, type of problem encountered, corrective action taken, and initials and affiliation of the person providing the service.

The instrument use log book will be monitored by the analysts to detect any degradation of instrument performance. Changes in response factors or sensitivity are used as indications of potential problems. These are brought to the attention of the laboratory supervisor and preventive maintenance or service is scheduled to minimize down time. Back-up instrumentation and an inventory of critical spare parts are maintained to minimize delays in completion of analyses.

Use of equipment in need of repair will not be allowed, and field work will be terminated until the malfunction is repaired or the instrument replaced.

12.2 Schedules

Written procedures, where applicable, will identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools, gauges, etc. shall be performed by qualified personnel.

12.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the sites. The Engineering Consultant’s Project Manager or the PQAM may audit these records to verify complete adherence to these procedures.

12.4 Spare Parts

Where appropriate, a list of critical spare parts will be identified by the operator in consultation with the equipment manufacturer. These spare parts will be stored for availability and use in order to reduce the downtime. In lieu of maintaining an inventory of spare parts, a service contract for rapid instrument repair or backup instruments will be available.

13.0 ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY

Procedures used to assess data precision and accuracy will be in accordance with the appropriate laboratory method, and as periodically updated.

13.1 Accuracy

The percent recovery is calculated as below:

$$\% = \frac{Ss - So}{S} \times 100$$

So = The background value, i.e.; the value obtained by analyzing the sample

S = Concentration of the spike added to the sample

Ss = Value obtained by analyzing the sample with the spike added

% = Percent Recovery

13.2 Precision

The relative percent difference (RPD) is calculated as below:

$$RPD = \frac{|V1 - V2|}{0.5\,(V1 + V2)} \times 100$$

V1, V2 = The two values obtained by analyzing the duplicate samples

13.3 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under ideal conditions. A target of 100 percent completeness, calculated for each analysis method, has been established as the overall project objective.

$$PC = \frac{NA}{NI} \times 100$$

where:

PC = Percent completeness
NA = Actual number of valid analytical results obtained
NI = Theoretical number of results obtainable under ideal conditions

14.0 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted on-site, at the laboratory, or at a subcontractor location, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the FOL, Engineering Consultant's Project Manager, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

At a minimum, corrective actions may be initiated:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined deficient
- When equipment or instrumentation is found faulty
- When samples and test results are questionably traceable
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/inter-field comparison studies
- As required by NM
- As required by NYSDEC ASP, 2001

<u>Procedure Description</u>

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities.

Work may be audited at Engineering Consultant's office, Site, laboratory, and subcontractor locations by the PQAM and/or designated auditor. Items, activities, or documents ascertained to be in noncompliance with quality assurance requirements will be documented and corrective actions mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the PQAM (Section 11.0).

Technicians assigned quality assurance functions will also control noncompliance corrective actions by having the responsibility of issuing and controlling the appropriate Corrective Action Request Form (Figure 5). All project personnel may identify a noncompliance; however, the technician is responsible for documenting, numbering, logging, and verifying the closeout action. It is the Engineering Consultant's Project Manager's responsibility to verify that all recommended corrective actions are produced, accepted, and received in a timely manner.

The Corrective Action Request (CAR) identifies the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible manager in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the technician in charge, affixing his signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The technician maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The technician will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Engineering Consultant's Project Manager, involved subcontractor, and the FOL, at a minimum. CARs are transmitted to the project file for the records.

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports to management may consist of the reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and the data validation report.

At the end of the project, the PQAM may submit a lessons leaned report to the Engineering Consultant's Project Manager which will discuss the QA activities. That report may include discussions of any conditions adverse or potentially adverse to quality, such as responses to the findings of any field or laboratory audits; any field, laboratory, or sample conditions which necessitated a departure from the methods or procedures specified in this QAPP; field sampling errors; and any missed holding times or problems with laboratory QC acceptance criteria; and the associated corrective actions undertaken. This report shall not preclude immediate notification to project management of such problems when timely notice can reduce the loss or potential loss of quality, time, effort, or expense.

These reports, if prepared, shall be reviewed by the Engineering Consultant's Project Manager for completeness and the appropriateness of any corrective actions, and they shall be retained in the project files.

In the final investigative report, laboratory and field QC data will be presented, including a summary of QA activities and any problems and/or comments associated with the analytical and sampling effort. Any corrective actions taken in the field, results of any audits, and any modifications to laboratory protocols will be discussed.

Attachment 1

NYSDEC ASP Methods 4035 (PAHs) and 4020 (PCBs)

Attachment 2

Field PAH and PCB Soil Test Technical Guides and Test Kit Instructions

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL Volatile Organic Compounds (by 2001-1)		
Acetone	10	10
Benzene	10	10
Bromodichloromethane	10	10
Bromoform	10	10
Bromomethane	10	10
2-Butanone	10	10
Carbon disulfide	10	10
Carbon tetrachloride	10	10
Chlorobenzene	10	10
Chloroethane	10	10
Chloroform	10	10
Chloromethane	10	10
Dibromochloromethane	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethane	10	10
1,1-Dichloroethene	10	10
1,2-Dichloroethene (cis and trans)	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
trans-1,3-Dichloropropene	10	10
Ethylbenzene	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Methylene chloride	10	10
Styrene	10	10
1,1,2,2-Tetrachloroethane	10	10
Tetrachloroethene	10	10
Toluene	10	10
1,1,1-Trichloroethane	10	10
1,1,2-Trichloroethane	10	10
Trichloroethene	10	10
Vinyl chloride	10	10
Total Xylenes	10	10

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2) Base/Neutral Extractables		
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benzo(a)anthracene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(g,h,i)perylene	10	330
Benzo(a)pyrene	10	330
bis(2-Chloroethoxy)methane	10	330
bis(2-Chloroethyl)ether	10	330
bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl phenyl ether	10	330
Butyl benzyl phthalate	10	330
Carbazole	10	330
4-Chloroaniline	10	330
2-Chloronaphthalene	10	330
4-Chlorophenyl phenyl ether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
Di-n-butylphthalate	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
3,3'-Dichlorobenzidine	10	330
Diethyl phthalate	10	330
Dimethyl phthalate	10	330
2,4-Dinitrotoluene	10	330

NOTES

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2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.)		
2,6-Dinitrotoluene	10	330
Di-n-octylphthalate	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	10	330
Hexachloroethane	10	330
Indeno(1,2,3-cd)pyrene	10	330
Isophorone	10	330
2-methyl Naphthalene	10	330
Naphthalene	10	330
2-Nitroaniline	25	800
3-Nitroaniline	25	800
4-Nitroaniline	25	800
Nitrobenzene	10	330
N-Nitroso-diphenylamine	10	330
N-Nitroso-dipropylamine	10	330
2,2' Oxybis(1-chloropropane)	10	330
Phenanthrene	10	330
Pyrene	10	330
1,2,4-Trichlorobenzene	10	330

NOTES

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2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	**Contract Required Quantitation Limit Soil Samples(ug/kg)**
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.) **Acid Extractables (cont.)**		
4-Chloro-3-methylphenol	10	330
2-Chlorophenol	10	330
2,4-Dichlorophenol	10	330
2,4-Dimethylphenol	10	330
4,6-Dinitro-2-methylphenol	25	800
2,4-Dinitrophenol	25	800
2-Methylphenol	10	330
4-Methylphenol	10	330
2-Nitrophenol	10	330
4-Nitrophenol	25	800
Pentachlorophenol	25	800
Phenol	10	330
2,4,5-Trichlorophenol	25	800
2,4,6-Trichlorophenol	10	330
NYSDEC ASP TCL Pesticides and PCBs (by 2001-3)		
Aldrin	0.05	1.7
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Chlordane (alpha &/or gamma)	0.05	1.7
4,4'-DDD	0.10	3.3
4,4'-DDE	0.10	3.3
4,4'-DDT	0.10	3.3
Dieldrin	0.10	3.3
Endosulfan I	0.05	1.7
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3

NOTES

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2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Pesticides and PCBs (by 2001-3, Cont.)		
Endrin	0.10	3.3
Endrin Aldehyde	0.10	3.3
Endrin Ketone	0.10	3.3
Heptachlor	0.05	1.7
Heptachlor Epoxide	0.05	1.7
Methoxychlor	0.50	17.0
Toxaphene	5.0	170.0
Aroclor-1016	1.0	33.0
Aroclor-1221	2.0	67.0
Aroclor-1232	1.0	33.0
Aroclor-1242	1.0	33.0
Aroclor-1248	1.0	33.0
Aroclor-1254	1.0	33.0
Aroclor-1260	1.0	33.0
NYSDEC ASP TAL Metals and Cyanide (by CLP-M)		
Aluminum	200	
Antimony	60	
Arsenic	10	
Barium	200	
Beryllium	5	
Cadmium	5	
Calcium	5000	
Chromium	10	
Cobalt	50	
Copper	25	
Iron	100	
Lead	3	
Magnesium	5000	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd.)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TAL Metals and Cyanide (by CLP-M) (Cont.)		
Manganese	15	
Mercury	0.2	
Nickel	40	
Potassium	5000	
Selenium	5	
Silver	10	
Sodium	5000	
Thallium	10	
Vanadium	50	
Zinc	20	
Cyanide	10	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

These CRQLs are the instrument detection limits obtained in pure water that must be met using the procedure in Exhibit E. The quantitation limits for samples may be considerably higher depending on the sample matrix.

TABLE 1
SAMPLE CONTAINERIZATION

Analysis	Bottle Type	Preservation[1]	Holding Time[2]
Aqueous Samples			
Volatile Organics (BTEX)	40 ml glass vial with Teflon-lined septa	Cool to 4ºC	7 days
PCBs/Pesticides	1000 ml amber glass	Cool to 4ºC	5 days*
Semivolatile Organics (PAHs)	1000 ml amber glass	Cool to 4ºC	5 days*
Metals	1000 ml polyethene	HNO_3 to pH <2	6 months (Mercury 26 days)
Cyanide	1000 ml polyethene	NaOH to pH >12	12 days
Soil & Sediment Samples			
Volatile Organics (BTEX)	Wide-mouth glass w/ teflon-lined septa [3]	Cool to 4ºC	7 days
Semivolatile Organics (PAHs)	Wide-mouth glass w/ teflon cap [3]	Cool to 4ºC	5 days*
Pesticide/PCBs	Wide-mouth glass w/ teflon cap [3]	Cool to 4ºC	5 days*
Metals, Cyanide	Wide mouth glass w/ teflon cap [3]	Cool to 4ºC	Metals - 6 months Mercury - 26 days Cyanide - 12 days

NOTES

1. All samples to be preserved in ice at 4°C during collection and transport.
2. Days from verified time of sample receipt (VTSR) by the laboratory.
3. Sized appropriately for the analytical method.
4. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in containerization requirements, the Site-Specific Work Plan (which will include this information) will take precedence.

* Extraction of water samples for pesticides/PCB analysis by separating funnel must be completed within five days of VTSR. Continuous liquid-liquid extraction is the required extraction for water samples for semivolatiles. Continuous liquid-liquid extraction of water samples, or sonication or soxhlet procedures for semivolatile and pesticides/PCB analyses, shall be started within five days. If a re-extraction and reanalysis must be performed, the extraction must start within 10 days and completed within 12 days of VTSR. Extracts of either water or soil/sediment samples must be analyzed within 40 days of VTSR.

TABLE 2
LABORATORY ANALYSIS PROGRAM

Matrix	Parameter [1]	Analytical Method [2]
Water	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	PCBs and Pesticides	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
Soil & Sediments	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	Pesticides and PCBs	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
	TCLP	Method 1311; Method Series 7000, 8000
Waste Characteristics		Methods 1010/1020A; 9040B/9041A; Section 7.3

NOTES

1. Abbreviations: BTEX = Benzene, Toluene, Ethylbenzene, Xylene; VOCs = Volatile organic compounds; SVOCs = Semivolatile organic compounds; PAHs = Polycyclic aromatic Hydrocarbons; TCLP = Toxicity Characteristic Leaching Procedure; PCBs = Polychlorinated Biphenyls; CLP = Contract Laboratory Program.
2. NYSDEC Analytical Services Protocol, 2001, Category B deliverables.
   Analyses must meet NYSDEC ASP holding time specified for Methods in Exhibit I Part II.
3. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in analytical requirements, the Site-Specific Work Plan (which will include this information) will take precedence

* BTEX and PAH analyses must meet NYSDEC ASP holding time specified for Methods 2001-1 and 2001-2, respectively.

APPENDIX C

NYSDOH Generic Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

<u>Overview</u>

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

<u>Community Air Monitoring Plan</u>

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all <u>ground intrusive</u> activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during <u>non-intrusive</u> activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. APeriodic@ monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

<u>VOC Monitoring, Response Levels, and Actions</u>

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

<u>Particulate Monitoring, Response Levels, and Actions</u>

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

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