Environment

Prepared for:
NYSEG
James A. Carrigg Center
18 Link Drive
Binghamton, New York 13904

Prepared by:
AECOM
Rocky Hill, CT
60189902
February 23, 2011

Feasibility Study Report

NYSEG's Ithaca Court St. Former MGP Site Operable Unit 2 Ithaca, New York NYSDEC Site No.:7-55-008 Index #: D0-0002-9309

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Certification

I, Lucas Hellerich, certify that I am currently a NYS registered professional engineer and that the Feasibility Study Report for the Ithaca Court Street Former Manufactured Gas Plant Site prepared in accordance with all applicable statues and regulations and in substantial conformance with the New York State Department of Environmental Conservation Division of Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER10).

February 23, 2011

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List of Acronyms

AOC .... Administrative Order on Consent
ARARs .... Applicable or Relevant and Appropriate Requirements
bgs .... Below Ground Surface
BTEX................. Benzene, Ethyl benzene, Toluene, and Xylene
cfs...................... cubic feet per second
COC .... Constituents of Concern
DER .... Division of Environmental Remediation
DNAPL .... Dense Non-Aqueous Phase Liquid
FS...................... Feasibility Study
gpm .... Gallons Per Minute
IRM.................... Interim Remedial Measure
LDR .... Land Disposal Restrictions
LNAPL............... Light Non-Aqueous Phase Liquid
mg/Kg................ Milligram/Kilogram
MGP .... Manufactured Gas Plant
NAPL................. Non-Aqueous Phase Liquid
NAWQC .... National Ambient Water Quality Criteria
NCP .... National Contingency Plan
NYCRR .... New York Code of Rules and Regulations
NYSCC .... New York State Canal Corporation
NYSDEC .... New York State Department of Environmental Conservation
NYSDOH .... New York State Department of Health
NYSDOT .... New York State Department of Transportation
NYSEG .... New York State Electric and Gas Corporation
NYSWQS .... New York State Water Quality Standards
OSHA................ Occupational Safety and Health Administration
PCB .... Polychlorinated Biphenyl
POTW .... ublicly Owned Treatment Works
ppb .... Parts per Billion
ppm .... Parts per Million
RI....................... Remedial Investigation
RIR .... Remedial Investigation Report

ROW .... Right-of-Way
SCGs .... Standards, Criteria, and Guidance
SCOs .... Soil Cleanup Objectives
sf .... Square Feet
SPLP................. ynthetic precipitation leaching procedure
SVI .... Soil Vapor Intrusion
SVOCs.............. Semivolatile Organic Compounds
TAL .... Target Analyte List
TAGM................ Technical and Administrative Guidance Memorandum
TCL .... Target Compound List
TOC .... Total Organic Carbon
µg/L .... Micrograms per Liter
USCS................ Unified Soil Classification System
U.S. EPA........... United States Environmental Protection Agency
UTS................... Universal Treatment Standards
VOCs .... Volatile Organic Compounds

1.0 Introduction

New York State Electric & Gas Corporation (NYSEG) has prepared this Feasibility Study (FS) report to evaluate potential remedial strategies to address manufactured gas plant (MGP) related impacts from a former manufactured gas plant (MGP) site (the Site) located on West Court Street in the City of Ithaca, New York. The MGP [NYSDEC Site No. 7-55-008] was operated by the Ithaca Gas Light Company and the Ithaca Gas and Electric Company. The former MGP site is currently owned by the Ithaca City School District, and site remediation is in process at the Site. This FS has been prepared to address off-site properties that may have been impacted by the potential migration of MGP related materials. This FS also incorporates post-remediation monitoring and management program for OU-1, which has been remediated. A remedial investigation of the off-site properties began in 2002, and a Remedial Investigation Report is currently being prepared for submittal to the New York State Department of Environmental Conservation (NYSDEC).

1.1 Purpose

The applicable guidance document, DER-10 (NYSDEC, 2010a), specifies that the FS Report should be prepared by the party responsible for conducting remediation and submitted to NYSDEC's Division of Environmental Remediation (DER) for approval prior to implementation of the remedy. The purpose of the FS Report is document the development and evaluation of options for a remedial action in accordance with CERCLA [40 CFR 300.430(e)] to address the contamination identified at the site or area of concern which is being addressed by a cleanup. DER-10 specifies that the FS Report should document the completion of the following activities:

- Identify the goal of the remedial program;
- Define the nature and extent of contamination to be addressed by the alternatives developed;
- Develop the Remedial Action Objectives (RAOs) for the Site;
- Develop remedial action alternatives;
- Undertake an initial screening and detailed analysis of the alternatives;
- Implement the specified decision-making process outlined in DER-10 to identify and evaluate appropriate remedial options;
- Develop and provide a detailed description of the proposed remedy; and
- Demonstrate the remedy can achieve the cleanup goals for the Site.

The document is organized as follows: The remainder of Section 1 describes the Site background and previous investigations and interim remedial measures (IRMs). Section 2 discusses the Site composition, nature and extent of chemicals of concern (COC), and results of the risk assessment. The remedial action objectives are presented in Section 3. Media of concern and limits of remediation are discussed in Section 4. Identification and screening of general response actions (GRAs) and evaluations of appropriate technology process options are provided in Section 5. The development and detailed analysis of alternatives is presented in Section 6. References are listed in Section 7.

1.2 Site description and history

The Court Street Site is located in Tompkins County in the City of Ithaca, New York (**Figure 2-1** in Appendix A). NYSEG's predecessors operated a coal gasification plant at the Site from 1853 to 1927. The plant occupied the western portion of the block bound by Esty Street on the north, North Plain Street on the west, and Court Street on the south. The gas plant had two coal sheds, a gas house containing three horizontal retorts, purifiers, two steel gas holders, two underground coal tar storage vessels, a tar separator, and two oil tanks. A subsurface wooden duct system, consisting of two wooden ducts and clay tile lines was formerly used to transport coal tar from the MGP site, along West Court Street, to the Cayuga Inlet for collection and disposal.

NYSEG acquired the plant in 1929 and operated an electric operation center until 1964, when the property was sold to the Ithaca City School District. In April 2002, the Site was divided into two Operable Units to facilitate further investigations at portions of the Site while evaluating remedial options at other portions. Operable Unit 1 (OU-1) consists of the former MGP property. OU-1 is bound by steel sheet piling, and remediation (excavation and off-site disposal) of the OU-1 Site has been completed. (URS, 2010). Operable Unit 2 (OU-2) consists of any properties outside of the sheet piling that may have been impacted by the migration of MGP materials directly from the Site, and OU-2 also includes the remaining portions of the wooden duct system and any properties that may have been impacted by potential tar releases from the ducts. The remaining wooden duct is currently being removed as part of the OU-1 remediation project. As shown on **Figure 2-2** (Appendix A) OU-2 has been divided into three areas: (1) Area 1, which consists of the off-site properties in the vicinity of OU-1; (2) Area 2, which consists of properties located along Washington Street, and (3) Area 3, which consists of the Cayuga Inlet Site and any remaining portions of the wooden ducts and associated properties along West Court Street.

Areas 1 and 2 of OU-2 are located within residential areas that consist of residential buildings (houses), grass-covered areas, sidewalks, asphalt-covered streets and driveways, and overhead and subsurface utilities. The locations of the subsurface utilities in OU-2 are shown on **Figure 2-3** (Appendix A). Area 3 of OU-2 is located within a mixed-use zone that includes both residential and commercial properties. To the north of West Court Street, Area 3 is occupied primarily by commercial properties while the south side of West Court Street is largely occupied by residential properties. Area 3 is not addressed in this FS report, but will be addressed as part of the remediation of the remaining portions of the wooden ducts.

1.3 Summary of previous investigations

From October 2001 through March 2002 NYSEG conducted a Supplemental Remedial Investigation (SRI) at OU-2. The purpose of the SRI was to locate the wooden duct system that ran beneath West Court Street, investigate the contents of the ducts, investigate the nature of the bedding material in the vicinity of the ducts, and to characterize the nature and extent of any contamination that may have been released and migrated from the ducts. The field work conducted during the SRI included the completion of soil borings, the collection of surface and subsurface soil samples, the installation of monitoring wells, and the analysis of soil and groundwater samples. Visual evidence of coal tar or coal tar non-aqueous phase liquids (NAPL) combined with the analytical results indicated that MGP-related impacts to subsurface soils were present along Washington Street and at West Court Street near the intersection of Washington Street. The impacts observed along Washington Street were located in proximity to the municipal sewer line. Analytical results for groundwater samples collected during the SRI identified MGP related compounds in the shallow aquifer along West Court Street and along Washington Street. Additional investigations were recommended to evaluate the extent of groundwater impacts observed along Washington Street.

During October 2002, April 2003, and March 2005, NYSEG implemented residential air monitoring programs to evaluate and delineate any potential air exposures due to MGP related materials. All residences within 100 feet of tar-like materials identified during the SRI were selected for sampling. A total of 173 air samples, which included a combination of sub-slab, indoor air, and ambient air samples, were collected from residences and the Markles Flats food storage area (within OU-1) during the implementation of the air monitoring programs. The air samples were analyzed by USEPA Method TO-15. No formal reports were completed for the programs; however, the laboratory data and Data Usability Summary Reports (DUSRs) were provided to the NYSDEC and New York State Department of Health (NYSDOH).

Based on the results of the SRI, 26 additional surface soil samples were collected from OU-2 during May 2003. The results of the surface soil sampling were provided to the NYSDEC; and evaluated by comparing them to polycyclic aromatic hydrocarbons (PAHs) in background soils of an urban environment. With the exception of one sample, all of the remaining samples contained at least one PAH at a concentration greater than the corresponding NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 soil cleanup objective. The PAHs measured in surface soils are believed to be unrelated to the release of MGP residual materials, and are reflective of typical urban background conditions in OU-2 (AECOM, 2011). Sources of PAHs in surface soils may include soot from petroleum and coal combustion, ash disposal, and urban fill (note that the upper several feet of soil at all locations in OU-2 are composed of fill soils). There are no indications of coal tar or tar-related staining or impacts at or near the ground surface outside of OU-1.

Based on the review of previous investigations of OU-2, a Phase II investigation was implemented to investigate identified data gaps. Between March and June of 2004, 24 soil borings were advanced, and 18 monitoring wells were installed in OU-2. Groundwater samples were collected from 8 previously installed monitoring wells and the 18 newly installed monitoring wells. Seven direct-push groundwater grab samples were also collected. A data summary report titled Phase II OU-2 Data Summary dated September 13, 2004 was submitted to the NYSDEC. With the exception of one sample, which contained two PAHs in concentrations greater that the cleanup objectives, none of the subsurface soil samples contained constituents of concern (COCs) in concentrations greater than their respective NYSDEC TAGM 4046 soil cleanup objectives. Strong coal tar-like odors, NAPL, and NAPL stringers were observed during the installation of several soil borings. Where these impacts were observed, no samples were collected for laboratory analysis. Of the samples collected from the 26 monitoring wells, five contained benzene, ethylbenzene, toluene, and/or total xylenes (BTEX) and PAHs in concentrations greater than the applicable NYSDEC groundwater standards.

Three test pits were excavated in October of 2004 to evaluate the possible conduits for NAPL along Park Place and Washington Street, and to investigate the wooden duct along West Court Street between Meadow Street and the Cayuga Inlet. No MGP-related impacts were observed in the test pit excavated along Park Place. Slight coal tar odors were noted, and NAPL was observed in the silty clay within a sand lens during the excavation of the test pit along Washington Street. During the excavation of the test pit along Court Street, a wooden duct, an 8-inch diameter clay pipe, and a 6-inch diameter steel pipe were identified. Stained soils and MGP-like odors were identified in the vicinity of the wooden duct and pipes.

A remedial investigation was performed by AECOM to complete the delineation of MGP related impacts in OU-2. The results of this remedial investigation are summarized in the Remedial Investigation Report (AECOM, 2010) and in Section 2.0 of this FS report.

1.4 Interim remedial measures

Between February and April of 1999, NYSEG implemented Interim Remedial Measures (IRM) (NYSEG, 1999) at the Ithaca Cayuga Inlet Coal Tar Site to limit potential exposure to MGP residuals and to limit potential future impacts to groundwater. Historically a wooden duct conveyed coal tar from the Court Street Site to the Cayuga Inlet Coal Tar Site located approximately one-half mile to the west. The IRM consisted of the excavation and disposal of a coal tar collection well and associated materials. The IRM also included the excavation and disposal of approximately 1,500 tons of impacted soil and debris in the vicinity of the former tar well. A portion of the wooden duct system was identified during the excavation activities. The wooden duct was removed from the Cayuga Inlet to the east side of the Cayuga Inlet Coal Tar Site. At the eastern property line, the duct was cut and plugged with grout. Post-excavation soil samples were collected to demonstrate the reduction in concentrations of PAHs, volatile organic compounds (VOCs), and heavy metals typically associated with MGP residuals.

Between October 2003 and September 2005, NYSEG implemented an IRM to excavate, remove, and dispose of two subsurface wooden ducts and clay tile pipes along West Court Street, from the intersection of Meadow and West Court Streets to the former MGP Site at the intersection of West Court and North Plain Streets. The IRM also included the excavation and removal of coal tar impacted soil on Washington Street, between West Court and Cascadilla Streets. The locations of the excavations are included on **Figure 2-2** (Appendix A). Approximately 41,000 tons of coal tar impacted soil and 750,000 gallons of water were removed and disposed of off-site during the implementation of the IRM. Post excavation soil samples were collected to demonstrate the reduction in concentrations of MGP residuals. The results of the field activities were submitted to the NYSDEC in a Final Engineering Report, dated April 2007 (NYSEG, 2007).

2.0 Summary of remedial investigation

2.1 Geology and hydrogeology

This section describes the regional geologic setting of the Ithaca area and the geological and hydrogeological conditions defined during Remedial Investigation activities.

2.1.1 Geology

The geology in the Ithaca area consists of Devonian age sedimentary bedrock overlain by fluvial outwash and lacustrine deposits which are reported to exceed 300 feet in thickness in the Cayuga Valley. The Court Street Site lies on these lacustrine deposits at the southern end of Cayuga Lake (USDA-SCS, 1965; Crain, 1974). Lacustrine deposits in this area generally consist of laminated silts and clays.

The stratum at OU-2 consists of fill, underlain by a silty sand, silty clay, with some local deposits of sand and gravel. These four units are described below. Five cross-sectional views have been developed to illustrate the subsurface conditions observed during the 2002 and 2002 remedial investigations. The locations of the cross-sections are shown on **Figures 4-1a and 4-1b** (Appendix A), and the cross-sections are included as **Figures 4-3 through 4-10** (Appendix A). As shown on the **Figure 4-5** (Appendix A), the four subsurface units were identified during the remedial investigation activities.

The fill material in OU-2 is comprised of gravel, brown medium to coarse sands, and some brick fragments and ash. Fill is present in all areas of the Site in thicknesses generally ranging from 1 to 2 feet. The fill material is similar in nature and thickness along both Washington Street and in the vicinity of OU-1.

Beneath the fill is a silty sand unit that is composed of tan-gray fine sand and silt with some mottling. The unit becomes denser and finer-grained with depth. The highest silt content was observed at the bottom of the unit, where traces of clay were identified. The silty sand unit was identified in every soil boring installed in OU-2.

Beneath the silty sand lies a gray silty clay unit. Some fine sand was observed in the top of the unit but grades out with depth. Thin lenses of medium to coarse sand were also identified in this unit. The boundary between the overlying sand unit and the silty clay varies as shown on the cross sections. A contour map showing the top of the silty clay unit is presented as **Figure 4-11** (Appendix A). As presented on this figure, the top of the silty clay unit ranges from approximately 5 to 18 feet below ground surface (bgs).

A sand and gravel unit was identified beneath the silty clay at several locations in OU-2. This sand and gravel unit consists of medium to fine-grained brown sand, with coarse gravel. The gravel content of this unit varies, and the unit shows a coarse texture where it is more prominent. The gravel unit was delineated within Area 1 and is depicted in **Figure 4-2** (Appendix A) and **Figure 5-1** (Appendix A).

2.1.2 Hydrogeology

Based on these investigations, two groundwater flow systems exist above a deep gravely sand aquifer at OU-2. The two groundwater systems are defined as a shallow, unconfined aquifer in the fill and upper silty sands and an intermediate, confined aquifer in the deeper permeable sands and gravel. The confined intermediate aquifer is located below the silty clay layer.

Water level measurements taken in the shallow aquifer at the site wells during the 2010 RI indicated that groundwater is between 3 and 6 feet bgs across OU-2. A ground water flow direction map is presented as **Figure 4-12**. Shallow groundwater flows toward the northwest across OU-2. Horizontal hydraulic gradient is estimated to be approximately 0.003 -0.006 foot per foot (ft/ft). Based on the permeability data presented in previous reports, flow within the aquifer is believed to be primarily horizontal due to the underlying silty clay unit. Horizontal flow in the shallow aquifer was previously estimated to be approximately 23-32 feet per year. Previous data also suggested that the silty clay unit was acting as an aquitard that limits the hydraulic connection between shallow groundwater and the underlying intermediate aquifer.

Seven monitoring wells were installed in OU-2 during the 2002 SRI to investigate the characteristics of the groundwater in the intermediate aquifer. Gauging of these wells indicated that the intermediate aquifer was found at depths between 21 and 28 feet bgs across OU-2. This aquifer appeared to be confined at the top by the silty clay unit and below by another clayey unit. The aquifer consists of gray sand and gravel. Horizontal flow in the intermediate aquifer is estimated to be in the range of 25 to 45 feet per year, which is similar to flow in OU-1 (E.C. Jordan, 1986; E.C. Jordan, 1987).

2.2 Nature and extent of contamination

Several field investigations have been conducted to evaluate the nature and extent of MGP related impacts in OU-2. A full description of the nature and extent of contamination is provided in the 2010 Remedial Investigation Report for Operable Unit 2 [AECOM, 2010]. Conclusions for each media, by area, are summarized below.

2.2.1 Surface Soils

- Surface soil samples were collected from 53 locations during previous investigations. The sample locations are shown on Figure 7-3 (Appendix A). The PAHs measured in surface soils are believed to be unrelated to the release of MGP residual materials, and are reflective of typical urban background conditions in OU-2. Sources of PAHs in surface soils may include soot from petroleum and coal combustion, ash disposal, and urban fill (note that the upper several feet of soil at all locations in OU-2 are composed of fill soils). There are no indications of coal tar or tar-related staining or impacts at, or near, the ground surface outside of OU-1. Further evaluation of the surface soil samples is provided in the RFI report (AECOM, 2011).

2.2.2 Soil vapor

Between October 2002 and March 2010, SVI investigations were conducted across OU-2 during five separate events, which included 56 homes, one building on OU-1, and one property to the south of OU-1. The sampled areas represent locations where MGP tar was historically present in the subsurface. The sample locations are shown on Figure 7-2 (Appendix A). The levels of site-related constituents detected in the sampled soil vapor samples were generally the 90^{th} percentile of the NYSDOH background indoor air values. Based on these levels, further actions are not anticipated to be required. Furthermore, the concentrations of site-related constituents in the subsurface are expected to further decrease with time due to the removal of subsurface sources as part of the remedial activities completed at the site.

2.2.3 Area 1 Subsurface soil

- Coal tar or coal tar NAPL impacts were observed at several soil borings advanced to the west of OU-1. At each of these borings, coal tar NAPL-impacted soil was observed between 11 and 15 feet bgs and within the gravel unit. Impacts were not observed in the underlying clay in any of these soil borings.
- Coal tar or coal tar NAPL impacts were observed in eight soil borings advanced to the north of OU-1 along North Plain Street. These impacts were observed either within the gravel unit or within sand lenses in the upper portion of the silty clay. The depth of impacts observed in this area ranges from 9 to 15 feet bgs.
- NAPL blebs, or coal tar NAPL impacts were observed in several borings advanced north of OU-1 along Esty Street. Consistent with the other borings advance in Area 1, the impacts observed in this area were generally contained within the gravel unit. Impacts were not observed in the underlying silty clay in this area.
- Based on the results of the 2010 investigation and previous investigations, with the exception of some isolated sand lenses, MGP-related impacts appear generally limited to the gravel unit, which extends to the west and north of OU-1 (see **Figure 5-2** in Appendix A). Additionally, it is likely that the gravel unit is a conduit for the migration of MGP residuals from OU-1. The underlying silty clay is likely acting as a confining layer, limiting the downward migration of MGP residuals.
- A summary of the extent of observed hydrocarbon impacts in subsurface soils for Area 1 of OU-2 is presented on **Figure 6-1** (Appendix A).

2.2.4 Area 1 Groundwater

- A summary of groundwater sample results from 2002 through 2010 is shown on figure 7-1 (Appendix A).
- Benzene was detected at concentrations greater than the groundwater standard in the samples from two of the 15 wells sampled in Area 1, MW-11S and MW-44S.
- One PAH compound, acenaphthene was detected in the groundwater sample collected from MW-11S at a concentration of 82 µg/l, which was greater than the groundwater guidance value of 20 µg/l. PAHs were not detected at concentrations greater than the groundwater standards or guidance values in any other samples collected from Area 1 monitoring wells during March 2010.
- Total cyanide was detected in six of the 15 wells sampled in Area 1. None of the concentrations were found to be greater than the groundwater standard of 200 µg/L.
- The distribution of COCs in groundwater in Area 1 is presented on **Figure 6-3** (Appendix A).
- As noted in the AECOM (2010) RI Report, the following trends have been observed in Area 1 between 2004 and 2010:
    - In MW-11S, concentrations of the VOC benzene have declined from 20 ug/L to 5 ug/L.

- In MW-11S, concentrations of the PAH acenapthalene have exhibited a slight increase from 73 ug/L to 82 ug/L.

2.2.5 Area 1 Soil vapor

- Soil vapor, indoor air, and ambient air samples were collected at the residence at 420 North Plain Street during March 2010. The sample results were compared to a database of typical background indoor air concentrations from fuel oil heated homes in New York State that was compiled by the NYSDOH in 2003, and revised in 2005. The low level VOCs detected in these samples are likely not indicative of MGP-related impacts.

2.2.6 Area 2 Subsurface soil

- MGP-related impacts were observed in six soil borings advanced during 2010. These borings include SB144, SB147, SB153, SB156, SB158, and MW48S.
- Impacts were only observed at boring locations along the west side of Washington Street and in close proximity to the utility corridor.
- Trace coal tar NAPL stringers, NAPL blebs, or sheens were observed in very thin, isolated sand lenses and/or root channels within the silty clay unit. Impacts were observed at depths ranging from six to 19 feet bgs.
- Visible evidence of MGP-related residuals was not observed in the silty clay in any of the Area 2 borings.
- Trace coal tar NAPL and sheen were observed in borings SB96 and SB147. These impacts were observed within a local pocket of sand and gravel. No other sand and gravel pockets were observed in any other Area 2 soil borings.
- **Figure 6-2** (Appendix A) presents a summary of the distribution of COCs in subsurface soils in Area 2.

2.2.7 Area 2 Groundwater

- BTEX compounds were detected at concentrations greater than their respective groundwater standards in the samples from three of the 23 wells sampled in Area 2, MW-39, MW-46S, and MW-48S. The total BTEX concentrations detected in these wells ranged from 12.17 µg/l at MW-39 to 2,972 µg/l at MW-46S.
- Two PAH compounds, acenaphthene and naphthalene were detected at concentrations greater than the respective groundwater guidance values of 20 µg/l and 10 µg/L in the samples collected from MW-39, MW-46S, and MW-48S. PAHs were not detected at concentrations greater than the groundwater standards or guidance values in any other samples collected from Area 2 monitoring wells.
- Cyanide was detected in six of the 23 wells sampled in Area 2. The total cyanide concentration detected in the sample from MW- 22S (384 µg/l) was found to be greater than the groundwater standard of 200 µg/L. Cyanide was not detected at concentrations greater than the groundwater standard in any other samples collected from Area 2 monitoring wells.
- The distribution of COCs in groundwater in Area 2 is presented on **Figure 6-4** (Appendix A).
- As noted in the AECOM (2010) RI Report, the following trends have been observed in Area 2 between 2004 and 2010:

  - In MW-39, concentrations of the VOC BTEX compounds benzene and isopropylbenzene have declined from 31 ug/L to 10 ug/L and from 23 ug/L to 6.2 ug/L, respectively.
  - In MW-39, concentrations of the PAHs acenapthalene and naphthalene have declined from 150 ug/L to 51 ug/L and from 460 ug/L to 15 ug/L, respectively.
- Based on the preliminary results from the September 2010 post-remediation groundwater sampling event, the following trends have been observed in Area 2 between 2002 and 2010:
  - In MW-15S, concentrations of total BTEX compounds have decreased from 163.5 ug/L in 2002 to 3.72 ug/L in September 2010.
  - In MW-15S, concentrations of total PAH compounds have decreased from 255 ug/L in 2002 to 43.99 ug/L in September 2010.
  - In MW-46S, concentrations of total BTEX compounds have decreased from 2,972 ug/L in March 2010 to 1,488 ug/L in September 2010.
  - In MW-46S, concentrations of total PAH compounds have decreased from 1,736.03 ug/L in March 2010 to 827.52 ug/L in September 2010.
  - In MW-48S, concentrations of total BTEX compounds have decreased from 2,344 ug/L in March 2010 to 1,774 ug/L in September 2010.
  - In MW-48S, concentrations of total PAH compounds have decreased from 1,484.19 ug/L in March 2010 to 825.1 ug/L in September 2010.These trends will continue to be monitored during future post-remediation sampling events.

2.2.8 OU-1 Subsurface soil

- Ninety seven (97) soil samples were collected during the excavation of OU-1 as part of the confirmation soil sampling program. Confirmation samples were collected from the bottom of the excavation within each excavation cell. Twenty (20) of the 97 samples contained at least one COC at concentrations greater than the corresponding cleanup criteria. A summary of these 20 samples is presented below.

SAMPLE ID	SAMPLE LOCATION	SAMPLE DEPTH (ft)
BM-EX-001	Between sheet piles along the western boundary	15
BM-EX-002		15
BM-EX-007	Cell 1A Northwest corner	20
BM-EX-008		15
BM-EX-009		15
BM-EX-011		10
BM-EX-014	Cell 6 Southwest corner	20
BM-EX-016	Cell 1B Northwest portion	20
BM-EX-017		20
BM-EX-018		20
BM-EX-019		20
BM-EX-021		20
BM-EX-024		18
BM-EX-039	Cell 2A North central portion	20
BM-EX-55	Between sheet piles along the eastern boundary	11
BM-EX62	Cell 4A Southwest portion	11
BM-EX-069	Between sheet piles along the southeast corner	9
BM-EX-079	Cell 5A South central portion	12
BM-EX-082		16
BM-EX-085	Between sheet piles along the southern boundary	17

3.0 Remedial Goals and Remedial Action Objectives

This section discusses the development of Remedial Action Objectives (RAOs) based on Standards, Criteria and Guidance (SCGs) and other regulations and guidance To Be Considered (TBCs). General response actions (GRAs) to address the RAOs are then identified.

3.1 Standards, Criteria, and Guidance (SCG) Values

In accordance with the New York Code of Rules and Regulations (6 NYCRR 375-1), NYSDEC-issued permits are not required for environmental remediation activities conducted at this Site. Rather, the activities are evaluated and implemented based on the substantive elements of the applicable and relevant and appropriate state environmental laws and regulations. Federal applicable, relevant and appropriate requirements (ARARs) must be complied with fully, including the requirements to obtain permits, if necessary. Since New York State does not have ARARs in its statute, these State environmental laws and regulations, in conjunction with the Federal environmental laws and regulations, are collectively referred to as SCGs.

The SCGs that may guide the remedial activities at OU-2 are identified in this section. This includes both New York State SCGs, as well as federal standards that are more stringent than State SCGs. New York State SCGs are standards or requirements that implement the New York State Environmental Conservation Law. Remedial actions conducted in New York State are required to attain SCGs to the extent practicable as per NYSDEC TAGM 4030 (NYSDEC, 1990). SCGs are categorized as chemical-, action-, or location-specific:

- Chemical-specific SCGs set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants or contaminants. **Table 3-1** presents the chemical-specific SCGs applicable to OU-2.
- Action-specific SCGs set controls or restrictions on particular kinds of activities that may be selected to accomplish a remedy. These SCGs may specify particular performance levels, actions or technologies to be used to manage hazardous substances, pollutants or contaminants. **Table 3-2** presents the action-specific SCGs applicable to OU-2.
- Location-specific SCGs set restrictions on activities within specific locations, such as wetlands and floodplains, and depend on the characteristics of a site and its immediate environs. **Table 3-3** presents the location-specific SCGs applicable to OU-2.

3.2 Remedial Action Objectives

The RAOs are site-specific goals that address media of concern, specific contaminants, and the active exposure pathways. The RAOs are established as the overall goal for remediation activities to provide protection of human health and the environment.

The RI found no immediate potential threats to human or ecological receptors. The primary constituents of concern (COC) in soil and groundwater were found to be benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAHs).

Upon consideration of the SCGs, and the nature and extent of MGP impacts, as described in the RI, the following long-term RAOs for protection of human health and the environment at the Site were developed:

1. Remove, contain, and/or treat the source of MGP groundwater contamination, including non-aqueous phase liquid, to the extent practicable.

2. Minimize human contact with soil containing COCs at levels above NYSDEC Part 375 Soil Cleanup Objectives - Residential Use.

3. Minimize ingestion/direct contact with MGP contaminated groundwater.

4. Mitigate groundwater impacts to the extent practicable.

4.0 Media of Concern

4.1 Exceedances of SCGs

Table 3-1 presents chemical-specific SCGs for surface soil, subsurface soil and groundwater.

4.1.1 Volume Estimates and Limits of Remediation

The volumes or areas of impacted soil and groundwater to be addressed by the proposed remedial alternatives were estimated as follows utilizing the scaled drawings of the Site. RAOs seek to address impacted media to the extent practicable. The limits of remediation are determined by the feasibility of conducting specific remedial actions on the Site as well as the extent of impacted media. The limits of remediation are described below.

4.1.1.1 Subsurface Soils

The remedial alternatives would address impacted areas within public right-of-ways and on NYSEG properties. NAPL, tar-like blebs and soils exhibiting hydrocarbon sheen materials are present in subsurface soil. NAPL has been observed along Esty Street immediately north of OU-1 and along North Plain Street immediately west of OU-1 to a depth of approximately 11 ft bgs. In addition, NAPL to a depth of approximately 19 ft bgs has been observed along the eastern side of North Plain Street north of Esty Street. A seam of gravel with DNAPL has been observed at approximately 15 ft bgs along the southern side of Esty Street approximately 150 ft from the intersection of Esty Street and North Plain Street. Coal tar is observed to be present on the eastern side of the intersection of Esty Street and North Plain Street. Hydrocarbon staining, odor and sheen are observed along Esty street east of north Plain Street and immediately south of OU-1. Exceedances of contaminants in soil are presented on **Figures 6-1** and **6-3** (Appendix A). Cross sections illustrating the depths of impacts are presented in **Figures 4-3 through 4-10** (Appendix A).

The areal extent of the impact in Area 1 that would be addressed by the proposed remedial alternatives is approximately 42,000 square feet. The volume of the impacted soil to be addressed by the remedial alternatives in Area 1 is approximately 25,000 cubic yards (for average depth of 16 feet).

The areal extent of the impact in Area 2 that would be addressed by the proposed remedial alternatives is approximately 50,000 square feet. The volume of the impacted soil to be addressed by the remedial alternatives in Area 1 is approximately 22,000 cubic yards (for average depth of 12 feet).

These limits of remediation address the RAOs to the extent possible, as the extents of impacted media are primarily located under non-residential areas including road pavement, sidewalks and public right-of-ways.

4.1.1.2 Groundwater

Depth to groundwater varies from 3 to 6 feet bgs across OU-2. Based on the depths to water measured in wells along Esty and North Plain Streets, shallow groundwater is likely between 5 and 6 feet bgs across OU-1. As described in Section 2.1.1, the shallow aquifer is confined by a silty clay unit the top of which ranges from approximately 5-18 feet bgs.

The groundwater exceedances are presented on **Figures 6-2 and 6-3** (Appendix A). Groundwater sample results for total BTEX, total PAHs, and cyanide from 2002 through 2010 are summarized on Figure 7-1 (Appendix A).

Remedial actions in regards to groundwater would be concentrated on the shallow groundwater aquifer. As described in Section 2.1.2, the shallow silty clay unit acts as an aquitard limiting the hydraulic connection between the shallow and underlying intermediate groundwater aquifer. The shallow water-bearing unit beneath the Site is observed to contain COCs associated with the former MGP operations, while the deep groundwater aquifer (found at depths between 21-28 feet) located below the Site contains only trace BTEX and no PAHs.

4.1.1.3 Soil Vapor

Extensive soil vapor and indoor air sampling was performed during the RI. Based on the results of this sampling, soil vapor has been impacted by site-related residuals; however indoor air receptors have not been identified. Therefore, an estimate of the extent of impacted soil vapor has not been included in the FS. Note that under each of the evaluated alternatives, source removal would be performed, and the removal of this material is expected to further reduce the potential that soil vapor may be a concern for potential receptors in the on-site and off-site areas.

4.2 Extents of NAPL

NAPL is present in subsurface soil in Area 1 and was observed in soil borings and in wells along North Plain Street and the east end of Esty Street. The vertical extent of observed NAPL is 8-19 feet bgs in specific portions of Area 1.

5.0 Identification and screening of remedial technologies

The screening of remedial technologies is performed in two steps: (1) the identification and screening of technology types and process options for each GRA, and (2) the evaluation and selection of representative process options. The following sections discuss the results of these steps.

5.1 General Response Actions

To meet the RAOs developed for the Site, the following GRAs for soil and groundwater have been identified:

- Limited Action
- Containment
- Removal/Treatment/Disposal

The following GRA descriptions have been generated in accordance with the guidelines in NYSDEC's Selection of Remedial Actions at Inactive Hazardous Waste Sites (TAGM 4030).

Limited Action involves institutional controls that restrict access to contaminated areas through physical and/or administrative measures; Limited Action also includes long-term monitoring.

Containment actions include control, isolation, and encapsulation technologies that involve little or no treatment, but provide protection of human health and the environment by reducing mobility of contaminants and/or eliminating pathways of exposure. Since these technologies consist primarily of physical barriers to control migration, contaminant toxicity and volume are not reduced significantly within the contained area.

Removal/Treatment/Disposal actions include technologies that act to reduce the volume, toxicity, and/or mobility of contaminants. These technologies include in-situ treatment, removal, ex situ treatment, and destruction. Solidification/chemical fixation treatment methods significantly reduce the mobility of contaminants and the availability of these contaminants for environmental transport and uptake. Separation/treatment methods reduce contaminant volume, toxicity, and/or mobility by treating waste streams to acceptable cleanup levels. Destruction technologies permanently and irreversibly destroy or detoxify contaminants to acceptable cleanup levels, thereby reducing contaminant volume, toxicity, and mobility. Disposal actions include both on-site and off-site technologies, including reuse/recycling, landfill disposal, and discharge of remediation wastewater to a sewer or Publicly Owned Treatment Works (POTW).

5.2 Identification of Screening Technologies

Remedial technology types associated with each GRA are discussed in this section. The remedial technology types associated with each of the GRAs typically considered for the cleanup of contaminated soil were developed from the literature, experience gained from implementing other hazardous waste remediation projects, knowledge of new technologies, and the professional judgment of engineers performing feasibility studies.

Most of these remedial technology processes contain several different process options that could apply to the contaminated soil. These potentially applicable technologies and process options are screened based on technical feasibility, considering site-specific conditions, contaminant types, and concentrations.

In this section, potential technologies for remediation of contaminated soil exceeding SCGs are discussed and summarized with the results of the initial screening. For those technologies that were not retained for further evaluation, the rationale for their elimination is included. **Tables 5-1** and **5-2** summarizes the results of the preliminary screening of soil and groundwater technologies, respectively, and process options discussed herein.

5.2.1 Soil

5.2.1.1 Limited Action – These screening technologies also apply to the other media of concern

Institutional Controls

Description: With this option, environmental easements would be specified in accordance with New York State regulations to restrict the land use and would be specified in the real estate transaction records for the property. Examples would include environmental easements and limitations on excavation at the Site.

Initial Screening: No active remediation is implemented under this option. Any reduction in the toxicity, mobility, or volume of contaminants would be the result of natural attenuation since no active treatment would be implemented. The evaluation of this limited action alternative serves as a baseline for comparison with other alternatives. This alternative is retained for further evaluation. Use restrictions may be required during or after implementation of the selected remedial alternative. Environmental easement is retained as a process option.

Health and Safety Plans

Description: This process option includes the preparation, implementation, and maintenance of a Health and Safety Plan (HASP) for any site workers performing tasks on the property. The plan would require monitoring and use of personal protective equipment (PPE) during invasive construction activities at the Site, and a soils and groundwater management/handling plan would be used by construction workers conducting intrusive activities to mitigate exposure to impacted soils and groundwater.

Initial Screening: A HASP may be required during or after implementation of the selected remedial alternative. The HASP is retained as a process option.

Monitoring and Site Reviews

Description: This process option includes periodic data collection (e.g., quarterly, annually) and review of the data to assess conditions at the Site. These data would be used to determine if implemented remedial activities have achieved the RAOs or are continuing to be protective of human health and the environment as conditions improve towards achieving the RAOs. Should site reviews indicate conditions are worsening or the conditions pose an unacceptable risk to human health or the environment, additional activities could be implemented.

Initial Screening: Periodic monitoring and site reviews are necessary to assess the progress of remedial activities and the protectiveness of implemented actions until all RAOs are achieved. They are a necessary component of nearly all of the remedial actions, the exception being those that immediately achieve RAOs. Therefore, monitoring and site reviews are retained as a process option.

5.2.1.2 Containment

Soil Cap

Description: A soil cover can be installed over contaminated soil to prevent direct contact with contaminants. A soil cover would have a high permeability relative to clay, and would allow percolation of surface water, runoff.

Initial Screening: A soil cover would be effective in reducing direct contact with contaminated site-wide soils but would not reduce contaminant migration to groundwater. Soil caps are susceptible to erosion from weather-related storm forces which can be mitigated with a properly maintained vegetative cover. Soil caps are also susceptible to settling, ponding of liquids, and naturally occurring invasions by burrowing animals and deep rooted vegetation if not properly maintained. Existing grassed surfaces and underlying clean soil serve as existing soil caps. This option is retained.

Asphalt Cap

Description: An asphalt cap would consist of graded soil, a gravel sub-base, and asphalt paving as a final cover. The cap minimizes wind and rain erosion, preserves slope stability, and provides protection from the elements for layers below it.

Initial Screening: An asphalt cap provides a low permeability cover to contain hazardous substances. It is less susceptible to erosion from weather-related forces than a soil or clay cap. An asphalt cap is subject to cracking and settling if not properly maintained. However, it would be effective in achieving remedial action objectives for soil, including reducing direct contact with contaminated soils. Existing paved surfaces serve as existing soil caps. This option is retained.

Multi-Media/Engineered Cap

Description: The multi-media cap is a combination of two or more of the single layer capping technologies. A disadvantage of one layer can be compensated for by an advantage of another layer. Most caps recommended for hazardous waste projects are multi-media caps. The multi-media cap typically consists of two (2) feet of clay, a synthetic liner, filter fabric, one (1) foot of sand, two (2) feet of top soil, and vegetation at the top.

Initial Screening: The performance of a properly installed, multi-layered cap is generally excellent. However, after time, the integrity of the synthetic liner becomes uncertain and should be investigated regularly. Unforeseen settling, invasions by burrowing animals, and deep rooted plants also contribute to the need for periodic monitoring and maintenance of the cap, but to a lesser extent than a single media cap. This type of cap would raise the elevation of the Site considerably above the surrounding area or result in unnecessary excavation and disposal if the existing grade were maintained. It would also be necessary to provide proper drainage. Installation of this cap would require restrictions on future use of the Site. This process option is not retained for further consideration as a process option.

In Situ Solidification

Description: In-situ solidification is a process whereby contaminated soils are converted in-place into a stable soil-cement matrix which reduces the mobility of contaminants by reducing the overall permeability.

Solidification involves the mixing of soils with a solidification agent, such as a cement based grout mixture. The technique has proven successful at many former MGP sites.
The implementation of this approach involves a batch plant to prepare the solidifying agent and a large diameter soil mixing rig or jet grout rig to blend the solidifying agent with the soils. Application may be achieved in both the saturated and unsaturated zones with this technology.

Initial Screening: For the Site contaminants and physical conditions present, this process option could effectively reduce the risks associated with the Site. Treatability studies would be required prior to design of an in-situ solidification remedy for the Site. This technology is retained for further evaluation.

5.2.1.3 Removal/Treatment

Treatment

In Situ Treatment
Treatment technologies are used to change the physical or chemical state of a contaminant or to destroy the contaminant completely to reduce volume, toxicity or mobility of the contaminant. In-situ treatment is a technology category in which contaminated soil is treated "in place" without removal. The technologies evaluated in this category are soil vapor extraction, soil washing, solidification, steam stripping, biodegradation, and chemical oxidation.

Soil Vapor Extraction (SVE)
Description: Wells are installed across the impacted material down to the water table. Through a network of piping, a vacuum is applied to the wells to draw off the volatile constituents as a vapor. Some variations utilize injected air into wells within the water table combined with vacuum extraction to liberate contaminants within the groundwater along with vadose zone contamination. The removed vapor usually requires further treatment via carbon adsorption or thermal oxidation prior to release to the atmosphere. This process option can also be applied to the construction of engineered stockpiles of impacted soil after excavation. Slotted pipes are installed within the stockpiles and a vacuum is applied to draw off the VOCs. An emissions control system is required to treat extracted vapor prior to release to the environment.

Initial Screening: Since this Site contains subsurface structures, these would serve as obstructions or preferential flow paths impeding the withdrawal of vapor phase constituents through the vadose zone and would cause short circuiting within the subsurface, resulting in incomplete exposure of impacted material to the vacuum. VOCs present in the impacted area are generally amenable to soil vapor extraction. However, coal tar and PAHs, the predominant contaminants of concern at the Site, are not highly volatile and not highly amenable to this treatment process, particularly the higher-ringed compounds. Therefore, this process option is not technically feasible and is not retained for further evaluation.

In Situ Soil Washing
Description: Organic constituents can be washed from contaminated soils by means of an extraction process termed "soil washing." An aqueous solution (e.g., surfactant) is injected into the area of impacted material. As the aqueous solution flows through the impacted media, sorbed contaminants are mobilized into solution by reason of solubility, formation of an emulsion, or by chemical reaction with the flushing solution. The solution, combined with the removed constituents, is then extracted from the subsurface by extraction wells. Surfactants can be used to improve the solvent property of the recharge water, emulsify insoluble organics, and enhance the removal of hydrophobic organics sorbed onto soil particles. Surfactants improve the effectiveness of contaminant removal by improving

both the detergency of aqueous solutions and the efficiency by which organics may be transported by aqueous solutions. Additional treatment of the extracted aqueous waste is often necessary prior to disposal.

Initial Screening: In-situ soil washing relies on the homogeneity of the subsurface medium for proper transmission of the washing reagent throughout the saturated zone and contact with organic constituents. Site geology includes heterogeneous fill material and subsurface structures which could negatively impact the ability of the washing reagent to contact all impacted material. Also, the low solubility of the heavier PAHs could prevent effective soil washing even in the presence of a surfactant. This process would also generate a substantial quantity of wastewater that would require treatment and disposal. Therefore, this process option is not technically feasible and is not retained for further evaluation.

In Situ Biodegradation

Description: Biological treatment involves the use of native microbes or selectively adapted bacteria to degrade a variety of organic compounds. The aerobic biological processes usually involve the addition of microbes, nutrients, and oxygen to the contaminated soil. To enhance the performance of microbial activity in the subsurface, oxygen is added to the saturated zone via either an oxygen releasing compound or controlled direct injection of air or oxygen itself. Treatment is generally only accomplished in the saturated zone.

Initial Screening: This process option relies on the natural action of microbial activity to reduce levels of organic constituents in the subsurface. In-situ aerobic biodegradation is suitable for use on the organic constituents present on-site; however, this process could take more time than others. This technology is retained for further evaluation.

In Situ Oxidation

Description: In-situ chemical oxidation (ISCO) involves the injection of an oxidizing reagent into the subsurface to break down the organic constituents into non-toxic byproducts (i.e., carbon dioxide and water under complete oxidation). Hydrogen peroxide (Fenton's reagent), permanganate or persulfate are commonly used oxidation chemicals used for remediation, with additives and catalysts to enhance the reaction characteristics. Typically, the oxidant is applied as a liquid and delivered to the subsurface through a series of injection points/wells, or by soil mixing. The amount of reagent needed, method of addition/spacing of injection points, and the frequency of injection to achieve cleanup goals are dependent upon organic concentrations and soil characteristics.

Initial Screening: This technology has been shown to be effective in the destruction of high levels of organic constituents in the subsurface saturated zone, including PAHs and BTEX. ISCO is most effective for treating aqueous phase contaminants, and effectiveness in treating the unsaturated zone is lower. Bench-scale testing, in combination with field pilot studies, would be necessary to further refine the operational conditions of this technology, including oxidant selection and injection spacing. ISCO is also not as effective at directly treating the heavy NAPL source materials similar to those detected at OU-2; however, this technology would significantly reduce aqueous concentrations thereby increasing NAPL dissolution through concentration gradients. Accordingly, ISCO could potentially result in the temporary mobilization of source materials and/or an increase in the concentrations of dissolved phase groundwater contamination. Therefore, several applications of chemical oxidants may be needed to further reduce contaminant concentrations. This process option is retained for further evaluation.

Phytoremediation
Description: Phytoremediation is the use of plants to extract contaminants from contaminated media. Specially selected plants known to be effective for such purposes are planted and allowed to grow. As the plants grow they absorb contaminants. The plants are then harvested and either incinerated or composted. For example, the Indian Mustard Plant has been the subject of much investigation into its potential for extracting and absorbing high amounts of lead, chromium, copper, and other heavy metals, as well as PAHs, into its stalks and leaves from the soil.

Initial Screening: This technology can be effective in removing metals and PAHs and is low in cost. However due to the depth of the contamination at the Site and the presence of significant areas of paved areas its potential effectiveness is limited. In addition, this process option would not be effective for treating contamination at depths greater than that of the plant's root structure (i.e., shallow or surface soils). This process option could also be lengthy as it may be necessary to harvest several crops before cleanup criteria are met. Therefore, phytoremediation is not retained for further evaluation.

Removal

Excavation
Description: Excavation refers to the use of construction equipment such as backhoes, bulldozers, front-end loaders and clamshells that are typically used on land to excavate and handle contaminated soil.

Initial Screening: Excavation ensures that contaminants are removed with the excavated soils. Excavation is retained as an option.

Ex situ Treatment
Treatment technologies are used to change the physical or chemical state of a contaminant or to destroy the contaminant completely to reduce volume, toxicity and/or mobility of the contaminant. Ex situ treatment first requires the removal of the contaminated medium prior to any type of treatment or disposal. The process options for treatment technologies that are included are reuse/recycling, solidification, thermal desorption, incineration, vitrification, phytoremediation, biodegradation, soil washing and soil vapor extraction.

Reuse/Recycling
Description: This category of process options includes the processing of removed impacted soil or material at off-site facilities that would use the material as part of the process to produce an end product, or as a fuel substitute. These process options include: cold batch asphalt (on or off-site), hot mix asphalt batching, brick manufacturing, cement manufacturing, and co-burning in an industrial boiler.

Initial Screening: Materials and soil impacted with MGP residuals are amenable to treatment in these off-site commercial facilities. Each process has different material handling and feed preparation requirements. This class of process options is applicable and effective for removal of volatile and semi-volatile organic constituents from impacted material at the Site. Therefore, it is retained for further evaluation.

Solidification
Description: Solidification is a process whereby contaminated soils are converted in-place into a stable soil-cement matrix which reduces the mobility of contaminants by reducing the overall permeabilityGenerally cement additives are used, with other reagents as necessary, to solidify the

organic constituents present in soils at the Site. A pug mill may be used to thoroughly mix the impacted material with the additives.

Initial Screening: This process would be effective for the impacted material by immobilizing contaminants in the soil matrix and would require long-term monitoring at the point of disposal. Engineering and constructability issues may arise due to the small Site area and Site logistics for the blending operation if treated soil was used as backfill at the Site. Bench testing would be required to identify the appropriate additives and dosage rates. This technology can be used for effective immobilization of constituents present at the Site and is retained for further evaluation.

Thermal Desorption

Description: The thermal desorption technology is a thermal stripping process. Prepared soils are introduced into an enclosed heated chamber using a heated screw or belt conveyor. Direct or indirect heating methods are used to volatilize organics from the soil. The off-gas containing the thermally stripped compounds is then combusted in an afterburner, adsorbed in a carbon adsorption unit, or treated by catalytic oxidation. Typical operating temperatures for thermal stripping of organics range between 400^{o}F and 900^{o}F, and higher temperatures are also used. Operating temperatures are selected based on the hydrocarbons present in the soil.

Initial Screening: The removed materials would require screening and dewatering as feedstock preparation for this process. The off-gas could potentially require the use of air pollution control devices. The residue would contain inorganics that may require additional treatment such as stabilization prior to disposal in a landfill. Based on limited available space on-site, thermal desorption would be accomplished at a permitted facility off-site prior to disposal. This technology is applicable and effective for removal of organic constituents in impacted soil at the Site. It is retained as a process option for off-site treatment.

Incineration

Description: Incineration is a thermal destruction method that can be used to destroy all forms of combustible waste materials, including organic contaminants in soils. Incineration systems such as multiple hearth, rotary kiln, infrared and fluidized bed can treat highly-contaminated soils at high temperatures (1200oF to 1800oF in the primary chamber and at 1400^{o}F to 2400^{o}F in the secondary chamber). Infrared incineration systems are used primarily for solids or sludge.

Initial Screening: High temperature incineration is suitable for removal of volatile and semi-volatile organics in contaminated soils, although the off gas could potentially require the use of air pollution control devices. The residue would contain inorganics that may require additional treatment prior to disposal in a landfill. Based on the limited available space on-site, incineration would be accomplished off-site at a permitted facility prior to disposal. Incineration is not retained as an option as other off-site, ex situ treatment options are available that are more cost-effective.

Vitrification

Description: Vitrification is a thermal treatment process intended to provide stabilization of chemically contaminated soil. Vitrification destroys organic compounds by pyrolysis and immobilizes inorganic contaminants, such as heavy metals, into a glass-like material. Vitrification includes use of a power supply system, off-gas containment, an electrode support hood, an off-gas treatment system, and a process control station.

Initial Screening: Vitrification is near commercialization for low-level radioactive waste stabilization, heavy metal fixation, and hydrocarbon destruction. However, vitrification is energy intensive and very costly. Vitrification is usually only used for highly toxic wastes in experimental applications and is therefore not retained for further evaluation.

Phytoremediation

Description: A description of phytoremediation is provided above with in situ soil treatment processes. Ex situ phytoremediation consists of removing the contaminated media from a site, placing it in a treatment area, and planting specific plants into the contaminated soil.

Initial Screening: This technology is effective in removing metals and PAHs and is low in cost. Application would require a large land area, and other ex situ processes are more readily implemented. Therefore, phytoremediation is not retained for further evaluation.

Biodegradation

Description: Biological treatment involves the use of native microbes or selectively adapted bacteria to degrade a variety of organic compounds. The biological processes usually involve the addition of microbes, nutrients, oxygen and moisture. The microbial action serves to effectively degrade the organic constituents.

Initial Screening: Aerobic biodegradation has been demonstrated to be effective on the organic constituents present on-site. Use of this option on-site would eliminate the need for off-site transportation and disposal of impacted material. Some of the heavier organics would require lengthy time frames to degrade. Since sufficient space is not available on-site for the construction of an engineered stockpile, to allow the addition of amendments and monitoring of the biological degradation process, the ex situ biodegradation option is not retained.

Soil Washing

Description: Soil washing of excavated soil involves processing the impacted material in a reactor vessel or other treatment unit in conjunction with a reagent solution designed to remove the organic constituents from the native soil. The optimum reagent and reaction time would require the performance of bench and pilot studies to optimize the process.

Initial Screening: Significant feedstock preparation is required for this process option. Ex situ soil washing overcomes heterogeneity concerns associated with in-situ soil washing. However, the low solubility of certain higher-ringed PAHs could still prevent effective treatment via this process option. Large volumes of aqueous wastes would also be generated and would require further treatment and disposal. This process option is not retained.

5.2.1.4 Disposal

This category of remedial process options refers to disposal of soil on or off-site, with or without any treatment. The remedial technologies are on-site reuse (after treatment), on-site landfill (no treatment) and off-site disposal (with or without treatment).

On-Site Reuse

Description: Impacted soil would be excavated, treated, and then be used as backfill on-site in the excavated areas.

Initial Screening: The treated material would have to meet geotechnical requirements and regulatory standards for use as backfill, and may require monitoring. It may not be possible to reuse all of the material on-site due to bulking after excavation. However, due to space limitations, this option is not retained for further evaluation.

On-Site Landfill
Description: Impacted soil would be excavated and then disposed of in an on-site landfill. Based on specific regulations that are triggered for this type of landfill, the on-site construction may include a liner system, leachate collection and treatment and multi-layer cap.

Initial Screening: The landfill would have to meet rigorous regulatory requirements. The depth to groundwater (i.e., 4-5 to five feet bgs) is not sufficient to allow for the construction of an effective landfill; therefore, this option is not retained.

Off-Site Disposal
Description: Hazardous impacted material would be transported to a regulated facility and properly disposed following treatment to meet Land Disposal Restrictions (LDRs), if necessary. Non-hazardous soil can be disposed off-site in a non-hazardous landfill, after treatment, if necessary.

Initial Screening: Although high disposal costs are associated with off-site disposal and there is limited off-site incineration (for hazardous soil) and landfill capacity available, it is still a technically viable option. Off-site disposal of soil is a feasible option and is retained for further evaluation.

5.2.2 Groundwater

5.2.2.1 Containment

Sheet Piling
Description: Sheet piling driven into the soil can be used as a barrier to limit the horizontal spread of contaminants from contaminated groundwater. This technique could also be extended whereby the soil within the contained area is dewatered and soil remedial activities could proceed in a “dry” state. Steel or heavy gauge PVC sheet piling cutoff walls require very little maintenance. Sheet piling cannot be considered for use in very rocky soils. Recent advances in grout-jointing technology have made sheet piling relatively resistant to leakage. This type of grout-jointed sheet pile barrier incorporates a sealable cavity at the interlocking joints between piles that can be flushed clean, inspected, and then sealed after the piles have been driven into the ground. The water-tight seal prevents off-site migration of contaminated groundwater and can be installed to isolate a site while remedial actions are in progress. It can also act as a structural wall during excavation or during soil dewatering.

Initial Screening: Sheet piling is feasible for source control when it can be keyed into a low permeability bottom layer. A dense silty clay ground moraine has been noted to underlie the Site at a depth of approximately 40 feet bgs. Driving sheet pile to this depth is within the threshold of this technology and is technically practicable. This is a well established practice with relatively easily available resources; however, sheet piling for groundwater containment is more commonly applied to contamination source areas (e.g. OU-1), than for an off-site plume. In addition, for OU-2 there are concerns due to the space limitation, required street disturbance and subsurface utility structures. Therefore, sheet piling for containment of OU-2 groundwater is not retained for further evaluation.

Slurry Walls
Description: Slurry walls are a relatively inexpensive means of reducing the horizontal groundwater flow through contaminated source materials and inhibiting the migration of contaminants and product material. Slurry walls are constructed in a vertical trench, and the slurry acts essentially like a drilling

fluid, providing lateral support to the excavation sidewalls below the water table and providing a low permeability medium that greatly reduces horizontal fluid flow.

Initial Screening: Slurry walls are typically used when they can be “keyed” into a confining layer that serves to reduce or prevent vertical fluid flow. The depth to the confining layer at the Site is 40 feet bgs. Technology studies and project experience show that it is practicable for slurry walls to be installed to this depth. However, groundwater containment is more commonly applied to contamination sources areas (e.g. OU-1), than for an off-site plume. A cement-bentonite wall would likely be used as opposed to a traditional soil-bentonite wall due reduced bearing capacity of a soil –bentonite wall and larger requirements for surface area. The cement –bentonite wall would be self hardening and would not require further backfill. All excavated soils are typically hauled off site for disposal once excavated from the trench. Due to space limitations, required street disturbance, and subsurface utility structures, this process option would be difficult to implement. It is retained for further evaluation due to its effectiveness.

5.2.2.2 In Situ Treatment

Groundwater Pump and Treat

Description: Aquifer remediation using groundwater extraction, also called pump and treat, is a source removal technology which removes contaminants in groundwater using extraction wells and pumps. As water impacted by contaminants is drawn from the aquifer, uncontaminated water is pulled into the source area limiting the migration of contaminants from the source area. Contaminants adsorbed to soil below the water table are released into groundwater by chemical gradients and then can be extracted and treated. The rate at which the concentrations are reduced depends on a number of factors including the characteristics of the soil, the chemical constituents, the concentrations of COC in soil and groundwater, and the constituent-specific soil/water partitioning relationships for each constituent. In order to implement this technology, a network of recovery wells would be installed throughout the Site. The number, location, well screen size/length, and pumping rates would be determined by pilot testing during the remedial design phase. Groundwater would be pumped from each well location using submersible pumps, lowering the groundwater table and drawing surrounding water into the wells. This pumping would lower the groundwater table around each well and promote groundwater flow into the wells. The collected water would be transported by underground piping to an on-site treatment facility and discharged to a sanitary or stormwater sewer, or potential discharged directly into the sanitary sewer.

Initial Screening: The source of COCs in a typical aquifer is a multi-phase system consisting of constituents dissolved in groundwater, adsorbed to soil particles above and below the water table, and existing as NAPL in soil pore spaces. The groundwater pump and treat system is expected to eventually reduce the concentrations of contaminants in the groundwater to acceptable levels; however, this technology would take significantly longer than other options considered. This option could be used as part of a hydraulic containment system to prevent off-site migration of contaminated groundwater. A more passive pump and treat system could be used with physical containment technologies to control groundwater levels inside of the containment area. Since groundwater pump and treat must be used in conjunction with another option in order to be effective, and requires extensive installation of wells, conveyance piping, and treatment system at a site with limited space, this option is not retained.

In Situ Oxidation
Description: ISCO technology is described above with soil in-situ technology options.

Initial Screening: Due to the relatively low levels of COCs at the Site and to overcome limited space to conduct extensive intrusive work, ISCO is an attractive option. Bench-scale and pilot-scale treatability studies would be necessary to select oxidant and confirm that chemical oxidation processes could reduce COC concentrations in source material to acceptable levels at the Site. ISCO is retained as a treatment option.

5.2.3 NAPL

5.2.3.1 Removal/Treatment/Disposal

This response action involves physical removal of contaminated soil or mobile product NAPL material, usually with the intention of subsequent treatment and/or disposal. For the purposes of this FS, removal actions include soil excavation and/or NAPL mobilization followed by NAPL collection and extraction as preliminary or support technologies for ex situ treatment actions that first require removal of contaminated media.

Excavation
Description: Excavation refers to the use of construction equipment such as backhoes, bulldozers, front-end loaders, and clamshells that are typically used on land to excavate and handle contaminated soil. Excavation of soil to confining layers or other barriers to NAPL migration can also provide a means of accessing and removing NAPL.

Initial Screening: Excavation is required to initiate material handling for subsequent ex situ treatment and/or disposal. Excavation is retained as a removal process option.

In Situ Steam Stripping (Dynamic Underground Stripping (DUS))
Description: In-situ steam stripping is a physical separation treatment process that utilizes steam introduced into the impacted material to strip off the organic constituents. Steam is injected into the periphery of the contaminated areas to vaporize and mobilize contaminants, which are then extracted at centrally located vapor and liquid extraction points. In combination, electrical heating may be used to vaporize contaminants in less permeable zones or lenses. Vapor and liquid collection and treatment systems would be required to process the extracted liquid and vapor prior to disposal. Treatment is achieved in both the saturated and unsaturated zones.

Initial Screening: Subsurface structures on-site would limit the effectiveness and implementability of this process option. Because of the physical conditions present and the presence of dense residential development, this process option could not effectively reduce the risks associated with the Site. Therefore, this technology is not retained for further evaluation.

NAPL Mobilization
MGP-related NAPL is generally resistant to flow through porous media due to its high viscosity; therefore, it does not move readily to collection points. Due to this flow resistance, it is usually necessary to enhance the mobility of MGP NAPL if collection (and then extraction) is to be successful. There are three general types of mobility-enhancing technologies: mechanical; thermal; and chemical. Each type is described and screened below.

Description: (Mechanical Technologies) Mechanical technologies that mobilize NAPL to collection points include: induction of hydraulic gradients in the saturated zone; induction of hydraulic gradients within the NAPL layer; and, induction of multiphase pneumatic and hydraulic gradients in the saturated zone, and NAPL layer. Hydraulic gradient induction is useful for slow, deliberate collection of NAPLs that are within the induction zone, which can be fairly extensive. Multiphase pneumatic and hydraulic induction can be very useful for more rapid collection of NAPLs that are within the short-term induction zone, which is usually not extensive in area.

Initial Screening: (Mechanical Technologies) Hydraulic induction technologies would be mostly ineffective at OU-2 because of the relatively high viscosity of MGP-related NAPL. These technologies would be generally ineffective with collection limited to very small zones around each collection point. Also, NAPL pockets isolated by subsurface structures would be isolated from the extraction effort and it would not be possible to assure removal. Finally, multiphase technologies could cause significant increases in local effective overburden pressures that could, in turn, create potential for settlement for adjacent structures. Therefore, this process option is not retained.

Description: (Thermal Technologies) Thermal technologies can be useful to mobilize NAPL to collection points. Both steam and hot water injection work in the same manner, by heating the contaminated media and entrained NAPL, lowering the effective viscosity of the NAPL, and making it more amenable to migration toward collection points. Both methods require significant energy input to overcome the thermal properties of the soil and water within the saturated zone to effectively raise subsurface temperatures and provide the desired increase in NAPL mobility. Electrical methods to raise subsurface temperatures are considered as part of the thermal technologies.

Initial Screening: (Thermal Technologies) In order to effectively mobilize NAPL at OU-2, extremely large quantities of both energy and water would be required because of the depth of the NAPL and the associated thermal inertia in the saturated zone. The presence of residential structures in the immediate vicinity of the Site would require extreme caution when implementing an in situ electrical/heating technology. Electrical technologies are available but not practical within the deeper saturated zones where the NAPL occurs at OU-2. In addition, subsurface structures/soils would most likely isolate some NAPL pockets, rendering this NAPL unrecoverable. The primary consideration regarding effectiveness of thermal technologies is the heterogeneity of the soil column at OU-2. Due to the heterogeneity of the soils, the mobilized NAPL would most likely migrate along preferential pathways and eventually form pockets of NAPL, rendering this NAPL unrecoverable. Based on the above, this process option is not retained.

Description: (Chemical Technologies) Chemical technologies include injection of chemical oxidants, alcohol flooding, and surfactant injection. All three technologies are capable of desorbing NAPL from porous media. In some cases chemical technologies thin NAPL so it can migrate as a free liquid through pore spaces in the form of nodules and stringers. Chemical oxidation is the most aggressive of the three; alcohol flooding is likely the most expensive; and surfactant injection is perhaps the most widely practiced for NAPL removal.

Initial Screening: (Chemical Technologies) Chemical agents would effectively mobilize NAPL in OU-2 soils; however, mobilization would be inhibited in locations where subsurface structures/soils isolate NAPL. This process option is retained.

<u>In Situ Oxidation</u>
Description: ISCO technology is described above with soil in-situ technology options. ISCO is not very effective at directly treating the heavy NAPL source materials similar to those detected at OU-2; however, this technology would significantly reduce aqueous concentrations thereby increasing NAPL dissolution through concentration gradients. Accordingly, ISCO could potentially result in the

temporary mobilization of source materials and/or an increase in the concentrations of dissolved phase groundwater contamination. Therefore, several applications of chemical oxidants may be needed to further reduce contaminant concentrations and to treat NAPL.

Initial Screening: Due to the relatively low levels of COCs in groundwater at the Site and to overcome limited space to conduct extensive intrusive work, In Situ Oxidation is an attractive option. Bench-scale and pilot-scale treatability studies would be necessary to confirm that chemical oxidation processes could reduce COC concentrations and NAPL in source material to acceptable levels. ISCO is retained as a treatment option.

NAPL Collection and Extraction

Description: NAPL collection and extraction can be accomplished with a wide range of technologies. Collection is typically achieved with the use of wells, sumps, and/or screen-points. Extraction is typically achieved with the use of skimmers, skimming pumps, or high viscosity piston pumps. These technologies are well established and reliable.

Initial Screening: NAPL may become mobilized through various forms of treatments or remedial actions (e.g., liberated during excavation and entrained in groundwater pooling in dewatering pits or sumps or mobilized through some other mechanism). If NAPL needs to be managed, the process options discussed are viable and appropriate. In addition, NAPL collection using wells, sumps, and/or screen points can be accomplished with minimal intrusiveness to the dense, residential development within OU-2. Therefore, this process option is retained.

6.0 Development and Detailed Analysis of Alternatives

6.1 Evaluation Criteria

The retained technologies and process options from the previous section have been combined to develop site-wide remedial alternatives. A range of alternatives was developed that would satisfy the site-specific remedial goals and RAOs. Each of the remedial alternatives was then evaluated using the 8 criteria set forth in the NYSDEC's Draft DER-10, Section 4.1(e): Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010a). The criteria are:

6.1.1 Overall protection of human health and the environment

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

6.1.2 Compliance with Standards, Criteria, and Guidance (SCGs)

This criterion is an evaluation of the remedy's ability to meet applicable environmental laws, regulations, standards, and guidance.

6.1.3 Long-Term Effectiveness and Permanence

This criterion is an evaluation of the long-term effectiveness of the remedy after implementation.

6.1.4 Reduction of Toxicity, Mobility or Volume

This criterion is an evaluation of the remedy's ability to reduce the toxicity, mobility or volume of the materials.

6.1.5 Short-term Effectiveness

The potential short term adverse impact(s) and risks of the remedy upon the community, the workers and the environment during implementation is evaluated. Short-term effectiveness addresses how an alternative affects its surroundings during the implementation phases of the remedial action, before RAOs are achieved. These effects include considering protection of workers and the community during construction, environmental impacts that might result from construction or implementation, and the length of time until the RAOs are achieved.

Environmental impacts are evaluated, in part, based on land disturbance, consumption of natural resource materials (e.g., for capping), landfill capacity utilization, transportation mileage, particulate matter, and gas emissions (including carbon dioxide [CO_2], nitrogen oxides [NO_x] and sulfur oxides [SO_x]). The degree of land disturbance is measured as the amount of active remediation in square feet. Transportation mileage, particulates (PM_{10}), and gas emissions are used to evaluate potential short-term impacts to the community and workers. In addition, general disruptions and inconveniences to the public and commercial community (e.g., noise and lights from night-time operations, traffic, and temporary waterway restrictions) can be expected to increase with the duration of construction.

This analysis incorporates an evaluation of the extent to which green and sustainable practices and technologies can be integrated into the remedy during its implementation. Proposed NYSDEC Guidance DER-31(NYSDEC, 2010b) establishes a preference for remediating sites in the most sustainable manner while still meeting legal, regulatory and program requirements. For this FS report, estimates for gas emissions based on heavy equipment use and transportation, energy usage, and landfill capacity use are incorporated into the analysis of short-term effectiveness.

6.1.6 Implementability

This criterion is an evaluation of whether the remedy can be technically and administratively implemented.

6.1.7 Cost

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

6.1.8 Land Use

This criterion is an evaluation of the current, intended and reasonably anticipated future use of the Site and its surroundings, as it relates to an alternative or remedy, when unrestricted levels would not be achieved.

6.1.9 Community Acceptance

Community acceptance is typically evaluated following a public comment period, after a remedy has been proposed.

6.2 Assembly of Alternatives

Representative process options are evaluated on the basis of overall remedial effectiveness, technical implementability, and cost relative to site-specific conditions, contaminant types, and contaminant concentrations.

Process option effectiveness focuses on: 1) protection of human health and the environment during the construction and implementation phases; 2) ability of the alternative to achieve the established RAOs; 3) ability to process the material quantity; and 4) reliability of the technology with respect to contaminants and site conditions.

Implementability refers to how easy it would be to employ the process option based on site and contaminant characteristics.

The cost evaluation is preliminary and relies upon engineering judgment and any vendor provided information to generate a relative cost of process options within a technology type.

The initially screened and accepted soil process options are evaluated qualitatively, based on effectiveness, implementability, and cost as described above. Based on this evaluation, specific process options were selected for development of remedial alternatives. Process options that are not selected are still technically feasible and may be substituted for the selected process option during remedial design.

6.3 Common Elements

There is always a risk that residual contamination may remain at a site after the performance of any of the proposed remedial alternatives. Therefore, each alternative except for the Alternative 1 (No Further Action) and Alternative 2 (Excavation-Unrestricted Use of OU-2) includes controls (e.g. Environmental easements, Site Management Plan, HASPs, Public Education and Awareness Programs), Long-Term Monitoring, and Site Reviews. There are institutional controls and site management requirements for OU-1.

6.3.1 Institutional Controls

This option utilizes non-physical mechanisms which restrict the use of a site, limit human exposure, and prevent any actions which would threaten the effectiveness or operation and maintenance of a remedy at or pertaining to the Site. Institutional Controls apply when contaminants remain at levels above the SCGs. Institutional Controls may include, without limitation, HASPs, restrictions on the use of structures, environmental easements, and covenants regarding the use of property and groundwater.

6.3.2 Monitoring and Site Reviews

This option includes periodic data collection (e.g., quarterly, annual) and review of the data to assess conditions at the Site. These data would be used to determine if implemented remedial activities have achieved the RAOs or are continuing to be protective of human health and the environment as conditions improve towards achieving the RAOs. Should site reviews indicate conditions are worsening or the conditions pose an unacceptable risk to human health or the environment, additional remedial activities could be implemented.

Periodic monitoring and site reviews are necessary to assess the progress of remedial activities and the protectiveness of implemented actions until all RAOs are achieved. They are a necessary component of nearly all of the remedial actions, the exception being those that immediately achieve RAOs.

6.4 Analysis of Remedial Alternatives

Technology process options that were retained are combined into remedial alternatives for Area 1 and Area 2 that address the remedial goals for the two media of concern: subsurface soil, soil vapor, and groundwater. Based on communication between NYSEG and NYSDEC, it was acknowledged that a combination of remediation processes would likely be implemented for OU-2 due to the variability in the concentrations and distribution of site contamination. Several subareas were identified, and remediation alternatives developed and evaluated for each subarea as part of this FS Report.

- Area 1 is located at the intersection of North Plain Street and Esty Street with an area of approximately 47,425 square feet (~1.1 acre) to be addressed by remediation.
  - Subarea 1A is located immediately north of OU-1 on Esty Street with an area of approximately 7,400 square feet. This subarea will encompass locations SB-21, SB-140, RW-6, SB-48, SB-164, and SB-172.
  - Subarea 1B is approximately 7,400 square feet in area located on North Plain Street, west of OU-1, and immediately south of Esty Street. Subarea 1B will encompass

locations SB-168, SB-24, RW-5, SB-58, GL-9, SB-135, and SB-162. The most grossly contaminated soil and groundwater in OU-2 is located in this subarea.
- o Subarea 1C is approximately 6,400 square feet in area located on North Plain Street, northwest of OU-1, and immediately north of Esty Street. Subarea 1C will encompass locations HP-3, SB-55, SB-134, SB-161, SB-52, HP-2, and SB-108.
- o The Remainder of Area 1 has an area of approximately 26,225 square feet and is considered outside of subareas 1A, 1B, and 1C for this FS Report.

- Area 2 is located primarily on Washington Street north to south between Cascadilla Street and West Court Street. The areal extent of the impacts in Area 2 that would be addressed by the proposed remedial alternatives is approximately 51,400 square feet.

For evaluating remedial alternatives for this FS Report, Alternative 1 (No Further Action) and Alternative 2 (Excavation-Unrestricted Use) apply to the entirety of Areas 1 and 2. Alternatives 3A, 3B, and 3C evaluate one remedial process each for Subareas 1A and 1B, assume a separate remedial process would be implemented for Subarea 1C, and that monitored natural attenuation (MNA) and a SMP would be implemented for the Remainder of Area 1 (outside of Subareas 1A, 1B, and 1C) and for Area 2. For Subareas 1A and 1B, the remedial processes evaluated are:

- Alternative 3A (Contaminant Containment);
- Alternative 3B (In-Situ Solidification); and
- Alternative 3C (Excavation).

Three remediation alternatives are evaluated for Subarea 1C to be implemented in combination with the selected alternative for Subareas 1A and 1B:

- Alternative 4A (Monitored Natural Attenuation)
- Alternative 4B (Enhanced Bioremediation)
- Alternative 4C (In-Situ Chemical Oxidation)

In all alternatives, except for the Alternative 1 (No Further Action) and Alternative 2 (Excavation-Unrestricted Use), monitored natural attenuation (MNA) would be a common element for the portions of Area 1 outside of Subareas 1A, 1B, and 1C, as well as for Area 2. For most sites it is not economically feasible for implementation of a single remediation process alone to achieve the low cleanup standards specified at many sites for the source area, and/or for the entire plume. The presence of NAPL and the fact that OU-2 consists of properties outside of the sheet piling around OU-1 will require multiple remediation process and/or controls. The period and extent of MNA activities is assumed to vary for each of the alternatives based on the extent of active remediation/removal included for each alternative.

Based on the Remedial Investigation activities completed for OU-2, site related impacts in Area 2 are only located along the west side of Washington Street and in close proximity to the utility corridor, present as “stringers” in distinct thin stratigraphic lenses, and that visible evidence of MGP-related residuals was not observed in the silty clay in any of the Area 2 borings. Therefore, no further remedial action beyond the previous IRM activities and other than MNA is being evaluated for Area 2 under Alternatives 3A through 4C.

Specific descriptions of each remedial alternative, provided with a detailed evaluation using criteria established in the DER-10 and DER-31, are presented below.

6.4.1 Alternative 1 – No Further Action

Description

This alternative would leave the Site in its present condition in both Area 1 and Area 2. This alternative incorporates the remedial work that was already conducted for OU-1 and within OU-2. Impacted soils and groundwater (OU-1 and OU-2), NAPL, and coal tar would remain in place with no treatment, means to prevent further migration of COCs, and would not provide any additional protection to human health and the environment. The existing cover material (i.e., grass/vegetation, asphalt, and concrete in Area 1 would be maintained. In Area 2, the majority of impacted soils have already been removed by an interim remedial action, as discussed in Section 1.4; remaining impacted soils within Area 2 exist as "stringers" in isolated areas. This alternative is retained as a baseline.

Overall Protection of Public Health and the Environment

The No Further Action alternative is not considered an effective or "stand alone" means of achieving the RAOs. The No Further Action Alternative does not include any additional activities to address MGP-related constituents, therefore, the alternative would not be effective in meeting the RAOs established for the Site. However, to the extent to which current conditions are already protective of human health and the environment, and such conditions remain in the future, aspects of the RAOs would be achieved. For instance, existing ground surface cover in the form of grass/vegetation, asphalt, and concrete prevents direct contact and potential ingestion of soil by local residents, as well as prevents exposures to soil via wind-blown dust. However, the alternative would not address exposure to construction workers performing subsurface excavation/construction activities. This alternative would involve natural degradation processes to reduce concentrations of COCs in soil. The timing and extent of improvements (if any) has not been estimated.

Compliance with SCGs

- Chemical-Specific SCGs: Removal or treatment is not included as part of this alternative, and, RAOs that relate to chemical-specific SCGs would not be met.
- Action-Specific SCGs: Action-specific SCGs are not applicable because the No Further Action alternative does not involve the implementation of active remedial measures.
- Location-Specific SCGs: Location-specific SCGs are not applicable because the No Futher Action alternative does not involve the implementation of active remedial measures.

Long-term Effectiveness and Permanence

Based on current conditions, there is a potential for construction worker exposure to MGP impacted subsurface soil during potential future intrusive activities (e.g., during excavation to repair or replace existing subsurface utilities/structures or install new underground facilities). The No Further Action alternative does not include actions or measures to address MGP-related impacts in subsurface soil or potential human exposure. Therefore, the No Further Action alternative is not considered to be effective at addressing RAOs related to potential direct contact, ingestion, or inhalation (human health exposure pathways), and would not meet the RAO related to preventing the migration of chemical constituents from soil.

Reduction of Toxicity, Mobility and/or Volume

It is anticipated that natural attenuation would slowly reduce the toxicity and/or volume of COC in subsurface soil and groundwater; however, there is no means to evaluate the remedial process.

Short-term Effectiveness

No remedial activities would be performed under the No Further Action alternative. Therefore, there would be no short-term environmental impacts or risks to on-site workers, construction/remediation workers (since there are no remedial activities proposed), or the community associated with implementation of the alternative.

Implementability

The No Further Action alternative does not involve any active remedial response and poses no technical or administrative implementability concerns.

Land Use

Alternative 1 includes no further action. This alternative would have the least impact on the existing land use; however, known contamination remains in place and may affect potential redevelopment.

Cost

There are no capital or operation and maintenance costs associated with the No Further Action alternative.

6.4.2 Alternative 2 – Excavation of Subsurface Soils for Unrestricted Use of Area 1 and Area 2

Description

This alternative would address impacted unsaturated and saturated soil through removal all contaminated soil such that all soil on Site meets unrestricted use criteria. Under this alternative, the removal would be performed to average depths of approximately 15 feet (Area 2) to 16 feet (Area 1) within an area of approximately 40,000 square feet within Area 1 and an area of approximately 7,000 square feet in Area 2 (1.5 acres total). In Area 2, only areas within and alongside the utility corridor where visual impacts were observed would require excavation. The approximate soil removal volume for both areas is 27,500 cy. Clean soil would be removed to an average depth of 7 ft bgs and be re-used as clean backfill. Un-impacted surficial soils could be reused. In order to access and remove contaminated media in some locations, demolition of existing structures may be required and is assumed for this FS Report. This alternative is presented as **Figures 6-1 and 6-2**.

Temporary sheet piles would be required around the perimeter of the proposed excavation area to stabilize excavation sidewalls (and to comply with OSHA requirements) and permit soil removal to the target depths. Sheet piling can be installed using a fixed mount rig or using a hydraulic press. Underground and overhead utilities in the area would need to be temporarily relocated in connection with site preparation and excavation activities.

A significant amount of the soil to be removed under this alternative is below the water table so that dewatering would be necessary. A temporary on-site wastewater treatment system would be provided for pre-treatment of the groundwater recovered during dewatering, and the treated effluent would be discharged to the Publicly Owned Treatment Works (POTW). For purposes of this FS, the dewatering rate under this alternative would be up to 50 gpm. The temporary on-site wastewater system would likely involve oil-water separation, filtration, carbon adsorption and possibly pH modification or cyanide removal. Details related to the water treatment, handling, and discharge would be determined during remedial design.

The excavation of impacted soils would generally be conducted using conventional construction equipment, such as excavators, front-end loaders, and dump trucks. Staging of equipment and clean fill is assumed to occur on the OU-1 property. Given the limited available space on-site for staging, the excavated soil would be pre-characterized for off-site transportation and disposal. Samples would be collected at a frequency of 1 per 500 cy of soil excavation. Soil removed from the excavation would be direct-loaded for off-site disposal, to the extent possible. Alternatively, the soil would be stockpiled in a lined material staging area (or portion of the excavation area or OU-1 property if practicable) for stabilization, if needed, prior to off-site disposal. Specifics of the handling approach would be determined during remedial design.

It is anticipated that the majority of subsurface soil and existing soil cover/other debris removed from this area would be characterized as non-hazardous. However, for the purpose of this FS, 10% of all the excavated soils are characterized as hazardous. Upon reaching target depths, verification soil samples may be collected from the bottom and sidewalls of the excavation for visual characterization and/or laboratory analysis; collection of side-wall and bottom of the excavation samples are included within the cost estimate of this alternative. Following receipt of results indicating that the cleanup objectives have been achieved, the excavated areas would be backfilled with select fill, compacted, and restored to grade. The utilities, paved roads, sidewalks and other soil cover (top soil and grass) would then be restored.

A foam spray or other vapor control measures would be used to suppress odors and volatile organic vapors originating from the excavation and the excavated soil, as needed. A Community Air Monitoring Plan (CAMP) would be followed throughout the completion of these activities to document airborne particulate and volatile organic vapor concentrations surrounding the excavation area.

Overall Protection of Public Health and the Environment

Implementation of this alternative would meet the soil RAOs related to protecting human health and the environment by removal of all contaminated soil.

A soil management plan (SMP) is not anticipated to be needed for Area 1. However, a SMP would exist for portions of OU-1 in the vicinity of the former wooded duct. The SMP would mitigate potential exposure to soil at the Site by identifying known locations of impact and setting forth actions to address possible future disturbances of subsurface soil. The soil excavation would minimize future impacts to groundwater since the most-impacted material would have been removed and impacted groundwater in the area of the soil excavation would be captured and treated during excavation. The SMP to be prepared would address exposures to construction workers performing intrusive activities in impacted areas below the water table, such as activities to repair existing, or install new, subsurface utilities/facilities. The SMP would identify requirements for use of personal protective equipment and proper management of impacted groundwater that may be encountered. All operations during the remedial phase would be controlled and monitored (e.g. dust monitoring) to prevent exposure to the public. After the excavation is completed, areas would be filled with clean fill and restored.

Compliance with SCGs

Chemical-Specific SCGs: Chemical SCGs would be met through the removal of all contaminated media and backfill with clean soils. The dewatering under this alternative would also result in the capture, removal, and treatment of impacted groundwater. Chemical-specific SCG that may apply to this alternative is associated with discharging treated groundwater to the POTW. A discharge permit would need to be obtained, and the treated water would need to meet influent requirements.

Action-Specific SCGs: Action-specific SCGs that apply to this alternative are associated with the excavation and disposal of the impacted soil, removal and treatment of groundwater from the excavations, periodic groundwater monitoring, including the handling, transportation, and disposal of waste material (i.e., purge water) in accordance with NYSDEC, USEPA and NYSDOT requirements, and performance of work in accordance with OSHA health and safety requirements. Workers and worker activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping, and reporting as identified in 29 CFR 1910, 29 CFR 1926, and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following a NYSDEC approved RD/RA Plan and site-specific HASP. Measures would be taken, as appropriate, to control levels of airborne particulate matter during soil excavation activities, in accordance with 40 CFR 50 National Ambient Air Quality Standards. Additional SCGs applicable to this alternative are associated with the transportation and disposal of the excavated materials. Transportation of the excavated materials would be completed in accordance with procedures identified in 6 NYCRR 364 and 372, 49 CFR 107, and 40 CFR 262, 263, 171, and 172. Disposal activities would be completed in accordance with 6 NYCRR 372, 373, and 376 and 40 CFR 262, 263, 170-179, and 270. National Ambient Air Quality Standards (including particulate levels) would be applicable and adhered to during excavation activities.

Process residuals generated during the implementation of this remedial alternative and not reused (e.g., activated carbon used in the temporary groundwater treatment system) would be characterized to determine the appropriate off-site disposal requirements. If any of the materials are characterized as a hazardous waste, then the RCRA, UTS/LDR, and USDOT requirements for the packaging, labeling, transportation, and disposal of hazardous or regulated materials may be applicable. Compliance with these requirements would be achieved by utilizing a licensed waste transporter and properly permitted disposal facilities.

Action-specific SCGs that potentially apply to the long term monitoring portion of this alternative are associated with periodic groundwater monitoring, including the handling, transportation, and disposal of waste material (i.e., purge water) in accordance with NYSDEC and NYSDOT requirements, and performance of work in accordance with OSHA health and safety requirements.

Location-Specific SCGs: Remedial activities would be designed and conducted in accordance with local codes and ordinances.

Long-term Effectiveness and Permanence

Excavation of the contaminated media is a permanent solution and would meet soil RAOs related to protecting human health and the environment over the long term. Contact with, or ingestion of, impacted soil would be minimized because the excavation would result in permanent removal of impacted soil. Dissolution of constituents from the soil to groundwater would be minimized because the impacted soil would be removed and replaced with clean backfill.

Reduction of Toxicity, Mobility or Volume

Excavation of grossly impacted soils, coal tar, and NAPL would reduce the toxicity, mobility, and volume of impacted soil and groundwater beneath the Site primarily because: (1) impacted unsaturated and saturated soil would be removed and replaced with clean backfill; and (2) groundwater from the area exhibiting the most impacts would be captured and treated. The toxicity, mobility, and volume of impacted subsurface soil and groundwater would be reduced. However, unless the disposal facility performs any soil treatment, this alternative does not reduce the volume and toxicity of contamination if soil is only transferred from the Site to a landfill disposal facility.

Short-term Effectiveness

During implementation of this alternative, on-site remedial construction workers may potentially be exposed to impacted soil by ingestion, dermal contact, and/or inhalation. Potential exposure of on-site workers to chemical constituents would be minimized by the use of personal protective equipment (PPE), as specified in a site-specific HASP that would be developed during the remedial design. In addition local residents within the immediate area of the work may potentially be exposed to impacted soil by inhalation. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays and/or foam to suppress dust/vapors/odors following removal of cover materials, modifying the rate of construction activities) and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in the site-specific HASP and CAMP. In addition, actions would be taken, if needed, to minimize potential MGP nuisance odors.

Under this alternative, traffic resulting from the transportation of impacted soil for off-site disposal and importing clean backfill would pose a potential nuisance to the community and increase the risk for accidents and spills. The transportation activities would be managed to minimize en-route risks to the community. Waste transport trucks would have watertight tailgates with a gasket between the box and the tailgate regardless of the designation of the load. Based on the sizeable extent of remedial activities described herein, soil removal activities under this remedial alternative may require approximately one year to complete, and possibly longer. Therefore the work may be completed in stages.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 82 tons of CO2, 2,653 lbs. of CO, 4,005 lbs. of NOX, and 596 lbs. of SOX emitted to the atmosphere. Approximately 2.8 x 10^6 MJ of energy would be consumed. Furthermore, approximately 15,600 CY of landfill capacity will be used, and 52,000 miles will be traveled by trucks transporting soils to and from the site. Best management practices (BMPs) described in NYSDEC's DER-31 (such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions and traffic impacts.

Implementability

Impacted soil removal and treatment is technically feasible. Remedial contractors for the removal of the impacted soil are readily available.

Major difficulties associated with this alternative are: (1) the extensive relocation of subsurface and overhead utilities that would be required; (2) the potential need to remove subsurface obstructions to drive sheet pile to the required embedment depths; (3) managing and treating water that would accumulate within the excavation; (4) the need to stabilize excavated soils to eliminate free liquids (water) in preparation for off-site transport; (5) controlling odors that would potentially be generated during excavation in close proximity residential and commercial areas; (6) controlling noise and vibration due to installation of sheet piling (if a fixed-mounted rig is used) in close proximity to residential areas; (7) protecting structures in the vicinity of the excavations; and (8) securing a sufficient number of waste haulers to expeditiously transport the excavated soil for off-site disposal.

A significant challenge from an implementation standpoint would be to plan and coordinate activities to minimize the disruption to local residents and business. The excavation area encompasses areas with subsurface and overhead utilities along public road way and sidewalks. Equipment and materials needed for excavation would be staged at the OU-1 area.

Waste hauling vehicles would present additional traffic and related concerns, including safety concerns (risk of accidents or spills), roadway wear and tear, and congestion from ongoing waste shipments during implementation of the remedy. There is a likelihood that technical problems could lead to schedule delays (i.e., equipment failure, water treatment difficulties, traffic issues) but could be minimized with proper advance planning and coordination of the remedial activities. The anticipated time necessary to complete the activities associated with this alternative is approximately six months to one year, not including the predesign or time to obtain necessary permits to conduct these activities.

Land Use

Excavation alternatives may have the most adverse short-term impact; however, backfill and compaction of the excavation can be implemented to minimize effects to existing geotechnical properties, compared to pre-excavation conditions. Future land use would be unaffected by this alternative.

Cost

Detailed costing of this alternative is provided in Appendix B and is compared to costs for other alternatives in **Table 6-2**.

6.4.3 Alternative 3A - Contaminant Containment for Subareas 1A and 1B

Description

The containment portion of this alternative would involve isolating the impacted soils, coal tar and NAPL via installation of a low-permeable cement-bentonite barrier wall along the perimeters of Subarea 1A and Subarea 1B. Subareas 1A and 1B are shown on Figure 6-3. This alternative assumes that additional response activities would be performed for Subarea 1C (Alternatives 4A, 4B, or 4C) and that MNA and ICs will be implemented for the Remainder of Area 1 and for Area 2. Impacted soils would be contained by installing barrier wall, such as a: conventional slurry wall, secant pile wall, watertight sheet piling, or other techniques. A slurry wall has been selected for costing and evaluation purposes, however the actual barrier wall type will be selected during final design.

A conventional slurry wall is constructed by excavating a slurry-filled trench down to the confining unit and backfilling the trench with a mixture of soil and bentonite (soil-bentonite slurry wall) or cement and bentonite (cement-bentonite wall). In general, soil bentonite walls are less expensive than cement bentonite walls. A secant pile wall is constructed by installing a series of vertical overlapping columns using a drill to turn a special mixing tool into the soil while cement-bentonite grout is pumped through the tool. The soil column is mixed into a homogeneous low permeability soil-cement. This process is continued in an overlapping manner along the perimeter of the impacted area to create a continuous low permeability barrier wall. A sheet pile cutoff wall makes use of interlocking sheet piles with a hydrophilic sealant applied to the interlock to provide a watertight barrier wall. In all cases, the cutoff wall would extend into the low permeability confining unit to provide a cutoff.

Installation of a containment barrier would limit potential further impacts to soil and groundwater by reducing the mobility of impacted groundwater flow through the impacted area, thus reducing the migration of grossly impacted groundwater.

The barrier wall would be installed at the intersection of Esty Street and North Plan Street within the approximate limits shown on **Figure 6-3**. The estimated length of the slurry containment walls would be approximately 440 and 380 linear feet, respectively, for Subareas 1 and 2. The walls would be approximately 2.5 feet in width and keyed into the clay layer to a depth of approximately 30 feet bgs to prevent flow of groundwater under the slurry wall.

Prior to full-scale installation of the barrier wall, a bench-scale study may be required to evaluate the effectiveness of various soil/bentonite/cement solidification mixtures at reducing the permeability of the impacted soil at the Site. The bench-scale study would consist of testing various mixtures for compatibility with the constituents of interest in soil at the site. Solidification mixtures would be tested for density, permeability, and strength. Use of a cement-bentonite slurry wall or watertight sheet piling would eliminate the need for bench scale testing.

Under this alternative, NAPL recovery wells would be installed where NAPL has been observed in soil borings in Subareas 1A and 1B to reduce contaminant mass within these two subareas. Manual methods (e.g., vacuum truck or bailing) would be used to remove NAPL from these wells. Frequency of removal and alternative removal methods may be in evaluated during remedial design (e.g., automated system).

Further studies would be necessary to investigate the possible long term groundwater impacts due to implementing containment, including maintaining groundwater levels. Evaluation of these issues would be included in the remedial design, and may include impermeable surfaces and/or liners which are already present throughout much of the area. The temporary removal of subsurface utilities may also be required. Specific details would be addressed as part of the remedial design.

An environmental easement for NYSEG owned properties would notify current and future property owners of the presence of MGP-related constituents in groundwater at the Site, restrict the use of on-site groundwater, and notify the owners of the applicability of an SMP. Existing groundwater use laws [10 NYCRR 5-1.31(b)], which prohibit the installation of private wells where public supply is available (unless approval is expressly granted by the public water authority), would continue to minimize potential human exposure to constituents in groundwater at concentrations exceeding the groundwater quality standards/guidance values.

An SMP would be prepared to: (1) identify areas of impacted groundwater and subsurface soils associated with the Site; (2) address possible future disturbances of site soil (to minimize the performance of intrusive subsurface activities in impacted areas and below the water table and/or dewatering without appropriate controls and measures); and (3) set forth the inspection and maintenance activities for the vegetation/cover materials.

Contingency work practices would be used to limit direct exposure of construction workers and other personnel during construction. Impacted groundwater is anticipated to be encountered at a depth of approximately four feet. These controls and/or SMP would require notification of applicable stakeholders (e.g., NYSDEC) prior to commencing subsurface work in a potentially impacted area, and would require appropriate oversight to monitor the work activities and take measures to prevent contact with groundwater above risk-based criteria.

Monitored Natural Attenuation would be implemented throughout Area 1, including outside of the containment subareas. However, the existing cover material (i.e., grass/vegetation, asphalt, and concrete) at the Site would be maintained. Institutional Controls in the form of an environmental easement and a SMP would be implemented to limit disturbance of the ground cover materials and place health and safety requirements on subsurface activities, Following remedial implementation, an evaluation of the necessity of institutional controls would be conducted for Subareas 1A and 1B, including but not limited to environmental easements and/or groundwater use prohibitions.

Long-term monitoring would be performed under this alternative to evaluate the effectiveness of the remedy.

Overall Protection of Public Health and the Environment

Implementation of the containment portion of this alternative would meet the soil RAOs related to protecting human health and the environment. Contact with or ingestion of impacted soil would be minimized by maintaining existing pavement and soil covers. The installation of a slurry wall prevents further migration of COCs, and does not create any additional exposure pathways. The installation of NAPL recovery wells in itself does not create any additional exposure pathways. Removal of NAPL from these wells is controlled as only trained and authorized personnel who shall follow the site HASP and wear PPE would be involved.

Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soils within Subareas 1A and 1B. Removal of NAPL would accelerate the natural degradation process by removing source material from the area. Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil via natural processes is permanent, although its rate cannot currently be predicted.

Compliance with SCGs

Chemical-Specific SCGs: This alternative would mitigate the migration of impacted groundwater within the containment area by preventing contaminated groundwater from flowing beyond the containment area; however, contaminated groundwater would still remain in the treatment area, therefore this alternative would not meet the SCOs presented in 6 NYCRR Part 375-6.8 or meet applicable SCGs for site groundwater (standards/guidance values presented in TOGS 1.1.1) because limited treatment would occur. Measures to further address potential exposure pathways would be implemented through an environmental easement and SMP.

Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may result in reduced concentrations of MGP-related constituents in groundwater and soil both inside and outside of the containment area, which may eventually attain compliance with chemical-specific SCGs.

Action-Specific SCGs: Action-specific SCGs that apply to this alternative are associated with monitoring, transportation and disposal of impacted soil, and OSHA health and safety requirements. Workers and work activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping, and reporting as identified in 29 CFR 1910, 29 CFR 1926, and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following a NYSDEC-approved Remedial Design/Remedial Action (RD/RA) Plan and site-specific HASP. Measures would be taken (as appropriate) to control levels of airborne particulate matter during soil excavation activities, in accordance with the 40 CFR 50 National Ambient Air Quality Standards. Waste materials generated during implementation of this alternative (i.e., excavated soil and spoils from soil mixing) would be characterized to determine appropriate off-site disposal requirements. If any of the materials were to be characterized as a hazardous waste (although not currently anticipated based on existing data), then the RCRA Universal Treatment Standards (UTS) or Land Disposal Restrictions (LDR) and USDOT requirements for the packaging, labeling, transportation, and disposal of hazardous or regulated materials may be applicable. Compliance with these requirements would be achieved by utilizing licensed waste transporters and properly permitted disposal facilities.

Location-Specific SCGs: Remedial activities at the Site would be conducted in accordance with local building/construction codes and ordinances.

Long-term Effectiveness and Permanence

Implementation of this alternative would meet the soil RAOs related to protecting human health and the environment. Contact with, or ingestion of, impacted soil would be minimized because it would be contained thereby preventing further migration vertically and the existing soil cover would prevent direct contact with, or ingestion of, soil by residents. Remaining soil and groundwater outside of the containment area would continue to be below cover materials and generally inaccessible for human exposure. The land use restriction would further mitigate potential exposure by notifying future site owners of the constituents of interest in soil and the applicability of the SMP. The SMP would mitigate potential exposure to remaining impacted subsurface soil and setting forth actions to address possible future disturbances of subsurface soil. This alternative would minimize future impacts to groundwater outside of the containment area and minimize potential contact with, or ingestion of, impacted groundwater since the impacted groundwater is within the treatment zone.

Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soils outside of the containment area, especially by eliminating further contaminant migration outside of the containment area and performing NAPL recovery. Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil via natural processes is permanent, although its rate cannot currently be predicted.

Reduction of Toxicity, Mobility or Volume

The containment of grossly impacted soils with the installation of a slurry wall would restrict the mobility of COCs and prevent further contamination of subsurface soils and groundwater outside of the treatment area. NAPL removal within the containment areas would reduce the volume and eventual mobility of COCs. Limiting the mobility of COCs in soil, would limit the potential future migration of constituents from soil to groundwater. In addition, since the slurry containment wall would extend to soils below the water table, saturated soils that might otherwise result in groundwater quality impacts would be contained within the containment area. Reduction of the toxicity, mobility, and volume of impacted groundwater and impacted subsurface soil would likely be reduced over an extended period of time via natural attenuation processes both within and outside of the containment area.

Short-term Effectiveness

During implementation of this alternative, on-site remedial construction workers may potentially be exposed to impacted soil by ingestion, dermal contact, and/or inhalation. Potential exposure of on-site workers to chemical constituents would be minimized through the use of PPE, as specified in a site-specific HASP that would be developed during the remedial design. In addition, local residents within the immediate area of the work may potentially be exposed to impacted soil by inhalation. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays and/or foam to suppress dust/vapors/odors following removal of cover materials, modifying the rate of construction activities) and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in the site-specific HASP and CAMP.

In addition, actions would be taken, if needed, to minimize potential MGP nuisance odors. The containment activities may require several months to complete.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 19 tons of CO2, 563 lbs. of CO, 368 lbs. of NOX, and 748 lbs. of SOX emitted to the atmosphere. Approximately 5.2×10^5 MJ of energy would be consumed. Furthermore, approximately 2,300 CY of landfill capacity will be used, and 4,500 miles will be traveled by trucks transporting soils to and from the site. Best management practices (BMPs) described in NYSDEC's DER-31 such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions and traffic impacts. However, estimated reductions in GHG emissions due to the implementation of BMPs would be minimal because the majority of the estimated GHG emissions are from the use of heavy equipment not suitable for alternative fuels.

Implementability

Installation of slurry wall containment is technically feasible and a proven technology. Remedial contractors that perform this technology are available. However, the type of equipment and skilled labor is usually provided by "specialty-type" contractors. A difficulty associated with this technology is the presence of subsurface utilities and potential obstructions (foundations or debris). Subsurface utility relocation may be required, which would disturb facility operations. Obstructions could impede or prevent the advancement of and potentially damage the drilling/injecting equipment. Technical problems could result in schedule delays (e.g., equipment failure, treatment difficulties, coordination issues, etc.), but could be minimized with proper advanced planning and coordination of the remedial activities. The time associated with successful implementation of this technology would be several months.

A significant challenge from an implementation standpoint would be to plan and coordinate activities to minimize the disruption to local residents and business. The perimeter of the containment area encompasses areas with subsurface and overhead utilities along public roadways and sidewalks. Equipment and materials needed for slurry wall installation could be staged at the OU-1 area.

Land Use

This alternative would involve construction of a barrier (e,g, slurry wall) along the perimeter of the containment subareas and create a volume of a continuous homogeneous mixture of soil and grout that acts to limit the flow of groundwater into and out of impacted areas. Future subsurface development activities would be able to be performed in the slurry wall area; however, extreme considerations such as avoiding compromising the quality of the slurry wall are required as the wall is required to contain contaminated material from migrating.

Cost

Detailed costing of this alternative is provided in Appendix B and is compared to costs for other alternatives in **Table 6-2**.

6.4.4 Alternative 3B - In-situ Solidification (ISS) for Subsurface Soils for Subareas 1A and 1B

Description

In-situ solidification is a process whereby contaminated soils are converted in-place into a stable soil-cement matrix in which contaminants are bound or trapped and reduce mobility. The resulting material is generally a homogeneous mixture of soil and grout that hardens into a low permeability soil-cement material. In order to create continuous zones of treatment, the columns of mixed soil and cement are overlapped to provide continuity. The mixing process breaks up the soil structure completely and mixes the soil particles with the grout mixture in-situ, to create a low permeability homogeneous solidified mass. The soil-cement monolith reduces the migration of impacted soils and groundwater. The two primary methods of implementing ISS for immobilizing contaminants within impacted soils include traditional auger mixing and jet grouting. Both techniques were evaluated in this FS.

Using augers, a large crane or excavator-mounted drill would be used to turn a special mixing tool into the soil while cement-bentonite grout is pumped through the tool and mixed into the soil. ISS using augers may require removal of the surface cover material (asphalt pavement) and upper several feet of soil as an initial step prior to ISS full-scale application (approximately 7 feet is assumed for the feasibility study). If removed, the upper soil would be characterized, and reused as clean backfill or transported for off-site disposal. The soil removal allows room for the soil volume increase (bulking) that would occur when solidifying agents are added to the soil matrix and for placement of clean imported sand/gravel backfill and replacement cover materials. The temporary removal/relocation of subsurface utilities may also be required. Specific details would be addressed as part of the remedial design. Off-site disposal of some spoils would still likely be required; this feasibility study assumes that 30% of the treated soil volume would require off-site disposal. For this feasibility study, augers would mix and solidify soil to an average depth of 16 feet. Clean soil would be removed to an average depth of 7 ft bgs and be re-used as clean backfill. The top of the ISS columns would start below the frost line.

The jet-grouting process utilizes high pressure to inject and mix a fluid cement-bentonite grout into a column of soil. The high pressure mixing allows for smaller diameter drill holes (6 inches) to be utilized, which allows ISS to be implemented in the vicinity of subsurface obstructions (e.g., foundations, utilities) as practicable to avoid the need for excavating the soil. An advantage of jet grouting compared to auger mixing is that discrete depths and thicknesses can be targeted, including a thin layer of impacted material at depth. For this feasibility study, ISS by jet grouting would be performed on an average five foot thickness, in the approximate average ranging (min/max) depth interval of 7 to 17 feet bgs. Spoils, consisting of a mixture of soil, groundwater, and grout, would be generated by ISS, whether performed using the mixing tool method or jet-grouting method. Spoils would be managed, as appropriate, prior to transportation for off-site disposal. Jet grouting would generate more spoils that would require off-site disposal than ISS using auger mixing. This feasibility study assumes that jet grouting would generate 55% of the treated soil volume as spoils.

Under this alternative ISS would be applied using auger mixing to soil in Subareas 1A and 1B within the limits shown on **Figure 6-3** within an approximately 15,000 sf area. This alternative assumes that additional response activities would be performed for Subarea 1C (Alternatives 4A, 4B, or 4C) and that MNAs and ICs will be implemented for the Remainder of Area 1 and for Area 2. ISS treatment would limit potential future impacts from soil to groundwater by: (1) reducing the mobility of constituents in soil; (2) minimizing the amount of free liquids in the soil pore space; and (3) reducing the hydraulic conductivity of the soil. With less soil pore space and reduced conductivity, the potential mobility of pore-filling liquids (water, NAPL) would be reduced in the treated area.

Prior to full-scale implementation of ISS, a bench-scale study would be conducted to evaluate the effectiveness of various soil solidification mixtures at reducing the permeability of the impacted soil at the Site. The bench-scale testing activities would consist of testing various mixtures for compatibility with the constituents of interest in soil at the Site. Solidification mixtures would be tested for density, permeability, and strength. Soil samples for bench scale testing would-be collected from within the proposed treatment areas. Post-ISS quality control (QC) sampling and analysis and quality assurance (QA) procedures would be performed to verify that performance criteria are met for the solidified soil columns (i.e., unconfined compressive strength, and permeability).

Monitored Natural Attenuation would be implanted throughout Area 1, including outside of the Subareas 1A, 1B, and 1C. However, the existing cover material (i.e., grass/vegetation, asphalt, and concrete) at the Site would be maintained or restored. An environmental easement and a SMP would be implemented to limit disturbance of the ground cover materials and place health and safety requirements on subsurface activities, as detailed under Alternative 3A.

Long-term monitoring would be performed under this alternative to evaluate its effectiveness, including chemical concentrations in the groundwater down gradient of ISS treatment areas and in the areas where ISS is not implemented.

Overall Protection of Public Health and the Environment

Implementation of the ISS alternative would meet the soil RAOs related to protecting human health and the environment. Contact with or ingestion of impacted soil would be minimized as contaminants would be bound up in a solidified matrix. In addition, the clean fill and replaced soil cover over the solidified soil would prevent direct contact with, or ingestion of, soil by residents. Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soils outside of the ISS area. Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil via natural processes is permanent, although its rate cannot currently be predicted.

Compliance with SCGs

Chemical-Specific SCGs: ISS would render contaminated soil and groundwater immobile and inaccessible. However, contaminated soil and groundwater would still remain in the treatment area, therefore ISS would not meet the SCOs presented in 6 NYCRR Part 375-6.8 or meet applicable SCGs for site groundwater (standards/guidance values presented in TOGS 1.1.1). However, the potential for dissolution of chemical constituents from the solidified material would be greatly reduced. Also, free liquids (e.g., impacted groundwater) within the stabilized material would have concentrations reduced. Measures to further address potential exposure pathways would be implemented through an environmental easement and SMP. Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may result in reduced concentrations of MGP-related constituents in groundwater and soil outside of the area where ISS is implemented.

Action-Specific SCGs: Action-specific SCGs that apply to this alternative are associated with ISS monitoring, transportation and disposal of impacted soil, and OSHA health and safety requirements. Workers and work activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping, and reporting as identified in 29 CFR 1910, 29 CFR 1926, and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following a NYSDEC-approved RD/RA Plan and site-specific HASP. Measures would be taken (as appropriate) to control levels of airborne particulate matter during soil excavation activities, in accordance with 40 CFR 50 National Ambient Air Quality Standards. Waste materials generated during implementation of this alternative (i.e., excavated soil and spoils from soil mixing) would be characterized to determine appropriate off-site disposal requirements. If any of the materials were to be characterized as a hazardous waste (although not currently anticipated based on existing data), then the RCRA UTSs/LDRs and USDOT requirements for the packaging, labeling, transportation, and disposal of hazardous or regulated materials may be applicable. Compliance with these requirements would be achieved by utilizing licensed waste transporters and properly permitted disposal facilities.

Location-Specific SCGs: Remedial activities at the Site would be conducted in accordance with local building/construction codes and ordinances.

Long-term Effectiveness and Permanence

Implementation of the ISS alternative could meet the soil RAOs related to protecting human health and the environment over the long term. Contact with or ingestion of impacted soil would be minimized in the long term because it would be bound up in a solidified matrix. Potential exposures to future construction workers performing subsurface excavation/ construction activities would also be addressed by the SMP. In addition, the clean fill material and/or the replaced soil cover placed over the solidified soil would prevent direct contact with, or ingestion of, soil by site workers.

Verification of the long-term effectiveness and permanence of the ISS would potentially require a long-term monitoring plan. Long-term effectiveness of the ISS could potentially be inhibited by the presence of subsurface obstructions (e.g., concrete/demolition debris and foundations for historical structures, large boulders) that might impede or otherwise prevent installation of the auger to the required depth. This would be a concern if the areas of refusal were above areas identified for solidification. Subsurface obstructions could potentially create “blind” areas where in-situ solidification would not be effective such that constituents of interest may not be immobilized. Other than utilities, such subsurface structures have not been encountered during previous investigation work; therefore, the effectiveness of ISS is anticipated to not be compromised due to this issue.

Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soils. Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil via natural processes is permanent.

Through the establishment of an environmental easement and SMP, this alternative would meet the soil groundwater RAOs related to potential direct contact, ingestion, and inhalation human health exposure pathways. The environmental easement and SMP would be kept in place, unchanged, unless site conditions were to change and make these measures unnecessary. If changes were to occur that would require modifications to the land use restriction or SMP, such modifications would be presented to the NYSDEC for review and approval, as appropriate. Together, these controls could be expected to adequately and reliably provide for the management of media exhibiting constituents at concentrations exceeding standards.

Reduction of Toxicity, Mobility or Volume

ISS would reduce the mobility of constituents in impacted soil through the solidification of these constituents. The toxicity of the downgradient groundwater would be reduced since the constituents of interest would be encapsulated within the ISS monolith. The volume of constituents would not change with the solidification activities. By minimizing the mobility of constituents of interest in soil, ISS would limit the potential future migration of constituents from soil to groundwater. In addition, since ISS would extend to soils below the water table, saturated soils that might otherwise result in groundwater quality impacts would be contained (and/or completely bound) within the solidified matrix.

In areas outside of the ISS treatment area, reduction of the toxicity, mobility, and volume of impacted groundwater and impacted subsurface soil would likely be reduced over an extended period of time via natural attenuation processes.

Short-term Effectiveness

During implementation of this alternative, on-site remedial construction workers may potentially be exposed to impacted soil by ingestion, dermal contact, and/or inhalation. Potential exposure of on-site workers to chemical constituents would be minimized by the use of PPE and engineering controls, as specified in a site-specific HASP that would be developed during the remedial design. In addition local residents within the immediate area of the work may potentially be exposed to impacted soil by inhalation. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays and/or foam to suppress dust/vapors/odors following removal of cover materials, modifying the rate of construction activities) and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in the site-specific HASP and CAMP. In addition, actions would be taken, if needed, to minimize potential MGP nuisance odors. The ISS treatment activities may require several months to complete.

The installation of additional monitoring wells and regular monitoring outside of the ISS treatment area would be the only ongoing field work performed pursuant to this alternative. Dust control, air monitoring and proper disposal of potentially impacted material would be implemented during the installation of the additional monitoring wells. Subcontractors installing the additional monitoring wells, and personnel conducting oversight and performing groundwater monitoring would use PPE and follow requirements of a site-specific HASP.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 43 tons of CO2, 676 lbs. of CO, 389 lbs. of NOX, and 1970 lbs. of SOX emitted to the atmosphere. Approximately 8.1×10^5 MJ of energy would be consumed. Furthermore, approximately 2,000 CY of landfill capacity will be used, and 4,400 miles will be traveled by trucks transporting soils to and from the site. Best management practices (BMPs) described in NYSDEC's DER-31 such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions and traffic impacts. However, estimated reductions in GHG emissions due to the implementation of BMPs would be minimal because the majority of the estimated GHG emissions are from the use of heavy equipment not suitable for alternative fuels.

Implementability

Soil solidification is technically feasible and a proven technology. Remedial contractors that perform this technology are available. However, this type of equipment and skilled labor is usually provided by "specialty-type" contractors.

A difficulty associated with implementing ISS using augers is the presence of subsurface utilities and potential obstructions (foundations or debris). At a minimum, soil would be excavated to the inverts of the utilities. Subsurface utility relocation might be required, which would disturb facility operations. Obstructions could impede or prevent the advancement of, and potentially damage, the drilling/injecting equipment used for ISS. However, such obstructions have not historically been observed in this area. Jet-grouting (or alternative immobilization methods) could potentially be used to stabilize soil near utilities in some cases. Technical problems could result in schedule delays (e.g., equipment failure, treatment difficulties, coordination issues), but could be minimized with proper advanced planning and coordination of the remedial activities. The time associated with successful implementation of this technology would be several months.

A significant challenge from an implementation standpoint would be to plan and coordinate activities to minimize the disruption to local residents and businesses. The solidification area encompasses areas with subsurface and overhead utilities along public road way and sidewalks. Equipment and materials needed for ISS would be staged at the OU-1 area. Construction activities would be phased to minimize access issues to local residents and businesses.

The controls and monitoring portion of this alternative would be both technically and administratively implementable. Institutional Controls could be implemented with standard agreements with the City and residents. MNA would not present substantial challenges. The resources required to implement this process option are readily available.

Land Use

The ISS alternative would create a homogeneous volume of soil-cement that serves as a low permeability monolith. However, this matrix would not impede future excavation/development difficult within the ISS treatment area, but would provide for a structurally competent subsurface for future development.

Cost

Based on vendor information obtained and AECOM experience, jet grouting is a significantly more expensive method for performing ISS on a unit volume basis; however, jet grouting can target discrete intervals. Separate cost estimates were prepared for performing ISS using traditional augers and by jet grouting. Detailed costing of this alternative by the augering method is provided in **Appendix B** and is compared to costs for other alternatives in **Table 6-2**.

6.4.5 Alternative 3C – Excavation of Subsurface Soils for Subareas 1A and 1B.

Description

This alternative would address unsaturated and saturated impacted soils through removal. The removal would be performed within an approximately 15,000 sf area to depths of approximately 17 feet bgs, depending on location. The approximate soil removal volume is 9,500 cy. Clean soil would be removed to an average depth of 7 ft bgs and be re-used as clean backfill. The removal limits under this alternative are shown on **Figure 6-3**.

Excavation processes, including temporary sheet pile shoring, relocation of underground and aboveground utilities, confirmation sampling with laboratory characterization, dewatering, and off-site disposal would be performed similar to that described in Alternative 2.

Overall Protection of Public Health and the Environment

Implementation of this alternative would meet the soil RAOs related to protecting human health and the environment. Contact with or ingestion of the most-impacted soil, coal tar and NAPL would be minimized because it would be physically removed from the Site and treated/disposed at permitted facilities. Remaining soil that exhibits MGP-related impacts would continue to be below cover materials and generally inaccessible for human exposure.

The SMP would mitigate potential exposure to soil at the Site by identifying known locations of impact and setting forth actions to address possible future disturbances of subsurface soil. The soil excavation would minimize future impacts to groundwater since the most-impacted material would have been removed and impacted groundwater in the area of the soil excavation would be captured and treated during excavation. The SMP to be prepared would address exposures to construction workers performing intrusive activities in impacted areas below the water table, such as activities to repair existing, or install new, subsurface utilities/facilities. The SMP would identify requirements for use of personal protective equipment and proper management of impacted groundwater that may be encountered. All operations during the remedial phase would be controlled and monitored (e.g. dust monitoring) to prevent exposure to the public. After the excavation is completed, areas would be filled with clean fill and restored.

Natural attenuation processes over time may result in decreases in concentrations of COCs in subsurface soils and groundwater outside of the excavation area after removal of source material. MGP-impacted soil outside of the treatment area is confined to deeper subsurface soil with existing soil cover. Therefore, residents would not come into contact with the soil.

Compliance with SCGs

Chemical-Specific SCGs: The more significantly impacted soil would be removed under this alternative, but soil remaining in certain areas would still exhibit constituents at concentrations exceeding the SCOs presented in 6 NYCRR Part 375-6.8. The dewatering under this alternative would also result in the capture, removal, and treatment of impacted groundwater. Chemical-specific SCG that may apply to this alternative is associated with discharging treated groundwater to the POTW. A discharge permit would need to be obtained, and the treated water would need to meet influent requirements.

Exceedances of certain chemical-specific SCGs would exist outside of the excavation area. However, such exceedances do not necessarily equate to a current risk to human health or the environment. Measures to address potential exposure pathways would be implemented as part of this alternative (institutional controls to limit subsurface activities and accessing groundwater). Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may result in reduced concentrations of MGP-related constituents in subsurface soils and groundwater. *Action-Specific SCGs:* Action-specific SCGs that apply to this alternative are similar to those described for Alternative 2.

Location-Specific SCGs: Remedial activities would be designed and conducted in accordance with local codes and ordinances.

Long-term Effectiveness and Permanence

Implementation of this alternative would meet the soil RAOs related to protecting human health and the environment over the long term, in part, by removing the most-impacted soil remaining. Contact with, or ingestion of, impacted soil would be minimized because the excavation would result in permanent removal of impacted soil. Dissolution of constituents from the soil to groundwater would be minimized because the impacted soil would be removed and replaced with clean backfill.

Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soils outside the excavation area. Long-term monitoring would be performed to evaluate changes in groundwater conditions and effectiveness of removal of grossly impacted soil removal. The reduction of concentrations of MGP-related constituents in soil and groundwater via natural processes is permanent, although its rate cannot currently be predicted.

Reduction of Toxicity, Mobility or Volume

Excavation of grossly impacted soils, coal tar, and NAPL would reduce the toxicity, mobility, and volume of impacted soil and groundwater beneath the Site primarily because: (1) impacted unsaturated and saturated soil would be removed and replaced with clean backfill; and (2) groundwater from the area exhibiting the most impacts would be captured and treated. Reduction of the toxicity, mobility, and volume of impacted subsurface soil and groundwater would likely be reduced over an extended period of time via natural attenuation processes. However, unless the disposal facility performs any soil treatment, this alternative does not reduce the volume and toxicity of contamination if soil is only transferred from the Site to a landfill disposal facility.

Short-term Effectiveness

During implementation of this alternative, on-site remedial construction workers may potentially be exposed to impacted soil by ingestion, dermal contact, and/or inhalation. Potential exposure of on-site workers to chemical constituents would be minimized by the use of PPE, as specified in a site-specific HASP that would be developed during the remedial design. In addition local residents within the immediate area of the work may potentially be exposed to impacted soil by inhalation. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays and/or foam to suppress dust/vapors/odors following removal of cover materials, modifying the rate of construction activities) and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in the site-specific HASP and CAMP. In addition, actions would be taken, if needed, to minimize potential MGP nuisance odors.

Traffic, noise, and vibration impacts would be associated with this alternative, and would be mitigated by similar measured described in Alternative 2. Based on the sizeable extent of remedial activities described herein, soil removal activities under this remedial alternative may require approximately three to six months to complete, and the work may be completed in stages.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 23 tons of CO2, 696 lbs. of CO, 389 lbs. of NOX, and 154 lbs. of SOX emitted to the atmosphere. Approximately 7.4×10^5 MJ of energy would be consumed. Furthermore, approximately 5,663 CY of landfill capacity will be used, and 11,000 miles will be traveled by trucks transporting soils to and from the site. Best management practices (BMPs) described in NYSDEC's DER-31 such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions and traffic impacts. However, estimated reductions in GHG emissions due to the implementation of BMPs would be minimal because the majority of the estimated GHG emissions are from the use of heavy equipment not suitable for alternative fuels.

Implementability

Impacted soil removal and treatment is technically feasible. Remedial contractors for the removal of the impacted soil are readily available. Major difficulties associated with this alternative are similar to Alternative 2, and these difficulties are exacerbated due to the expansive area as well as completing the alternative in as short a period of time as possible to minimize impact on the local community. Soil staging areas and procuring sufficient excavation equipment/vehicles may be time limiting factors.

Land Use

Excavation alternatives may have the most adverse short-term impact; however, backfill and compaction of the excavation would restore the area to pre-excavation conditions. Future land use would be unaffected by this alternative.

Cost

Sheet piling for excavation could be installed using a hydraulic press as opposed to vibratory installation of sheets to minimize disturbance to the residential and commercial areas due to noise and vibration nuisances. The cost for using a hydraulic press is slightly greater (<$100,000, <1% of capital costs) that driven sheeting. Detailed costing of this alternative is provided in Appendix B and is compared to costs for other alternatives in **Table 6-2**.

6.4.6 Alternative 4A - Monitored Natural Attenuation for Subsurface Soils and Groundwater for Subarea 1C

Description

USEPA's MNA directive (April 1999) (http://www.epa.gov/oust/directiv/d9200417.pdf) defines "monitored natural attenuation" as the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods."

Human and ecological receptors are not being exposed to MGP impacts in soil, groundwater, or air. The absence of exposure is expected to continue. In portions of the Site where MNA would be applied, soil and groundwater impacts will continue to be treated via the monitored natural attenuation processes of sorption, dilution, dissolution, dispersion, volatilization, and microbial degradation. As indicated in the RI Report (AECOM, 2010), based on the results of soil vapor samples collected to date, further actions are not anticipated to address soil vapor conditions at OU-2. However, if concentrations of COCs in the groundwater increase as a result of residual source material or a new release, a soil vapor monitoring program will be evaluated. Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater in a limited area near OU-1. As indicated in the RI Report (AECOM, 2010), concentrations of VOCs and PAHs have decreased from 2004 to 2010 in wells located in both Areas 1 and 2.

The Monitored Natural Attenuation sub-alternative would not involve active remedial measures to remove, treat, or contain MGP-impacted subsurface soil and groundwater for those portions of the Site. However, the existing cover material (i.e., grass/vegetation, asphalt, and concrete) at the Site would be maintained. An environmental easement (on NYSEG properties) and a SMP would be implemented to limit disturbance of the ground cover materials and place health and safety requirements on subsurface activities.

An environmental easement would notify current and future property owners of the presence of MGP-related constituents in groundwater at the Site, restrict the use of on-site groundwater, and notify the owners of the applicability of an SMP. Existing groundwater use laws [10 NYCRR 5-1.31(b)], which prohibit the installation of private wells where public supply is available (unless approval is expressly granted by the public water authority), would continue to minimize potential human exposure to constituents in groundwater at concentrations exceeding the groundwater quality standards/guidance values.

The SMP would be prepared to: (1) identify areas of impacted groundwater and subsurface soils associated with the Site; (2) address possible future disturbances of site soil (to minimize the performance of intrusive subsurface activities in impacted areas and below the water table and/or dewatering without appropriate controls and measures); and (3) set forth the inspection and maintenance activities for the vegetation/cover materials.

Long-term monitoring would be performed under this alternative to evaluate the effectiveness of MNA over an extended period of time. Samples would be collected from both selected existing monitoring wells and newly installed monitoring wells (approximately 10 in Area 1), and analyzed for constituents of interest. Results of the groundwater monitoring would be summarized and presented to the NYSDEC in annual reports. The goal of the long-term monitoring would be to show an order of magnitude decrease in both total BTEX and total PAHs concentrations within five years of the completion of remedial construction activities. For this FS Report, after a five-year period, an evaluation of the long-term monitoring would be made and presented to the NYSDEC. Based on the analytical results and trends in groundwater constituent concentrations, NYSEG could propose modifications to the monitoring program, if necessary. For the purposes of this FS Report, the subsequent period of annual sampling would be additional 15 years of MNA sampling. Seasonal variation of groundwater concentrations is anticipated and will be established during the first two years of monitoring. Quarterly monitoring would be performed for two years and then annually thereafter.

Contingency remedies could be implemented at the end of the initial five-year period based on criteria, developed as part of the remedial action work plan, including:

- Contaminant concentrations in groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection;
- Near-source wells exhibit large concentration increases indicative of a new or renewed release;
- Contaminants are identified in monitoring wells located outside of the original plume boundary;
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives; and
- Changes in land and/or groundwater use will adversely affect the protectiveness of the MNA remedy.

The contingency remedy is anticipated to be enhanced aerobic bioremediation via oxygen addition to the subsurface soils and groundwater within Subarea 1C. This technology is described in Alternative 4B, Section 6.4.6.

In conjunction with remedial alternatives for Subareas 1A, 1B, and 1C, Monitored Natural Attenuation would be implemented for the Remainder of Area 1 and for Area 2, as shown on **Figures 6-1 and 6-2**.

Overall Protection of Public Health and the Environment

Human and ecological receptors are not being exposed to MGP impacts.

MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways. The SMP would be a means to address potential future soil excavation (e.g. utility work). The SMP would include a requirement for developing a remedial plan that would identify proposed excavation limits and details of the soil removal (e.g., waste characterization sampling, verification sampling, excavation sidewall support, off-site transportation and disposal, dewatering, backfilling) and place health and safety requirements on subsurface activities.

The environmental easement would further mitigate potential exposure by notifying future site owners of the constituents of interest in soil and the applicability of the SMP. The SMP would mitigate potential exposure to impacted subsurface soil by setting forth actions to address possible future disturbances of subsurface soil. There are no known sources of private or public drinking water in the area of MGP impacted groundwater. The existing groundwater use laws under 10 NYCRR 5-1.31(b) would continue to minimize potential human exposure to MGP-related constituents in groundwater at concentrations exceeding standards/guidance values. The SMP to be prepared would address exposures to construction workers performing intrusive activities below the water table, such as activities to repair existing, or install new, subsurface utilities/facilities. The SMP would identify requirements for use of personal protective equipment and proper management of impacted groundwater that may be encountered.

Natural attenuation processes over time are expected to result in decreases in concentrations of COCs in groundwater and soil.

MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways. Therefore, residents would not come into contact with the soil under foreseeable activities.

Compliance with SCGs

Chemical-Specific SCGs: While exceedances of certain chemical-specific SCGs would exist, such exceedances do not necessarily equate to a current risk to human health or the environment. Measures to address potential exposure pathways would be implemented as part of this alternative (e.g., restricting land use to industrial, requiring adherence to provisions of the SMP). Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may result in reduced concentrations of MGP-related constituents in groundwater, but this process would take a longer amount of time compared with more active remedies.

Action-Specific SCGs: Action-specific SCGs that potentially apply to this alternative are associated with periodic groundwater monitoring, including the handling, transportation, and disposal of waste material (i.e., purge water) in accordance with NYSDEC and NYSDOT requirements, and performance of work in accordance with Occupational Safety and Health Administration (OSHA) health and safety requirements.

Location-Specific SCGs: Location-specific SCGs are not applicable because this alternative does not involve the implementation of active remedial measures.

Long-term Effectiveness and Permanence

Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soil.   Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil via natural processes is permanent, although its rate cannot currently be predicted.

Through the establishment of an environmental easement and SMP, this alternative would meet the soil groundwater RAOs related to potential direct contact, ingestion, and inhalation human health exposure pathways. The environmental easement and SMP would be kept in place, unchanged, unless site conditions were to change and make these measures unnecessary. If changes were to occur that would require modifications to the environmental easement or SMP such modifications would be presented to the NYSDEC for review and approval, as appropriate. Together, these controls could be expected to adequately and reliably provide for the management of media exhibiting constituents at concentrations exceeding standards.

Reduction of Toxicity, Mobility and/or Volume

MGP-impacted groundwater would not be contained, removed, or actively treated (other than by natural processes). Reduction of the toxicity, mobility, and volume of impacted groundwater and subsurface soils would be reduced over an extended period of time via natural attenuation processes.

Short-term Effectiveness

The installation of additional monitoring wells and regular monitoring would be the only field work performed pursuant to this alternative. Dust control, air monitoring and proper disposal of potentially impacted material would be implemented during the installation of the additional monitoring wells. Subcontractors installing the additional monitoring wells, and personnel conducting oversight and performing groundwater monitoring would use PPE and follow requirements of a site-specific HASP.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 1 ton of CO2, 72 lbs. of CO, 46 lbs. of NOX, and 16 lbs. of SOX emitted to the atmosphere. Approximately 4.1×10^4 MJ of energy would be consumed. Furthermore, no landfill capacity use is required and no trucks are required for the transportation of soil. Best management practices (BMPs) described in NYSDEC's DER-31 such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions. Estimated reductions in GHG emissions due to the implementation of BMPs may be significant because the majority of the estimated GHG emissions are from the use of small transport vehicles compatible with alternative fuels.

Implementability

This subalternative would be both technically and administratively implementable. Controls could be implemented through standard agreements with the City and residents. MNA would not present substantial challenges. The resources required to implement this process option are readily available. This alternative would result in very low disturbance of the community.

Land Use

Limited activity is required for this alternative, and land use is anticipated to remain unchanged from current use. Alternative 4A is anticipated to attain SCGs in the longest period of time for Subarea 1C; thereby requiring environmental easements on a larger area and for the longest period of time than other alternatives.

Cost

A detailed cost estimate of Monitored Natural Attenuation is provided in **Appendix B**, and is summarized alongside other remedial alternatives in **Table 6-2**.

6.4.7 Alternative 4B –In-situ Enhanced Bioremediation of Subsurface Soil and Groundwater for Subarea 1C.

Description

In-situ enhanced bioremediation (ISB) would be implemented within Subarea 1C as shown in **Figure 6-3.** To enhance the activity of naturally occurring aerobic bacteria capable of degrading Site contaminants, oxygen would be added to the saturated zone via either an oxygen releasing compound or controlled direct injection of ambient air or pure oxygen.

Bench scale testing would be performed to estimate oxygen demand of the Site soils to determine oxygen loading rates and to support selection of oxygen addition method. A small field pilot test would be performed to evaluate field injection parameters, demonstrate the effectiveness in destroying contaminants (proof of concept), and obtain other information to optimize the design of the full-scale application. For this FS Report, oxygen was assumed to be supplied directly using a slow-release downwell diffuser. The treatment program would be configured with conservative spacing of the injection points and includes approximately 20 bioremediation wells containing oxygen diffuser units. The enhanced bioremediation network would be operated for a period of 10 years in Subarea 1C. Permanent PVC wells would be installed for the oxygen diffuser units. However, oxygen releasing

chemicals would be added directly through direct-push (i.e., GeoProbe®) rods. Advantages of permanent wells are that no future drilling is required and that significantly larger amount of oxygen can be injected; advantages of direct-push injections are that there is no well construction required which potentially can reduce time and costs for well installation and abandonment, and that direct-push points offer greater flexibility if follow-up injections are required as injection locations can be moved.

Recoverable NAPL, if present, would be removed manually by utilizing recovery wells, and disposed of off-site appropriately. NAPL recovery wells would be installed where thin lenses of residual NAPL has been observed in soil borings. Manual methods (e.g., vacuum truck or bailing) would remove NAPL from these wells. Frequency of removal and alternative removal methods may be in evaluated during remedial design (e.g., automated system). Based on the RI, minimal amounts of NAPL would be recovered in Subarea 1C.

Monitored Natural Attenuation would be implanted throughout Area 1, including outside of the area treated with ISB. However, the existing cover material (i.e., grass/vegetation, asphalt, and concrete) at the Site would be maintained. Controls in the form of an environmental easement and a SMP would be implemented to limit disturbance of the ground cover materials and place health and safety requirements on subsurface activities. Long-term monitoring would be performed under this alternative to evaluate the effectiveness of ISB and MNA (in areas outside of the treatment area) over an extended period of time.

Overall Protection of Public Health and the Environment

Implementation of the bioremediation alternative would meet the groundwater RAOs related to protecting human health and the environment if oxygen can be delivered to enhance bioremediation throughout the subarea. Concentrations of MGP-related constituents in groundwater would be reduced by converting contaminants to non-hazardous compounds. NAPL would be removed from the site through manual removal.

MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways. Therefore, residents would not come into contact with these soils.

Compliance with SCGs

Chemical-Specific SCGs: Enhanced bioremediation is expected to result in reduced concentrations of MGP-related constituents in groundwater, which is anticipated to meet groundwater quality standards. Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may also aid and result in reduced concentrations of MGP-related constituents in groundwater following ISCO.

Action-Specific SCGs: Action-specific SCGs that apply to this alternative are associated with completing soil borings, installing NAPL wells, monitoring groundwater conditions, and transporting waste materials for off-site disposal. Workers and work activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping, and reporting as identified in 29 CFR 1910, 29 CFR 1926, and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following a NYSDEC-approved RD/RA Plan and site-specific HASP. Measures would be taken (as appropriate) to control levels of airborne particulate matter during activities that disturb soil (drilling), in accordance with 40 CFR 50 National Ambient Air Quality Standards. Other action-specific SCGs that potentially apply to this alternative are associated with periodic groundwater monitoring, including the handling, transportation, and disposal of waste material (i.e., purge water) in accordance with NYSDEC and NYSDOT requirements, and performance of work in accordance with OSHA health and safety requirements.

Location-Specific SCGs: Remedial activities at the Site would be conducted in accordance with federal, state, and local building/construction codes and ordinances.

Long-term Effectiveness and Permanence

Enhanced bioremediation would permanently reduce concentrations of MGP-related constituents in groundwater. Long-term monitoring would be performed to evaluate changes in groundwater conditions. Direct contact, ingestion, and inhalation (human health exposures to MGP-impacted groundwater) would be reduced in the long term because concentrations would be reduced. The general approach of conducting NAPL recovery and enhanced bioremediation together would facilitate the effectiveness of this alternative.

Reduction of Toxicity, Mobility or Volume

Using enhanced bioremediation, MGP residuals in impacted groundwater and soil would be permanently destroyed, thereby reducing volume and toxicity. Toxicity and volume of COCs in areas outside of the areas treated with oxidants would be reduced over time via natural attenuation.

Short-term Effectiveness

During subsurface work under this alternative (drilling, installation of NAPL and monitoring wells, etc), on-site remedial construction workers may potentially be exposed to impacted soil by ingestion, dermal contact, and/or inhalation. Potential exposure of on-site workers to chemical constituents would be minimized by the use of PPE, as specified in a site-specific HASP that would be developed during the remedial design. Dust control, air monitoring and proper disposal of potentially impacted material would be implemented during the installation of the additional monitoring wells. Subcontractors installing the additional monitoring wells, and personnel conducting oversight and performing groundwater monitoring would use PPE and follow requirements of a site-specific HASP.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 2 tons of CO2, 130 lbs. of CO, 81 lbs. of NOX, and 58 lbs. of SOX emitted to the atmosphere. Approximately 7.8×10^4 MJ of energy would be consumed. Furthermore, no landfill capacity use is required and no trucks are required for the transportation of soil. Best management practices (BMPs) described in NYSDEC's DER-31 such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions. Estimated reductions in GHG emissions due to the implementation of BMPs may be significant because a significant portion of the estimated GHG emissions are from the use of small transport vehicles compatible with alternative fuels. However, a large portion of the estimated GHG emissions are from drilling equipment that is not compatible with alternative fuels.

Implementability

Enhanced bioremediation is technically feasible and a proven technology. Contractors that perform this technology are available. The resources required to implement this process option are readily available.

Land Use

This enhanced bioremediation alternative utilizes in-situ remediation to treat contamination in place. Oxygen addition wells or injection points would not adversely impact land use, and this technology is anticipated to meet SCGs (and more area with less restricted land use) more quickly than other alternatives.

Cost

Detailed costing of this alternative is provided in **Appendix B** and is summarized alongside other remedial alternatives in **Table 6-2**.

6.4.8 Alternative 4C –In-situ Chemical Oxidation of Subsurface Soil and Groundwater for Subarea 1C.

Description

In-situ chemical oxidation (ISCO) would be implemented within Subarea 1C as shown in **Figure 6-3** by the injection of a chemical oxidant into the impacted areas to convert contaminants to non-hazardous or more stable compounds. Typical oxidants which can be used to treat the site contaminants include modified Fenton's reagent (MFR, hydrogen peroxide (H2O2) with chelated iron), activated sodium persulfate (ASP, Na2S2O8), and permanganate (MnO4-). For ISCO applications, sodium persulfate needs to be activated (catalyzed) in order to form sulfate radicals (SO4-), a more powerful oxidant than persulfate. Catalyzing agents include elevated temperatures, ferrous iron (Fe(II)), elevated pH (base), and peroxide. ASP is more stable with a longer half–life as MFR;

therefore, it may be more beneficial in addressing the aqueous contamination. ISCO using permanganate does not require any activating or stabilizing agents and is the most stable of the three possible oxidants and would have the longest anticipated persistence; however, benzene is recalcitrant to oxidation by permanganate. The actual chemical oxidant would be evaluated and selected using bench scale and/or field pilot testing. As a significant mass of COCs is likely present (adsorbed to soils and present as thin lenses of residual NAPL), MFR is assumed to be the oxidant for this FS due to its ability to achieve significantly more desorption compared to other oxidants, and bubbling associated with peroxide reactions also enhances NAPL solubilization and oxidation. ASP or permanganate could be considered for the later stages of the treatment program due to longer persistence after increased NAPL solubilization has been initiated by MFR.

Bench scale testing is recommended to confirm that MFR is the most appropriate oxidant, optimally select peroxide dosage and determine quantities of chelating and/or activating agents. Soil and groundwater for bench scale testing would be collected from within the proposed treatment area. A small field pilot test would be performed to evaluate field injection parameters, demonstrate the effectiveness in destroying contaminants (proof of concept), and obtain other information to optimize the design of the full-scale application.

For purposes of this FS, the treatment program is configured with conservative spacing of the injection points. The treatment area is for Subarea 1C is approximately 6,000 square feet (sf). The vertical treatment area is generally 10 feet from approximately 6-16 ft bgs, primarily within more conductive soils; this interval would straddle the water table to treat the “smear” zone located between the high and low water table elevations. The estimated treatment volume is approximately 2,200 cy.

Injection can be performed through permanent PVC wells or directly through direct-push (i.e., GeoProbe®) rods. Advantages of permanent wells are that future, follow-up injections can be completed without additional drilling activity and wells allow additional data collection points. Advantages of direct-push injections are that there is no well construction required which potentially can reduce time and costs for well installation and abandonment, and that direct-push points offer greater flexibility if follow-up injections are required as injection locations can be moved. For this FS, injection would be performed using temporary direct push-points which allow for flexibility in injection locations and to minimize injection well installation in the street and on residential properties. The injection points are proposed to be placed in a grid pattern to address the contamination within the target treatment area. For purposes of this FS, the assumed layout uses a spacing of 15 ft between each injection point, assuming a minimum radius of influence of approximately 10 ft per injection point, with a total of approximately 40 injection points proposed. Grid spacing and orientation may be altered during the remedial design or during the treatment program depending on the response noted in the monitoring points and any encountered site constraints. The injection point locations for all subsequent events could be offset from the previous event location for better overall coverage and/or contact with contamination.

Based on the elevated concentrations and the presence of residual coal tar NAPL, three to four injection events would be required to attain chemical specific SCGs. Each injection event would require approximately three weeks to complete injections, with two days of field time assumed each for mobilization and demobilization. The third and fourth injections would likely have a smaller scope to target residual contamination areas; however, for the cost estimate in this FS, all four events would include all proposed injection points. As a built-in contingency, the cost estimate assumes three additional future injections with limited scope for residual contamination areas.

Recoverable NAPL, if present, would be removed manually by utilizing recovery wells, and disposed of off-site appropriately. NAPL recovery wells would be installed where NAPL has been observed in soil borings. Manual methods (e.g., vacuum truck or bailing) would remove NAPL from these wells. Frequency of removal and alternative removal methods may be in evaluated during remedial design (e.g., automated system). As discussed above, oxidation injections are anticipated to enhance desorption of NAPL in the soil matrix; therefore, enhancing NAPL removal. Based on the RI, minimal amounts of NAPL are anticipated to be recovered in Subarea 1C.

Monitored Natural Attenuation would be implanted throughout Area 1, including outside of the area treated with ISCO. However, the existing cover material (i.e., grass/vegetation, asphalt, and concrete) at the Site would be maintained. Controls in the form of an environmental easement and a SMP would be implemented to limit disturbance of the ground cover materials and place health and safety requirements on subsurface activities. Long-term monitoring would be performed under this alternative to evaluate the effectiveness of ISCO and MNA (in areas outside of the treatment area) over an extended period of time.

Overall Protection of Public Health and the Environment

Implementation of the ISCO alternative would meet the groundwater RAOs related to protecting human health and the environment. Concentrations of MGP-related constituents in groundwater would be reduced by converting contaminants to non-hazardous compounds. This, in turn, could reduce or eliminate off-site migration of MGP-related constituents at concentrations exceeding water quality standards. In addition, ISCO may increase solubility of NAPL from the soil matrix. Solubilized NAPL would then be manually recovered from Site monitoring wells.

MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways. Therefore, residents would not come into contact with these soils.

Compliance with SCGs

Chemical-Specific SCGs: ISCO is expected to result in reduced concentrations of MGP-related constituents in groundwater, which is anticipated to meet groundwater quality standards. Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may also aid and result in reduced concentrations of MGP-related constituents in groundwater following ISCO.

Action-Specific SCGs: Action-specific SCGs that apply to this alternative are associated with completing soil borings, installing NAPL wells, injecting oxidant into groundwater, monitoring groundwater conditions, and transporting waste materials for off-site disposal. Workers and work activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping, and reporting as identified in 29 CFR 1910, 29 CFR 1926, and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following a NYSDEC-approved RD/RA Plan and site-specific HASP. Measures would be taken (as appropriate) to control levels of airborne particulate matter during activities that disturb soil (drilling), in accordance with 40 CFR 50 National Ambient Air Quality Standards. Other action-specific SCGs that potentially apply to this alternative are associated with periodic groundwater monitoring, including the handling, transportation, and disposal of waste material (i.e., purge water) in accordance with NYSDEC and NYSDOT requirements, and performance of work in accordance with OSHA health and safety requirements.

Location-Specific SCGs: Remedial activities at the Site would be conducted in accordance with federal, state, and local building/construction codes and ordinances, especially with regard to transporting and handling chemical oxidants.

Long-term Effectiveness and Permanence

ISCO would be effective at reducing concentrations of MGP-related constituents in groundwater. Long-term monitoring would be performed to evaluate changes in groundwater conditions. Direct contact, ingestion, and inhalation (human health exposures to MGP-impacted groundwater) would be reduced in the long term because concentrations would be reduced. Natural degradation processes may be effective at reducing concentrations of COCs in groundwater after ISCO. Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil and soil via chemical oxidation and natural processes is permanent. The general approach of conducting NAPL recovery and ISCO together would facilitate the effectiveness of this alternative.

Reduction of Toxicity, Mobility or Volume

Using chemical oxidation, MGP residuals in impacted groundwater and soil would be permanently destroyed, thereby reducing volume and toxicity. Although mobility may increase immediately after the first ISCO event, overall contaminant mobility would also be reduced. Toxicity and volume of COCs in areas outside of the areas treated with oxidants would be reduced over time via natural attenuation.

Short-term Effectiveness

During subsurface work under this alternative (drilling, installation of NAPL and monitoring wells, etc), on-site remedial construction workers may potentially be exposed to impacted soil by ingestion, dermal contact, and/or inhalation. Potential exposure of on-site workers to chemical constituents would be minimized by the use of PPE, as specified in a site-specific HASP that would be developed during the remedial design. Dust control, air monitoring and proper disposal of potentially impacted material would be implemented during the installation of the additional monitoring wells. Subcontractors installing the additional monitoring wells, and personnel conducting oversight and performing groundwater monitoring would use PPE and follow requirements of a site-specific HASP.

Estimated GHG/air emissions, landfill capacity use, energy use, and traffic impacts are presented in **Figure 6-5**. Implementation of this alternative would result in approximately 7 tons of CO2, 149 lbs. of CO, 68 lbs. of NOX, and 367 lbs. of SOX emitted to the atmosphere. Approximately 1.6×10^5 MJ of energy would be consumed. Furthermore, no landfill capacity use is required and no trucks are required for the transportation of soil. Best management practices (BMPs) described in NYSDEC's DER-31 such as alternative fuels and the sequencing of work to mitigate unnecessary movement of construction equipment should be used to reduce the estimated GHG emissions. Estimated reductions in GHG emissions due to the implementation of BMPs are estimated to be minimal because the majority of the estimated GHG emissions are from drilling equipment that is not compatible with alternative fuels.

Implementability

ISCO is technically feasible and a proven technology. Contractors that perform this technology are available. However, this type of equipment and skilled labor is usually provided by "specialty-type" contractors. The main concern for ISCO is that the oxidant must come in contact with the COCs in order to become effective; thereby requiring additional injection events to treat hot spots. In addition, controls could be implemented with standard agreements with the City and residents. MNA would not present substantial challenges. The resources required to implement this process option are readily available.

Land Use

This alternative utilizes in-situ remediation to treat contamination in place. Injection wells or injection points would not adversely impact land use, and this technology is anticipated to meet SCGs (and more area with less restricted land use) more quickly than other alternatives.

Cost

Detailed costing of this alternative is provided in **Appendix B** and is summarized alongside other remedial alternatives in **Table 6-2**.

6.4.9 Alternatives 3A through 4C - Monitored Natural Attenuation for Subsurface Soils and Groundwater, and Soil Vapor for the Remaining Portions of Area 1 and for Area 2 and OU-1

Description

The description of MNA was presented in Alternative 4A, Section 6.4.5.

Long-term monitoring would be performed under this alternative to evaluate the effectiveness of MNA over an extended period of time. Samples would be collected from both selected existing monitoring wells and newly installed monitoring wells (approximately 15 in Area 1, 15 in Area 2, and 3 in OU-1), and analyzed for constituents of interest. Results of the groundwater monitoring would be summarized and presented to the NYSDEC in annual reports. The goal of the long-term monitoring would be to show an order of magnitude decrease in both total BTEX and total PAHs concentrations within five years of the completion of remediation construction activities. For this FS Report, after a five-year period, an evaluation of the long-term monitoring would be made and presented to the NYSDEC. Based on the analytical results and trends in groundwater constituent concentrations, NYSEG could propose modifications to the monitoring program, if necessary.

For the purposes of this FS Report, it is assumed that the subsequent period of annual sampling would vary based on the selected remedial alternatives selected for Subareas 1A and 1B and Subarea 1C. For alternatives where Site contaminants would be contained, removed, treated in-situ, and/or immobilized in the three subareas, an additional 10 years of annual MNA sampling is assumed (years 6-15). For alternatives where monitored natural attenuation would be implemented, an additional 15 years of MNA sampling is assumed (years 6 to 20). Seasonal variation of groundwater concentrations is anticipated and will be established during the first two years of quarterly monitoring.

Contingency remedies could be implemented, based on criteria developed as part of the remedial action work plan, including:

- Contaminant concentrations in groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection;
- Near-source wells exhibit large concentration increases indicative of a new or renewed release;
- Contaminants are identified in monitoring wells located outside of the original plume boundary;
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives; and
- Changes in land and/or groundwater use will adversely affect the protectiveness of the MNA remedy.

The contingency remedy is anticipated to be enhanced in situ aerobic bioremediation via oxygen addition to the subsurface soils and groundwater within Subarea 1C. This technology is described in Alternative 4B, Section 6.4.6. However, the scale of the enhanced bioremediation site wide for the contingency is assumed to be approximately 10 times the magnitude of that described for Subarea 1C.

In conjunction with remedial alternatives for Subareas 1A, 1B, and 1C, Monitored Natural Attenuation would be implemented for the Remainder of Area 1 and for Area 2, as shown on **Figures 6-3 and 6-4**.

Overall Protection of Public Health and the Environment

Human and ecological receptors are not being exposed to MGP impacts in soil, groundwater, or air. The absence of exposure is expected to continue. In portions of the Site where MNA would be applied, soil and groundwater impacts will continue to be treated via the monitored natural attenuation processes of sorption, dilution, dissolution, dispersion, volatilization, and microbial degradation. As indicated in the RI Report (AECOM, 2010), based on the results of soil vapor samples collected to date, further actions are not anticipated to address soil vapor conditions at OU-2. However, if concentrations of COCs in the groundwater increase as a result of residual source material or a new release, a soil vapor monitoring program will be evaluated. Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater in a limited area near OU-1. As indicated in the RI Report (AECOM, 2010), concentrations of VOCs and PAHs have decreased from 2004 to 2010 in wells located in both Areas 1 and 2.

Evaluation of the OU-1 confirmation soil sample data indicates that residual COCs are present at concentrations greater than the corresponding cleanup criteria at several locations within OU-1. In order to address groundwater conditions at OU-1, three monitoring wells will be installed and included in the MNA program. These monitoring wells will be installed in areas where elevated concentrations of COCs were detected in the confirmation soil samples.

MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways. The SMP would be a means to address potential future soil excavation (e.g. utility work). The SMP would include a requirement for developing a remedial plan that would identify proposed excavation limits and details of the soil removal (e.g., waste characterization sampling, verification sampling, excavation sidewall support, off-site transportation and disposal, dewatering, backfilling) and place health and safety requirements on subsurface activities.

The environmental easement would further mitigate potential exposure by notifying future site owners of the constituents of interest in soil and the applicability of the SMP. The SMP would mitigate potential exposure to impacted subsurface soil by setting forth actions to address possible future disturbances of subsurface soil. There are no known sources of private or public drinking water in the area of MGP impacted groundwater. The existing groundwater use laws under 10 NYCRR 5-1.31(b) would continue to minimize potential human exposure to MGP-related constituents in groundwater at concentrations exceeding standards/guidance values. The SMP to be prepared would address exposures to construction workers performing intrusive activities below the water table, such as activities to repair existing, or install new, subsurface utilities/facilities. The SMP would identify requirements for use of personal protective equipment and proper management of impacted groundwater that may be encountered.

Natural attenuation processes over time are expected to result in decreases in concentrations of COCs in groundwater and soil.

Compliance with SCGs

Chemical-Specific SCGs: While exceedances of certain chemical-specific SCGs would exist, such exceedances do not necessarily equate to a current risk to human health or the environment. Measures to address potential exposure pathways would be implemented as part of this alternative (e.g., restricting land use to industrial, requiring adherence to provisions of the SMP). Natural attenuation processes (biodegradation, volatilization, adsorption, chemical reactions and dilution) may result in reduced concentrations of MGP-related constituents in groundwater, but this process would take a longer amount of time compared with more active remedies.

Action-Specific SCGs: Action-specific SCGs that potentially apply to this alternative are associated with periodic groundwater monitoring, including the handling, transportation, and disposal of waste material (i.e., purge water) in accordance with NYSDEC and NYSDOT requirements, and performance of work in accordance with Occupational Safety and Health Administration (OSHA) health and safety requirements.

Location-Specific SCGs: Location-specific SCGs are not applicable because this alternative does not involve the implementation of active remedial measures.

Long-term Effectiveness and Permanence

Natural degradation processes may be effective over the long-term at reducing concentrations of COCs in groundwater and subsurface soil. Long-term monitoring would be performed to evaluate changes in groundwater conditions. The reduction of concentrations of MGP-related constituents in soil via natural processes is permanent, although its rate cannot currently be predicted.

Through the establishment of an environmental easement and SMP, this alternative would meet the soil groundwater RAOs related to potential direct contact, ingestion, and inhalation human health exposure pathways. The environmental easement and SMP would be kept in place, unchanged, unless site conditions were to change and make these measures unnecessary. If changes were to occur that would require modifications to the environmental easement or SMP such modifications would be presented to the NYSDEC for review and approval, as appropriate. Together, these controls could be expected to adequately and reliably provide for the management of media exhibiting constituents at concentrations exceeding standards.

Reduction of Toxicity, Mobility and/or Volume

MGP-impacted groundwater would not be contained, removed, or actively treated (other than by natural processes). Reduction of the toxicity, mobility, and volume of impacted groundwater and subsurface soils would be reduced over an extended period of time via natural attenuation processes.

Short-term Effectiveness

The installation of additional monitoring wells and regular monitoring would be the only field work performed pursuant to this alternative. Dust control, air monitoring and proper disposal of potentially impacted material would be implemented during the installation of the additional monitoring wells. Subcontractors installing the additional monitoring wells, and personnel conducting oversight and performing groundwater monitoring would use PPE and follow requirements of a site-specific HASP.

Since MNA applies to all of the Alternatives 3A through 4C, estimated Environmental impacts (i.e., GHG emissions, landfill capacity used, and traffic impacts) were not calculated for MNA. This subalternative relies on natural processes to reduce volume, toxicity, and mobility, which is viewed favorably by DER-31. Limited environmental impact would occur from sampling activities and associated laboratory analysis.

Implementability

This subalternative would be both technically and administratively implementable. Controls could be implemented through standard agreements with the City and residents. MNA would not present substantial challenges. The resources required to implement this process option are readily available. This alternative would result in very low disturbance of the community.

Land Use

Limited activity is required for this alternative, and land use is anticipated to remain unchanged from current use. Alternative 2 is anticipated to attain SCGs in the longest period of time; thereby requiring environmental easements on a larger area and for the longest period of time than other alternatives.

Cost

A detailed cost estimate of Monitored Natural Attenuation is provided in **Appendix B**, and is summarized alongside other remedial alternatives in **Table 6-2**.

6.5 Comparative Analysis of Alternatives

After individual evaluation of each alternative based on eight of the criteria, comparative analyses were conducted to evaluate the relative performance of each alternative. The purpose of the analyses was to identify the advantages and disadvantages of each alternative relative to the others so that key tradeoffs that must be balanced could be identified. Overall protection of human health and the environment and compliance with SCGs must be met by any selected alternative. Tradeoffs among the alternatives are related to five criteria: long-term effectiveness and permanence; reduction of toxicity, mobility and volume; short-term effectiveness; implementability; and cost. The remediation timeframes of each alternative are comparable since MNA is a component of all of the remedies, and the likely presence of utilities and residences will likely result in residual MGP impacts remaining following remedial actions. State and community acceptance would be addressed following regulatory review and a public comment period after a remedy has been recommended. **Table 6-2** summarizes the present value (PV) cost of each of the remedial alternatives. **Table 6-3** summarizes the comparative analysis of the alternatives and ranks each alternative for each of the criteria.

6.5.1 Overall Protection of Human Health and the Environment

Alternatives 2, 3 (3A, 3B, and 3C), and 4 (4A, 4B, 4C) include common elements that would result in overall protection of human health and the environment. All alternatives assume monitoring and institutional controls associated with OU-1.

All alternatives would meet the SCGs for groundwater over time via natural attenuation. They would achieve overall protection of human health and the environment by the remedial actions and/or the implementation of groundwater MNA. However, alternatives would meet SCGs in varying periods of time based on the degree of active remediation proposed.

All alternatives, with the exception of the No Further Action Alternative, would be protective of human health and the environment by eliminating potential exposure pathways, either by removal, treatment or containment of impacted soils and NAPL in addition to limiting exposure pathways to intrusive activities, as in the current site environment.

6.5.2 Compliance with SCGs

Chemical specific SCGs would be met for with implementation of excavation, chemical oxidation, and/or enhanced bioremediation alternatives, with No Further Action and Monitoring Natural Attenuation alternatives over a longer period of time. Some chemical specific SCGs would not be met with containment and in-situ solidification alternatives. All alternatives would be implemented such that action- and location-specific SCGs would be met.

6.5.3 Long-Term Effectiveness and Permanence

All of the alternatives except for the No Further Action Alternative would result in permanent reduction and/or containment of impacted media. The No Further Action Alternative would be least effective because it would involve no removal, immobilization or containment of impacted materials, relying on prolonged MNA to treat impacted media without monitoring or administrative means to confirm its progress.

6.5.4 Implementability

Each of the presented alternatives could be implemented; although, the degree of difficulty varies between each of the alternatives. The Excavation Alternative for Unrestricted Use (Alternative 2), the Containment alternative (Alternative 3A), and the ISS alternative (Alternative 3B) would result in the greatest amount of disturbance. In-situ remedial alternatives (MNA, in-situ chemical oxidation, and enhanced bioremediation) would result in the least amount of disturbance of the community.

6.5.5 Cost

The FS cost estimates for each of the alternatives are summarized and compared in **Table 6-2**. Net present value costs for the alternatives for Area 1 and Area 2 range between approximately $8.5 million and $12.8 million when assuming that long-term monitoring and controls will be included in the remedy. The cost for the unrestricted use alternative is estimated to be almost $18 million.

6.5.6 Land Use

Each of the presented alternatives includes some degree of controls which would alter land use to be protective of human health and the environment, with the exception of the No Further Action and Unrestricted Use alternatives. In addition to controls, each alternative would have varying degree of impact on land use. Excavation alternatives (Alternatives 2 and 3C) and ISS (Alternative 3B) would have the lowest impact on future land use by removing the source material. A groundwater containment wall (Alternative 3A) would present the greatest impacts to future land use.

6.5.7 Short-Term Effectiveness

All remediation and construction activities pose an environmental risk from a variety of impacts. The environmental impacts evaluated as a part of this FS include GHG emissions, landfill capacity use, and traffic impacts. **Figure 6-5** presents the environmental impact of each alternative in graphical form. In general, those alternatives that emphasize removal will have a larger environmental impact. Landfill use capacity was estimated assuming all excavated soils would be disposed of at an offsite landfill as waste and, therefore, be of detrimental use to the landfill. Actual disposal may be of beneficial reuse to the landfill. However, this varies dependent upon the needs of the landfill at the time of disposal. Those alternatives with a greater amount of estimated miles traveled by trucks transporting soil will have a greater impact on traffic patterns.

6.6 Recommended Alternative

The recommended remedial alternative is the combined Alternative 3B/4C for OU-2. This alternative includes ISS for Subareas 1A and 1B (in Area 1), with ISCO in Subarea 1C, and MNA in the remainder portion of Area 1 and in Area 2. Institutional controls would be in place for OU-1 and environmental easements would be in place for OU-2 areas. A SMP encompassing OU-1 and OU-2 would be developed.

This alternative had the overall lowest total score and the best ranking. This alternative will achieve the compliance criteria, and result in the lowest amount of relative impact to future land use. These alternatives will not impede future development. The ISS alternative for Subareas 1A and 1B can be implemented more easily and in a shorter timeframe than the excavation alternatives, resulting in a lesser impact to area residents. There would also be less truck traffic, and therefore less disturbance, to area residents. The ISCO alternative for Subarea 1C can be completed in a shorter duration and will offer more aggressive treatment compared to longer-term alternatives such as MNA and enhanced bioremediation. The environmental impact for ISS is moderate, while it is minimal for ISCO and MNA. The environmental footprint for ISS is similar to the environmental footprint for the excavation alternatives, but results in significantly less truck traffic and landfill space usage. MNA for remaining areas is appropriate given the relatively low impacts in these areas and observed decreasing trends in groundwater concentrations in groundwater wells.

Long-term monitoring would be performed under this alternative to evaluate the effectiveness of MNA over an extended period of time. Samples would be collected from both selected existing monitoring wells and newly installed monitoring wells, and analyzed for constituents of interest. Results of the groundwater monitoring would be summarized and presented to the NYSDEC in annual reports. The goal of the long-term monitoring would be to show an order of magnitude decrease in both total BTEX and total PAHs concentrations within five years of the completion of remediation construction activities. A contingency remedy of enhanced bioremediation would be implemented if the goals are not met. For this FS Report, after a five-year period, an evaluation of the long-term monitoring would be made and presented to the NYSDEC. Based on the analytical results and trends in groundwater constituent concentrations, NYSEG could propose modifications to the monitoring program, if necessary.

7.0 References

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Tables

Table 3-1
Chemical-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Media	Requirements	Citation	Description	SCG or TBC	Comment
Soil	NYSDEC Soil Cleanup Objectives (SCOs)	6 NYCRR Part 375-6	Establishes soil cleanup objectives SCOs based on residential, commercial, and industrial land use; protection of ecological resources; and protection of groundwater quality	SCG	Specified SCOs may be applicable in determining site-specific soil objectives.
	NYSDEC	6 NYCRR Part 371	Establishes criteria for hazardous waste classification as a characteristic hazardous waste. Characteristics include toxicity, reactivity, corrosiveness, and igniteabilty.	SCG	This regulation may be applicable for determining whether a generated waste is a hazardous waste.
Groundwater	NYSDEC Groundwater Objectives	NYSDEC, Division of Water, TOGS (1.1.1) - 6 NYCRR 703.5	Establishes guidance or standard values for groundwater quality objectives	SCG	May be applicable in determining site-specific groundwater objectives.

Notes:
SCG = Standards, Criteria, and Guidance
TBC = Other Criteria To Be Considered

Table 3-2
Action-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Action	Requirements	Citation	Description	SCG or TBC	Comment
Remedy Implementation		TAGM 4059	Making Changes to Selected Remedies	TBC	Potentially Applicable.
Water Treatment Discharge	NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	Compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in NYSDEC programs (i.e., SPDES)	TBC	These standards and guidance values establish discharge limitations to surface waters, if applicable.
	Clean Water Act	Section 401	Water Quality Certification	SCG	Potentially Applicable.
	SPDES	16NYCRR750-01, 750.-02	Requirements for obtaining a SPDES permit Requirements for operating in accordance with an SPDES permit	SCG	Potentially Applicable, if constructing and operating water treatment system
	Town Sewer Division	TOGS (1.3.8)	New Discharge to Publicly Owned Treatment Works	SCG	Potentially Applicable, if constructing and operating water treatment system
In Situ Treatment of Soils and Groundwater	Underground Injection Control Program	40 CFR Part 144	Includes requirements for Class V wells that are used to clean up, treat, or prevent contamination of aquifiers.	SCG	Potentially Applicable as treated ground water (pump and treat), bioremediation agents, or other recovery enhancement materials may be injected into the subsurface via Class V wells.
Waste Management	Solid Waste Management Facility	6 NYCRR 360	Includes solid waste disposal requirement	SCG	Applicable, if soil is removed.
	Waste Transporter Permits	6 NYCRR 364	Requires that wastes be transported by permitted waste haulers	SCG	Applicable, if soil is removed.
		TAGM 4032	Disposal of Drill Cuttings	SCG	Applicable during the installation of wells/injection points.
Hazardous Waste	Identification and Listing of Hazardous Waste	6 NYCRR 371	Outlines criteria determining whether solid waste is hazardous and subject to regulations under 6 NYCRR Parts 370-376	SCG	Applicable, if soil is excavated.
	Hazardous waste manifest system and related standards for generators, transporters, and facilities.	6 NYCRR 372; 40 CFE 263	Must be met when hazardous waste is being disposed of off site	SCG	Applicable, if soil is removed. Any soils classified as hazardous will be transported following these regulations.

Table 3-2
Action-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Action	Requirements	Citation	Description	SCG or TBC	Comment
MGP-Impacted Soil and Sediment	Management of soil and sediment contaminated with coal tar from Manufactured Gas Plants	NYSDEC TAGM 4060 and NYSDEC TAGM 4061	This guidance outlines the criteria for MGP coal tar waste. Soils and sediment only exhibiting the toxicity characteristic for benzene (D018) may be conditionally excluded from the requirements of 6 NYCRR Parts 370-374 and 376 when they are destined for permanent thermal treatment	SCG	Applicable for off-site treatment and disposal, if soil is removed.
Generation, Management, and Treatment of Hazardous Waste	**Federal:** *Resource Conservation and Recovery Act (RCRA) Subtitle C – Hazardous Waste Management*				
	Identification and Listing of Hazardous Wastes	40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266	SCG	These regulations do not set clean-up standards, but would apply to the classification of all MGP-impacted soils and residual waste streams generated during onsite thermal treatment.
	Hazardous Waste Determinations	40 CFR Part 262.11	Generators must characterize their wastes to determine if the waste is hazardous by listing (40 CFR 261, Subpart D), by characteristic (40 CFR 261, Subpart C), or excluded from regulation (40 CFR 261.4)	SCG	Neither coal tars nor petroleum-based residuals are listed hazardous wastes but may be hazardous by characteristic (particularly for benzene toxicity).
	Manifesting	40 CFR 262, Subpart B	Generators must prepare a Hazardous Waste Manifest (EPA form 8700-22) for all off-site shipments of hazardous waste to disposal or treatment facilities	SCG	Will apply to all off-site shipments of RCRA/NYSDEC hazardous wastes.
	Recordkeeping	40 CFR 262.40	Generators must retain copies of all hazardous waste manifests used for off-site disposal	SCG	Generators must retain copies of waste manifests for a minimum period of three years after shipment date.
	Labeling and Marking	40 CFR 262, Subpart C	Specifies EPA marking, labeling, and container requirements for off-site disposal of hazardous waste	SCG	Pre-transportation requirements for off-site shipments of hazardous wastes.
	Accumulation Limitations	40 CFR Part 262.34	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers, and containment buildings without having to obtain a RCRA hazardous waste permit	SCG	Hazardous wastes may be stored for up to 90 days on site without the need for a storage permit unless NYSDEC waives the 90-day limit as an administrative requirement. Requirement will likely apply to coal tar or purifier wastes that contain little or no soil and treatment residuals that are characteristically hazardous.

Table 3-2
Action-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Action	Requirements	Citation	Description	SCG or TBC	Comment
Generation, Management, and Treatment of Hazardous Waste (Cont'd.)	*Standards for Owners/Operators of Hazardous Waste Treatment, Storage, Disposal (TSD) Facilities*				
	General Facility Standards	40 CFR Part 264/265 Subpart B	General requirements for owners/ operators of TSD facilities including general waste analysis and compatibility, notices and inspection requirements, location and construction standards, and security.	SCG	Applicable to the on-site management of hazardous waste material in tanks, containers, or containment buildings.
	Closure and Post-Closure	Subpart G	Establishes closure and post-closure requirements for hazardous waste treatment and storage units.	SCG	Potentially applicable for remediation activities that would involve the construction of upland hazardous waste management facilities.
	Container Management	Subpart I	Hazardous waste stored in containers must comply with management requirements, including types of containers used, waste compatibility, and inspection requirements.	SCG	Applicable to storage and/or treatment of hazardous wastes in containers on site.
	NYSDEC Division of Hazardous Substances Regulation				
	Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376.	SCG	These regulations do not set clean-up standards, but would apply during the on-site management of excavated hazardous waste soils and the upland management of excavated sediments and residual waste streams generated during remedial activities.
	New York State Hazardous Waste Management Facility Regulations	6 NYCRR Part 370, 373, 372	Establishes New York State's USEPA equivalent hazardous waste management program. Includes regulations for hazardous waste facility construction, operation, and closure, and standards for hazardous waste generation, manifesting and transport.	SCG	Applicable to the on-site management of hazardous waste soils and sediments in tanks, containers, or containment buildings.
	Management of Soils Contaminated with Coal Tar from Former Manufactured Gas Plants Policy	NYSDEC Division of Environmental Remediation, Technology Section	Addresses management of MGP-contaminated soils within defined Areas of Contamination (AOCs) and allows for consolidation of such soils under specified circumstances without triggering LDR requirements	SCG	Provisions are consistent with USEPA Area of Contamination (AOC) policy. The provisions will be referenced in developing and evaluating MGP-impacted soil remediation alternatives.

Table 3-2
Action-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Action	Requirements	Citation	Description	SCG or TBC	Comment
Off-site Management of Non-hazardous Waste	RCRA Subtitle D	42 U S C Section 6901 *et seq.*	State and local governments, in accordance with EPA's guidance, are the primary planning, regulating, and implementing entities for the management of non-hazardous solid waste, such as household garbage and non-hazardous industrial solid waste	SCG	Applicable if the soil is removed from site.
	Criteria for Classification of Solid Waste Disposal Facilities	40 CFR Part 257	Minimum criteria for siting, construction, operation, and closure of solid waste disposal facilities	SCG	Potentially applicable to the onsite disposal of excavated soil and associated waste streams
Air Emissions from a Point Source	*Clean Air Act (CAA)*				
	New York State Ambient Air Quality Standards	6 NYCRR Part 257	Establishes state ambient air quality standards and guidelines for protection of public health	SCG	Applicable in evaluating air impacts during remediation activities. Establishes short-term exposure action limits for occupational exposure.
	Fugitive dust suppression and particulate monitoring	NYSDEC TAGM 4031	Fugitive dust suppression and particulate monitoring during source area remedial activities	SCG	Applicable in evaluating air impacts and implementation under a site health and safety plan during remedial activities.
	Community Air Monitoring Plan (CAMP)	NYSDOH	Air Quality Requirements	SCG	Applicable in evaluating air impacts and implementation under a site health and safety plan during remedial activities.
Land Disposal of Hazardous Waste	*RCRA Subtitle C*				
	Land Disposal Restrictions (LDRs)	40 CFR Part 268	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous wastes must be treated to prior to land disposal. Phase IV rule revision establishes Alternate Treatment Standards for Soils containing hazardous wastes.	SCG	Wastes exhibiting a hazardous characteristic would need to be treated to meet UTS for all hazardous constituents present in the residuals prior to disposal. Characteristically hazardous soils can be treated to meet the UTS standards or to meet the alternative treatment standards for RCRA hazardous soils.
Institutional Controls	Institution of an Environmental Easement	NYSDEC Policy on Environmental Easements	NYSDEC has developed a standard form and procedure for establishing environmental easements	TBC	Institutional controls will be established in accordance with NYSDEC policy

Table 3-2
Action-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Action	Requirements	Citation	Description	SCG or TBC	Comment
Monitored Natural Attenuation	Provides specific requirement for implementation of MNA	*Use of MNA at Superfund, RCRA Corrective Action and UST Sites* (USEPA, 1997)	This guidance document establishes the technical basis for implementing MNA	TBC	Monitored Natural attenuation will be implemented in accordance with USEPA guidance

Notes:
SCG = Standards, Criteria, and Guidance
TBC = Other Criteria To Be Considered

Table 3-3
Location-Specific Standards, Criteria, and Guidance
NYSEG OU-2
Ithaca, NY

Location	Requirements	Citation	Description	SCG or TBC	Comment
Entire Site	General Regulations		County transportation and site use regulations	TBC	Requirements of County, City, Town and Village would be applicable to all remediation alternatives, especially those requiring transportation.
	General Ordinances		City regulations regarding transportation, noise, zoning, building permits, etc.	TBC	Requirements of County, City, Town and Village would be applicable to all remediation alternatives.
Areas Within Site To Be Determined.	National Historic Preservation Act	16 USC 470	Establishes requirements for the identification and preservation of historic and cultural resources.	SCG	Applicable to the management of historic or archeological artifacts, if identified on the site. A No Findings determination is required prior to remedial activities.
	New York State Department of Parks, Recreation, and Historic Preservation	Historic Preservation Act	Establishes requirements for the identification and preservation of historic and cultural resources.	SCG	Applicable to the management of historic or archeological artifacts, if identified on the site. A No Findings determination is required prior to remedial activities.

Notes:
SCG = Standards, Criteria, and Guidance
TBC = Other Criteria To Be Considered

Table 5-1
Preliminary Screening Technologies for Soil
NYSEG OU-2 Site

General Response	Technology	Process	Applicability to OU-2
No action	(n/a)	(n/a)	**Applicable**
Limited action	**Institutional Controls**	Environmental Easement	**Applicable**
		Zoning / Ordinance	**Applicable**
		Current Site Use	**Applicable**
		Site Management Plan	**Applicable**
In-situ treatment	**On-Site Capping**	Asphalt cap	**Applicable**
		HDPE cap	Not Applicable due to Site Uses
		Clay cap	Not Applicable due to Site Uses
		Soil cover	**Applicable**
		RCRA Landfill	Not Applicable due to Space Limitations
	In-situ Solidification	Bucket/blender mixed - Portland, bentonite, fly ash, slag, activated carbon, blend	**Potentially Applicable**
		Auger Rig Mixed - Portland, bentonite, fly ash, slag, activated carbon, blend	**Potentially Applicable**
		Pressure Jet Grout - Portland, bentonite, fly ash, slag, activated carbon, blend	**Applicable**
	Soil Vapor Extraction	Vacuum extraction	Not Applicable to MGP Impacts
	In-situ Washing	Surfactant flushing	Not Applicable - generate significant quantity of wastewater
	Phytoremediation	Mustard Plant or other plants that uptake PAHs	Not Applicable due to depth of contamination
	Biological treatment	Oxygenation - ORC / iSOC	**Applicable in Subsurface Soil below the water table**
		Oxygenation - Ozone	**Potentially Applicable**
		Oxygenation - H2O2	**Potentially Applicable**
		Oxygenation - Air	**Potentially Applicable**
		Phytoremediation/ Constructed Wetlands	Not Applicable - space limitatoins/urban area.
	Chemical Treatment All processes may be potentially Applicable. However, Insufficient contact with oxidant to provide effective treatment in vadoze zone. Flooding of vadoze zone may not be practicable.	Oxidation - Ozone	**Potentially Applicable**
		Oxidation - H2O2/Modified Fenton's	**Applicable in Subsurface Soil below the water table**
		Oxidation - KMnO4 or NaMnO4	**Applicable in Subsurface Soil below the water table**
		Oxidation - Persulfate	**Applicable in Subsurface Soil below the water table**
		Reduction - Calcium Polysulfide	Not Applicable
		Solidification / Stabilization	**Applicable in Subsurface Soil below the water table**
		Lime addition	Not Applicable due to nature of impacts
	Physical treatment	Solidification / Stabilization	**Applicable in Subsurface Soil below the water table**
		Soil flushing	Not Applicable
		Surfactant enhanced recovery	Not Applicable - Experimental
		Electro kinetic separation	Not Applicable to MGP impacts.
		Vitrification	Not Applicable - Experimental, high energy cost, and dense residential site use prohibits this technology
		Thermal resistivity	Not applicable - due to dense residential site use
		Electromagnetic heating	Not applicable - due to dense residential site use
		Heat enhanced recovery	Not applicable - due to dense residential site use
		Soil vapor extraction	Not applicable - due to nature of impacts at site

Table 5-1
Preliminary Screening Technologies for Soil
NYSEG OU-2 Site

General Response	Technology	Process	Applicability to OU-2
Ex-situ treatment	**Excavation**	Soil removal - surface	**Applicable**
		Soil removal - above water table	**Applicable**
		Soil removal - below water table	**Applicable**
		Soil removal - deep excavation	**Applicable**
		(Sheet piling)	**Applicable**
		(Slurry Wall)	**Applicable**
		(Trench Box)	**Potentially Applicable**
	Excavation and On-site Treatment: Not Applicable at this site due to space limitations.	Chemical Oxidation	Not Applicable
		Lime addition	Not Applicable
		Solidification - hot asphalt	Not Applicable
		Solidification - cold mix asphalt	Not Applicable
		Solidification - cement	Not Applicable
		Thermal desorption	Not Applicable
		Incineration - fluidized bed	Not Applicable
		Incineration - rotary kiln	Not Applicable
		Incineration - co-burning	Not Applicable
		Incineration - brick manufacture	Not Applicable
		Soil washing - acid	Not Applicable
		Soil washing - base	Not Applicable
		Soil washing - solvent	Not Applicable
		Separation - magnetic	Not Applicable
		Land farm	Not Applicable
		Phytoremediation	Not Applicable
		Biopile	Not Applicable
		Slurry phase treatment	Not Applicable
		On-Site Reuse	Not Applicable due to bulking and changes in geotechnical properties
	Excavation and Off-site Treatment/ Disposal	Lime addition for moisture control	**Applicable**
		Solidification - cement	**Applicable**
		Thermal desorption	**Applicable**
		Landfill (Debris and Low-Level Impacted Soil Only)	**Applicable**

Table 5-2
Preliminary Screening Technologies for Groundwater/NAPL
NYSEG OU-2 Site

General Response	Technology	Process	Applicability to OU-2
No Action	(n/a)	(n/a)	**Applicable**
Limited Action	**Institutional Controls**	Environmental Easement	**Applicable**
		Zoning / Ordinance	**Applicable**
		Current Site Use	**Applicable**
		Site Management Plan	**Applicable**
	Environmental Monitoring	Groundwater Monitoring	**Applicable**
		Monitored Natural Attenuation	**Applicable**
Containment	**Trenched Slurry Wall**	Pumped - Portland, Bentonite, or Blend	**Applicable**
		HDPE liner	Not Applicable - due to utilities
	Augered Slurry Wall	In-situ Solidification - Portland, Bentonite or Blend	**Applicable**
	Grout Curtain Wall/Bottom	Pressure/Jet Grouting - Portland. Bentonite or Blend	**Applicable**
	Sheet Pile Wall	Steel - Grouted Joints	Not Applicable - due to utilities
		Steel - Standard Joints	Not Applicable - due to utilities
		HDPE - Grouted	Not Applicable - due to utilities
	Hydraulic	Induced Drawdown - Pump and Treat	Not Applicable - due to limited space to construct a water treatment plant

Table 5-2
Preliminary Screening Technologies for Groundwater/NAPL
NYSEG OU-2 Site

General Response	Technology	Process	Applicability to OU-2
In-situ Treatment	**Biological Treatment**	Oxygenation - ORC	**Applicable**
		Oxygenation - Air Diffusion via iSOC	
		Oxygenation - H_2O_2 Low Conc., Injection.	**Applicable**
		Oxygenation - Ozone Sparging	**Potentially Applicable**
		Microbial Fence (treatment only at the property line to prevent further migration, using one or more of the above oxygenation processes.)	Not Applicable - will require long-term maintenance and re-establishment of the barrier.
		Nitrate Enhancement	Not Applicable to MGP Impacts
		Co-metabolic Treatment	Not Applicable to MGP Impacts
		Reduction - Calcium Polysulfide	Not Applicable to MGP Impacts
		Dechlorination - Edible oil (e-)	Not Applicable to MGP Impacts
		Dechlorination - Molasses (e-)	Not Applicable to MGP Impacts
		Phytoremediation/ Constructed Wetlands	Not Applicable
	Chemical Treatment	Oxidation - Ozone	**Potentially Applicable**
		Oxidation - H_2O_2/Fenton's	**Applicable**
		Oxidation - KMnO4	**Applicable**
		Oxidation - NaMnO4	**Applicable**
		Oxidation - Persulfate	**Applicable**
		Reduction - Calcium Polysulfide	Not Applicable
		Reactive barrier (Similar in purpose to the microbial fence. Treatment to prevent further migration using one or more of the above oxidation processes).	Not Applicable - will require long-term maintenance and re-establishment of the barrier.
		Zero Valent Iron	Not Applicable to MGP Impacts
	Physical Treatment	Air Sparging - with Vapor Recovery	Not Applicable to MGP Impacts
		Air Sparging - without Vapor Recovery	Not Applicable to MGP Impacts
		Bioslurping	Not Applicable to MGP Impacts

Table 5-2
Preliminary Screening Technologies for Groundwater/NAPL
NYSEG OU-2 Site

General Response	Technology	Process	Applicability to OU-2
Ex-situ Treatment Ex-situ pump and treat is not applicable for groundwater due to space restrictions at the site.	Biological Treatment	Activated Sludge	Not Applicable
		Fluidized Bed Reactor	Not Applicable
		Attached Growth Methanogens	Not Applicable
		Constructed Wetland	Not Applicable due to space limitations and nature of impacts
	Physical / Chemical Treatment	Oxidation - KMnO4	Not Applicable
		Oxidation - UV	Not Applicable
		Gravity Separation	Not Applicable
		Sedimentation, with Coagulation	Not Applicable
		Dissolved Air Floatation	Not Applicable
		Filtration - Granular / Multi-granular	**Potentially Applicable for Dewatering Operations**
		Filtration - Cartridge / Bag	**Potentially Applicable for Dewatering Operations**
		Air Stripping - Tower	**Potentially Applicable for Dewatering Operations**
		Air Stripping	**Potentially Applicable for Dewatering Operations**
		Adsorption	**Potentially Applicable for Dewatering Operations**
		POTW Treatment	**Potentially Applicable for Dewatering Operations**
	NAPL Recovery	Passive or Low Flow	**Applicable**
		High Flow (Pump and Treat)	**Applicable**
		Heat Enhanced Recovery	Not applicable due to dense residential setting
		Steam (pressure) Enhanced Recovery	Not applicable due to dense residential setting
		Sound/Vibration Enhanced Recovery	Not applicable due to dense residential setting
		Surfactant Enhanced Recovery	Not applicable - experimental

Table 6-1. Summary of Remedial Alternatives
OU-2 Feasibility Study
NYSEG Ithaca Court Street MGP Site
Ithaca, New York

Remedial Action Objectives (RAOs)
1. Remove, contain, and/or treat the source of MGP groundwater contamination, including non-aqueous phase liquid, to the extent practicable.
2. Minimize human contact with soil containing MGP contaminants of concern at levels above NYSDEC Part 375 Soil Cleanup Objectives - Residential Use.
3. Minimize ingestion/direct contact with MGP contaminated groundwater.
4. Mitigation of MGP groundwater impacts to the extent practicable.

General Comments
- Wooden duct (Area 3) to be removed as part of OU-1 remediation activities.
- No demolition of buildings will be conducted.

Note: One of each of the Alternative 3 (3A, 3B, or 3C) and 4 (4A, 4B, or 4C) options would be combined together with the MNA alternative for the Remainder of Area 1 and Area 2.

Alternative	SITE AREA			
Alternative 1 - No Further Action	**Area 1 & Area 2**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
No action for OU-2. Institutional controls and site management required as part of OU-1.		This alternative is retained as a baseline.	None	RAOs for OU-2 are not addressed by this alternative. RAOs for OU-1 are achieved.
Alternative 2 - Excavation (Unrestricted Use)	**Area 1 & Area 2**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
Perform pre-design investigation, as needed .		Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil.
Excavation of subsurface soils.				Excavation will remove impacted soils and migration of impacted media will be eliminated to the extent possible.
Alternative 3A - Containment	**Subarea 1A & 1B**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
Perform pre-design investigation, as needed.		Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil.
Contaminant containment for subsurface soils and groundwater.				MGP impacted soils will be contained, and migration of impacts eliminated, to the extent practicable. Further impact of groundwater from the impacted soils will be mitigated.
NAPL recovery.				NAPL recovery will remove contamination, to the extent practicable.
Alternative 3B - ISS	**Subarea 1A & 1B**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
Perform pre-design investigation, as needed .		Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil.
In-situ solidification/stabilization (ISS) for subsurface soils.				In-situ solidification will prevent the migration of impacted media.
Alternative 3C - Excavation	**Subarea 1A & 1B**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
Perform pre-design investigation, as needed .		Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil.
Excavation of subsurface soils.				Excavation will remove impacted soils and migration of impacted media will be eliminated to the extent possible.

Table 6-1. Summary of Remedial Alternatives
OU-2 Feasibility Study
NYSEG Ithaca Court Street MGP Site
Ithaca, New York

Remedial Action Objectives (RAOs)

1. Remove, contain, and/or treat the source of MGP groundwater contamination, including non-aqueous phase liquid, to the extent practicable.
2. Minimize human contact with soil containing MGP contaminants of concern at levels above NYSDEC Part 375 Soil Cleanup Objectives - Residential Use.
3. Minimize ingestion/direct contact with MGP contaminated groundwater.
4. Mitigation of MGP groundwater impacts to the extent practicable.

General Comments

- Wooden duct (Area 3) to be removed as part of OU-1 remediation activities.
- No demolition of buildings will be conducted.

Note: One of each of the Alternative 3 (3A, 3B, or 3C) and 4 (4A, 4B, or 4C) options would be combined together with the MNA alternative for the Remainder of Area 1 and Area 2.

Alternative 4A - MNA	Subarea 1C	Comments	RAOs Achieved	How RAOs are addressed by Remedial Alternative
Perform pre-design investigation, as needed . Institutional controls for subsurface soils and groundwater. Monitored natural attenuation for groundwater and soil.		Significant MGP tar is not present in this subarea. Human and ecological receptors are not being exposed to MGP impacts. Soil and groundwater impacts will be treated via the monitored natural attenuation processes of dilution, dissolution, dispersion, volatilization, and microbial degradation. Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater in a limited area near OU-1.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil. There are no known sources of private or public drinking water in the area of MGP impacted groundwater; therefore people do not ingest or come into contact with MGP contaminated groundwater. MGP-impacted groundwater is primarily confined to areas located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the groundwater. An environmental easement with groundwater restrictions will be used to mitigate future exposure to impacted groundwater. Monitored natural attenuation will treat the groundwater contamination, but will require a longer cleanup time than active remedies due to the presence of residual coal tar. The extent of groundwater impacts appear to not have migrated significantly beyond the vicinity of coal tar impacts.
Alternative 4B - Enhanced Bioremediation	**Subarea 1C**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
Perform pre-design investigation, as needed . Implement enhanced aerobic bioremediation		Significant MGP tar is not present in this subarea. Human and ecological receptors are not being exposed to MGP impacts. Conduct in situ enhanced bioremediation to address residual NAPL and grossly impacted soils. Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil. Groundwater contamination will be treated by bioremediation and monitored natural attenuation. The extent of groundwater impacts appear to not have migrated significantly beyond the vicinity of coal tar impacts.
NAPL recovery.				NAPL recovery will remove contamination, to the extent practicable.

Table 6-1. Summary of Remedial Alternatives
OU-2 Feasibility Study
NYSEG Ithaca Court Street MGP Site
Ithaca, New York

Remedial Action Objectives (RAOs)

1. Remove, contain, and/or treat the source of MGP groundwater contamination, including non-aqueous phase liquid, to the extent practicable.
2. Minimize human contact with soil containing MGP contaminants of concern at levels above NYSDEC Part 375 Soil Cleanup Objectives - Residential Use.
3. Minimize ingestion/direct contact with MGP contaminated groundwater.
4. Mitigation of MGP groundwater impacts to the extent practicable.

General Comments

- Wooden duct (Area 3) to be removed as part of OU-1 remediation activities.
- No demolition of buildings will be conducted.

Note: One of each of the Alternative 3 (3A, 3B, or 3C) and 4 (4A, 4B, or 4C) options would be combined together with the MNA alternative for the Remainder of Area 1 and Area 2.

Alternative 4C - ISCO	Subarea 1C	Comments	RAOs Achieved	How RAOs are addressed by Remedial Alternative
Perform pre-design investigation, as needed . In-situ oxidation of subsurface soil and groundwater. NAPL recovery.		Significant MGP tar is not present in this subarea. Human and ecological receptors are not being exposed to MGP impacts. Conduct in situ oxidation to address residual NAPL and grossly impacted soils. Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil. In-situ oxidation will treat impacted media and eliminate contaminant migration. The extent of groundwater impacts appear to not have migrated significantly beyond the vicinity of coal tar impacts. NAPL recovery will remove contamination, to the extent practicable.
Alternatives 3A, 3B, 3C, 4A, 4B, and 4C - MNA	**Remainder of Area 1 & Area 2**	**Comments**	**RAOs Achieved**	**How RAOs are addressed by Remedial Alternative**
Perform pre-design investigation, as needed . Institutional controls for subsurface soils and groundwater. Monitored natural attenuation for groundwater and soil.		Human and ecological receptors are not being exposed to MGP impacts. Soil and groundwater impacts will be treated via the monitored natural attenuation processes of dilution, dissolution, dispersion, volatilization, and microbial degradation. Evaluation of the OU-2 data indicates that MGP impacts are restricted to subsurface soils and groundwater in a limited area near OU-1. Extensive remedial actions (excavation) have already been implemented in Area 2. Therefore, only localized areas of impact primarily consisting of "stringers" exist at Area 2.	1, 2, 3, 4	MGP-impacted soil is confined to deeper subsurface soil primarily located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the soil. A soil management plan will be used by construction workers to mitigate their exposure to impacted subsurface soil. There are no known sources of private or public drinking water in the area of MGP impacted groundwater; therefore people do not ingest or come into contact with MGP contaminated groundwater. MGP-impacted groundwater is primarily confined to areas located under non-residential areas such as road pavement, sidewalks and public right of ways; therefore residents will not come into contact with the groundwater. An environmental easement with groundwater restrictions will be used to mitigate future exposure to impacted groundwater. Monitored natural attenuation will treat the groundwater contamination, but will require a longer cleanup time than active remedies due to the presence of coal tar. The extent of groundwater impacts appear to not have migrated significantly beyond the vicinity of coal tar impacts.

Table 6-2
Summary of Present Value Cost Estimates for Remedial Alternatives
NYSEG Ithaca Court Street MGP Site OU-2
Ithaca, New York

Alternatives	Remedial Activity within OU-2 Areas	Capital Cost	Net Present Value	Total Capital Cost	Total Net Present Value
Alternative 1	No Further Action	$0	$0		
Alternative 2	Excavation of Areas 1 and 2 (Unrestricted Use)	$17,806,843	$17,806,843		
Alternative 3A/4A	Contaminant Containment of Sub Areas 1A and 1B	$5,328,194	$5,774,478	$5,660,149	$8,530,493
	MNA of Sub Area 1C	$46,995	$405,037		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3A/4B	Contaminant Containment of Sub Areas 1A and 1B	$5,328,194	$5,774,478	$6,417,490	$9,423,791
	Enhanced Bioremediation of Sub Area 1C	$804,336	$1,298,335		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3A/4C	Contaminant Containment of Sub Areas 1A and 1B	$5,328,194	$5,774,478	$6,524,805	$10,038,385
	ISCO of Sub Area 1C	$911,651	$1,912,929		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3B/4A	ISS of Sub Areas 1A and 1B (cost assumes auger is ISS technology)	$5,917,355	$5,917,355	$6,249,310	$8,673,370
	MNA of Sub Area 1C	$46,995	$405,037		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3B/4B	ISS of Sub Areas 1A and 1B (cost assumes auger is ISS technology)	$5,917,355	$5,917,355	$7,006,651	$9,566,668
	Enhanced Bioremediation of Sub Area 1C	$804,336	$1,298,335		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3B/4C	ISS of Sub Areas 1A and 1B (cost assumes auger is ISS technology)	$5,917,355	$5,917,355	$7,113,966	$10,181,262
	ISCO of Sub Area 1C	$911,651	$1,912,929		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3C/4A	Excavation of Sub Areas 1A and 1B	$8,547,139	$8,547,139	$8,879,094	$11,303,154
	MNA of Sub Area 1C	$46,995	$405,037		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3C/4B	Excavation of Sub Areas 1A and 1B	$8,547,139	$8,547,139	$9,636,435	$12,196,452
	Enhanced Bioremediation of Sub Area 1C	$804,336	$1,298,335		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		
Alternative 3C/4C	Excavation of Sub Areas 1A and 1B	$8,547,139	$8,547,139	$9,743,750	$12,811,046
	ISCO of Sub Area 1C	$911,651	$1,912,929		
	MNA in the Remainder of Area 1 and in Area 2	$284,960	$2,350,978		

Notes:
- MNA = Monitored Natural Attenuation (timeframes and contingencies specified in FS); ISS = In-Situ Solidification; ISCO = In-Situ Chemical Oxidation
- Site Management Plan and Annual Period Review Report Costs are Included in the MNA for the remainder of Area 1 and in Area 2
- It is assumed that 100% of clean soil is suitable for reuse. A portion of this may be deemed unsuitable during the construction process. This unknown factor is accounted for in the contingency.
- Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

Table 6-3. Criteria Comparison and Ranking of Remedial Alternatives
OU-2 Feasibility Study
NYSEG Ithaca Court Street MGP Site
Ithaca, New York

Ranking scale of 1 through 11, with 1 being most favorable and 11 being least favorable.
Overall ranking is determined by summing up the rankings of the different criteria. If the overall ranking value is the same for multiple alternatives, the lowest cost alternative is given the highest ranking.

Alternative	Overall Protection of Human Health & the Environment	Compliance with ARARs	Reduction of Toxicity, Mobility, and Volume through Treatment	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Implementability	Land Use	Cost (Present Value rounded to nearest $100,000)	Overall Ranking	Total Score
Alternative 1 No Further Action	11 Alternative would be least effective without any removal, immobilization, or containment of impacted materials, with only natural attenuation to treat impacted media without monitoring or administrative means to prevent exposure.	11 Chemical SCGs will be met over a significantly long period of time; however, the alternative does not include monitoring to assess concentrations in site media.	11 Alternative would reduce volume and toxicity over time due to natural attenuation. However, alternative does not include monitoring to evaluate reduction.	1 Alternative requires no action.	11 Alternative would be least effective as it does not involve removal, immobilization or containment of impacted materials, without monitoring or administrative means to prevent exposure.	1 Alternative requires no technical or administrative action, and therefore is easy to implement.	11 Alternative includes no action. This alternative would have the least impact on the neighborhood, however, known contamination remains in place reducing potential for redevelopment and potential property values.	Not Ranked This alternative is required by DER-10 and is retained as a baseline alternative for comparison purposes. No cost generated.	**No Ranking**	**57**
Alternative 2 Excavation (unrestricted use) in Areas 1 and 2	1 Alternative would be most protective with removal and off-site disposal of contaminated material	1 Alternative would meet chemical specific SCGs in the shortest period of time. Action- and location-specific ARARs will be met.	1 Alternative will result in permanent reduction in mobility, but does not reduce volume or toxicity (unless treatment performed at disposal facility).	11 Alternative has the greatest potential exposure to contamination during excavation to exposed materials, dust, and volatilized organic vapors. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. This alternative has the greatest environmental footprint (CO2 emissions, Landfill Capacity, Energy Use).	1 Alternative (excavation) permanently removes contaminants.	11 Alternative could be implemented, but with difficulty inherent in deep excavation work in soils immediately adjacent to existing buildings and utilities. Noise and vibration due to deep excavation and excavation in roadway also causes difficulties.	10 Alternative may have the most adverse short term impact; however, backfill and compaction of the excavation can be implemented to minimize effects to existing geotechnical properties. There will be significant temporary land use disruptions, including utilities.	10 $17.8 Million	**7**	**46**
Alternative 3A/4A - Containment for Subareas 1A and 1B - MNA for Subarea 1C - MNA for Remainder of Area 1 and Area 2	10 Alternative would be protective because it contains NAPL source material to the extent practicable via containment (slurry/grout) wall. MNA would require a longer time to treat Subarea 1C. However, impacted media remain in place and potentially accessible in utility maintenance scenarios.	10 Chemical specific SCGs will not be met within treatment area. Alternative does include NAPL removal. MNA would require a longer time to treat Subarea 1C.	10 Alternative would reduce the mobility of contaminants from traveling beyond the containment wall. Toxicity and volume would be permanently reduced over time due to NAPL removal and natural attenuation.	2 Alternative has moderate potential exposure to contamination during excavation/containment wall installation. Containment would have moderate environmental footprint (energy use, CO2 emissions, landfill capacity). MNA would have minimal environmental impact.	10 Alternative permanently reduces contaminants from migrating outside of the treatment area; contamination permanently removed by NAPL recovery and natual attenuation processes within the treatment area.	5 Alternative could be implemented, but with substantial difficulty with regard to constructing the slurry/grout walls to the depth of competent clay immediately adjacent to existing buildings and underground utilities.	7 Alternative will construct a slurry wall along the perimeter of the containment area and create a volume of a homogeneous cement-soil mixture. No future subsurface development activities will be able to be performed in the slurry wall area, as the wall is required to contain contaminated material from migrating.	1 $8.5 Million	**8**	**55**
Alternative 3A/4B - Containment for Subareas 1A and 1B - Enhanced Bioremediation for Subarea 1C - MNA for Remainder of Area 1 and Area 2	9 Alternative would be protective because it contains NAPL source material to the extent practicable via containment (slurry/grout) wall. Enhanced bioremediation would treat impacted media within Subarea 1C. However, impacted media remain in place and potentially accessible in utility maintenance scenarios.	9 Chemical specific SCGs will not be met within treatment area. Alternative does include NAPL removal. Enhanced bioremediation would treat impacted media within Subarea 1C.	9 Alternative would reduce the mobility of contaminants from traveling beyond the containment wall. Toxicity and volume would be permanently reduced over time due to NAPL removal and natural attenuation. Enhanced bioremediation would treat impacted media within Subarea 1C.	3 Alternative has moderate potential exposure to contamination during excavation/containment wall installation. Containment would have moderate environmental footprint (energy use, CO2 emissions, landfill capacity). Enhanced bioremediation would have relatively low environmental footprint (energy use, CO2 emissions).	9 Alternative permanently reduces contaminants from migrating outside of the treatment area; contamination permanently removed by NAPL recovery and natual attenuation processes within the treatment area. Enhanced bioremediation would treat impacted media within Subarea 1C.	6 Alternative could be implemented, but with substantial difficulty with regard to constructing the slurry/grout walls to the depth of competent clay immediately adjacent to existing buildings and underground utilities. Enhanced bioremediation could be implemented in Subarea 1C. There will be more disruption than the previous alternative.	8 Alternative will construct a slurry wall along the perimeter of the containment area and create a volume of a homogeneous cement-soil mixture. No future subsurface development activities will be able to be performed in the slurry wall area, as the wall is required to contain contaminated material from migrating. There will be more disruption than the previous alternative.	3 $9.4 Million	**9**	**56**
Alternative 3A/4C - Containment for Subareas 1A and 1B - ISCO for Subarea 1C - MNA for Remainder of Area 1 and Area 2	8 Alternative would be protective because it contains NAPL source material to the extent practicable via containment (slurry/grout) wall. ISCO would treat impacted media within Subarea 1C. However, impacted media remain in place and potentially accessible in utility maintenance scenarios.	8 Chemical specific SCGs will not be met within treatment area. Alternative does include NAPL removal. ISCO would treat impacted media within Subarea 1C.	8 Alternative would reduce the mobility of contaminants from traveling beyond the containment wall. Toxicity and volume would be permanently reduced over time due to NAPL removal and natural attenuation. ISCO would treat impacted media within Subarea 1C.	4 Alternative has moderate potential exposure to contamination during excavation/containment wall installation. Containment would have moderate environmental footprint (energy use, CO2 emissions, landfill capacity). ISCO would have relatively low environmental footprint (energy use, CO2 emissions).	8 Alternative permanently reduces contaminants from migrating outside of the treatment area; contamination permanently removed by NAPL recovery and natual attenuation processes within the treatment area. ISCO would treat impacted media within Subarea 1C.	7 Alternative could be implemented, but with substantial difficulty with regard to constructing the slurry/grout walls to the depth of competent clay immediately adjacent to existing buildings and underground utilities. ISCO could be implemented in Subarea 1C, somewhat more difficult than the previous alternative.	9 Alternative will construct a slurry wall along the perimeter of the containment area and create a volume of a homogeneous cement-soil mixture. No future subsurface development activities will be able to be performed in the slurry wall area, as the wall is required to contain contaminated material from migrating. There will be more disruption than the previous alternative.	5 $10.0 Million	**10**	**57**

Table 6-3. Criteria Comparison and Ranking of Remedial Alternatives
OU-2 Feasibility Study
NYSEG Ithaca Court Street MGP Site
Ithaca, New York

Alternative	Overall Protection of Human Health & the Environment	Compliance with ARARs	Reduction of Toxicity, Mobility, and Volume through Treatment	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Implementability	Land Use	Cost (Present Value rounded to nearest $100,000)	Overall Ranking	Total Score
Alternative 3B/4A - ISS for Subareas 1A and 1B - MNA for Subarea 1C - MNA for Remainder of Area 1 and Area 2	7 Alternative would be protective because it would involve mitigating direct exposure and mobility of contamination.	7 Chemical specific SCGs will not be met within the treatment area. Soil impacted above ARARs within treatment area will be immobile. Impacted media outside of the treatment area would be treated via MNA.	7 Alternative would permanently reduce the mobility of contaminants through solidification. Toxicity of the immobilized soil would be reduced as contaminants would be encapsulated within the grout and rendered immobile. Volume of contamination would not change with the solidification activities. Impacted media outside of the treatment area would be treated via MNA.	5 Alternative has limited exposure to contamination during shallow excavation and moderate potential for exposure during augering/grouting for stabilization. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. (Note, for jet grouting vibration would be minimized) However, this alternative will cause less disruption to area residents and businesses compared to the excavation alternative. The environmental impact for ISS is moderate (CO2 emissions, energy use). MNA has minimal environmental impact.	7 Alternative permanently encapsulates contaminants. Impacted media within Subarea 1C would be treated by MNA, but would require a longer treatment timeframe than other methods. Impacted media outside of the treatment area would be treated via MNA.	2 Alternative could be implemented, but with some difficulty and uncertainty with regard to performing ISS to depth immediately adjacent to existing buildings and underground utilities. MNA is readily implementable.	1 Alternative will create a homogeneous volume of soil-grout starting at an approximate depth of seven feet below the ground surface. This matrix will not impede future excavation/development within the ISS treatment area. However, the future land use of the treatment area is anticipated to remain as a roadway and sidewalks. There will be temporary disruption to the community. The MNA areas will only result in short-term impacts to land use, including utilities.	2 $8.7 Million	**2**	**38**
Alternative 3B/4B - ISS for Subareas 1A and 1B - Enhanced Bioremediation for Subarea 1C - MNA for Remainder of Area 1 and Area 2	5 Alternative would be protective because it would involve mitigating direct exposure and mobility of contamination. Enhanced bioremediation would treat impacted media within Subarea 1C, but would require more time.	6 Chemical specific SCGs will not be met within the treatment area. Soil impacted above ARARs within treatment area will be immobile. Enhanced bioremediation would treat impacted media within Subarea 1C, but would require more time. Impacted media outside of the treatment area would be treated via MNA.	6 Alternative would permanently reduce the mobility of contaminants through solidification. Toxicity of the immobilized soil would be reduced as contaminants would be encapsulated within the grout and rendered immobile. Volume of contamination would not change with the solidification activities. Impacted media within Subarea 1C would be treated via enhanced bioremediation. Impacted media outside of the treatment area would be treated via MNA.	6 Alternative has limited exposure to contamination during shallow excavation and moderate potential for exposure during augering/grouting for stabilization. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. (Note, for jet grouting vibration would be minimized) However, this alternative will cause less disruption to area residents and businesses compared to the excavation alternative. The environmental impact for ISS is moderate (CO2 emissions, energy use). Enhanced bioremediation would have relatively low environmental footprint (energy use, CO2 emissions).	6 Alternative permanently encapsulates contaminants. Enhanced bioremediation would treat impacted media within Subarea 1C, but would require more time. Impacted media outside of the treatment area would be treated via MNA.	4 Alternative could be implemented, but with some difficulty and uncertainty with regard to performing ISS to depth immediately adjacent to existing buildings and underground utilities. Enhanced bioremediation can be implemented with relatively low difficulty. There will be more disruption than the previous alternative.	3 Alternative will create a homogeneous volume of soil-grout starting at an approximate depth of seven feet below the ground surface. This matrix will not impede future excavation/development within the ISS treatment area. However, the future land use of the treatment area is anticipated to remain as a roadway and sidewalks. There will be temporary disruption to the community. The enhanced bioremediation/MNA areas will only result in short-term impacts to land use, including utilities, but will require more time. There will be more disruption than the previous alternative.	4 $9.6 Million	**3**	**40**
Alternative 3B/4C - ISS for Subareas 1A and 1B - ISCO for Subarea 1C - MNA for Remainder of Area 1 and Area 2	4 Alternative would be protective because it would involve mitigating direct exposure and mobility of contamination. ISCO would aggressively treat impacted media within Subarea 1C.	5 Chemical specific SCGs will not be met within the treatment area. Soil impacted above ARARs within treatment area will be immobile. ISCO would aggressively treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	5 Alternative would permanently reduce the mobility of contaminants through solidification. Toxicity of the immobilized soil and groundwater would be reduced as contaminants would be encapsulated within the grout and rendered immobile. Volume of contamination would not change with the solidification activities. Impacted media within Subarea 1C would be aggressively treated via ISCO. Impacted media outside of the treatment area would be treated via MNA.	7 Alternative has limited exposure to contamination during shallow excavation and moderate potential for exposure during augering/grouting for stabilization. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. (Note, for jet grouting vibration would be minimized) However, this alternative will cause less disruption to area residents and businesses compared to the excavation alternative. The environmental impact for ISS is moderate (CO2 emissions, energy use). ISCO would have relatively low environmental footprint (energy use, CO2 emissions).	5 Alternative permanently encapsulates contaminants. ISCO would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	3 Alternative could be implemented, but with some difficulty and uncertainty with regard to performing ISS to depth immediately adjacent to existing buildings and underground utilities. ISCO can be implemented with relatively low difficulty. There will be similar disruption compare to the previous alternative, but the disruption will be shorter-lived.	2 Alternative will create a homogeneous volume of soil-grout starting at an approximate depth of seven feet below the ground surface. This matrix will not impede future excavation/development within the ISS treatment area. However, the future land use of the treatment area is anticipated to remain as a roadway and sidewalks. There will be temporary disruption to the community. The ISCO/MNA areas will only result in short-term impacts to land use, including utilities. There will be similar disruption compared to the previous alternative.	6 $10.2 Million	**1**	**37**

Table 6-3. Criteria Comparison and Ranking of Remedial Alternatives
OU-2 Feasibility Study
NYSEG Ithaca Court Street MGP Site
Ithaca, New York

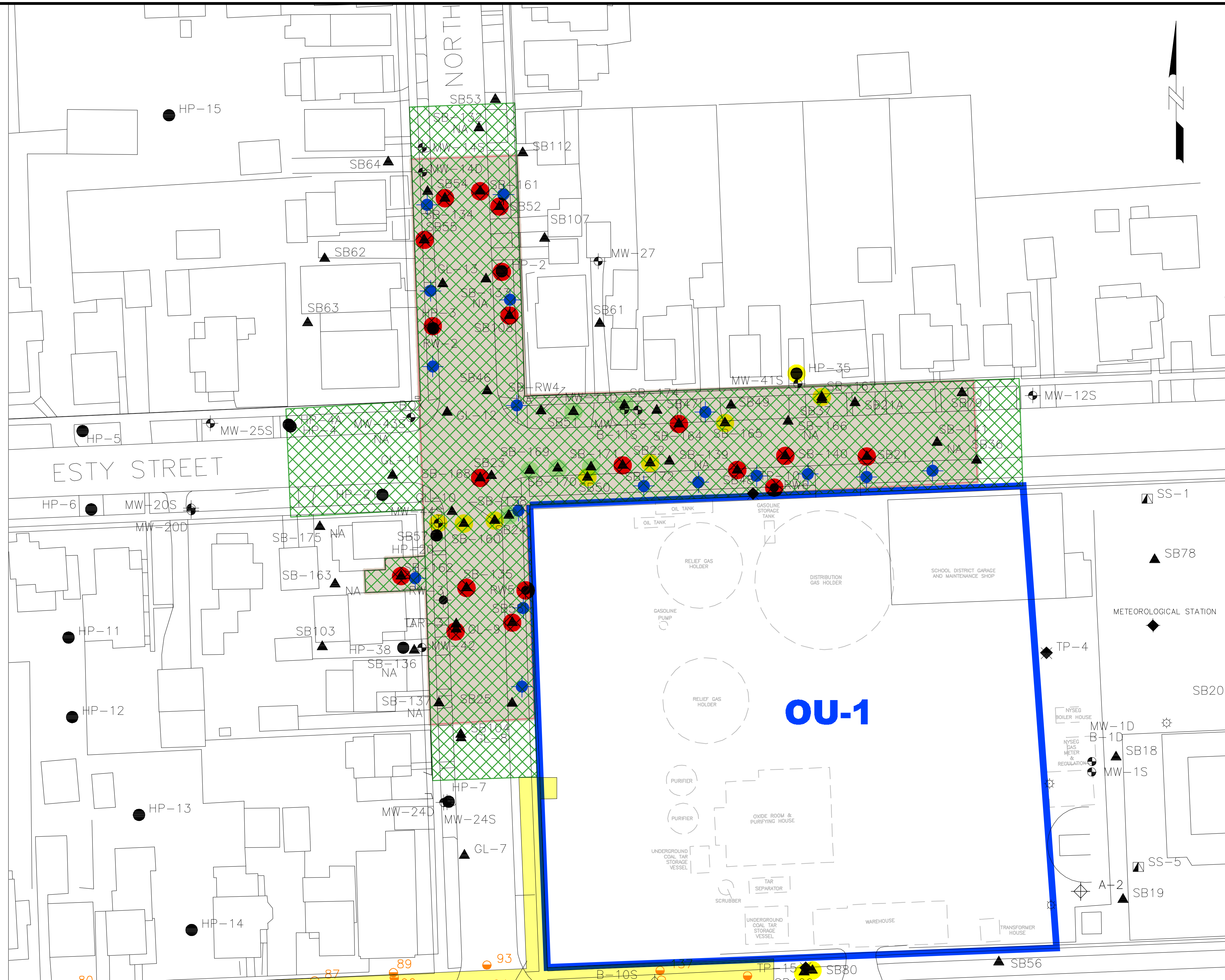
Alternative	Overall Protection of Human Health & the Environment	Compliance with ARARs	Reduction of Toxicity, Mobility, and Volume through Treatment	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Implementability	Land Use	Cost (Present Value rounded to nearest $million)	Overall Ranking	Total Score
Alternative 3C/4A - Excavation for Subareas 1A and 1B - MNA for Subarea 1C - MNA for Remainder of Area 1 and Area 2	6 Alternative would be highly protective with removal and off-site disposal of contaminated material from Subareas 1A and 1B.	4 Alternative would meet chemical specific SCGs in the shortest period of time for Subareas 1A and 1B. Action- and location-specific ARARs will be met.	4 Alternative will result in permanent reduction in mobility for Subareas 1A and 1B, but does not reduce volume or toxicity (unless treatment performed at disposal facility).	8 Alternative has high potential exposure to contamination during excavation to exposed materials, dust, and volatilized organic vapors. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. The environmental impact for excavation is high (CO2 emissions, energy use). The environmental footprint for MNA is minimal.	4 Alternative (excavation) permanently removes contaminants from Subareas 1A and 1B. Impacted media outside of the treatment area would be treated via MNA.	8 Alternative could be implemented, but with difficulty inherent in deep excavation work in soils immediately adjacent to existing buildings and utilities. Noise and vibration due to deep excavation and excavation in roadway also causes difficulties. MNA is readily implementable.	4 Alternative may have the most adverse short term impact; however, backfill and compaction of the excavation can be implemented to minmize effects to existing geotechnical properties. There will be significant temporary land use disruptions to the greater community due to truck traffic, utility relocation, and soil staging. The MNA areas will only result in short-term impacts to land use, including utilities.	7 $11.3 Million	**6**	**45**
Alternative 3C/4B - Excavation for Subareas 1A and 1B - Enhanced Bioremediation for Subarea 1C - MNA for Remainder of Area 1 and Area 2	3 Alternative would be highly protective with removal and off-site disposal of contaminated material from Subareas 1A and 1B. Enhanced bioremediation would treat impacted media within Subarea 1C.	3 Alternative would meet chemical specific SCGs in the shortest period of time for Subareas 1A and 1B. Action- and location-specific ARARs will be met. Enhanced bioremediation would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	3 Alternative will result in permanent reduction in mobility for Subareas 1A and 1B, but does not reduce volume or toxicity (unless treatment performed at disposal facility). Enhanced bioremediation would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	9 Alternative has high potential exposure to contamination during excavation to exposed materials, dust, and volatilized organic vapors. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. The environmental impact for excavation is high (CO2 emissions, energy use). Enhanced bioremediation would have relatively low environmental footprint (energy use, CO2 emissions). The environmental footprint for MNA is minimal.	3 Alternative (excavation) permanently removes contaminants from Subareas 1A and 1B. Enhanced bioremediation would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	9 Alternative could be implemented, but with difficulty inherent in deep excavation work in soils immediately adjacent to existing buildings and utilities. Noise and vibration due to deep excavation and excavation in roadway also causes difficulties. Enhanced bioremediation can be implemented with relatively low difficulty. There will be more disruption than the previous alternative.	5 Alternative may have the most adverse short term impact; however, backfill and compact ion of the excavation can be implemented to minmize effects to existing geotechnical properties. There will be significant temporary land use disruptions to the greater community due to truck traffic, utility relocation, and soil staging. The ISCO/MNA areas will only result in short-term impacts to land use, including utilities. There will be more disruption than the previous alternative.	8 $12.2 Million	**4**	**43**
Alternative 3C/4C - Excavation for Subareas 1A and 1B - ISCO for Subarea 1C - MNA for Remainder of Area 1 and Area 2	2 Alternative would be highly protective with removal and off-site disposal of contaminated material from Subareas 1A and 1B. ISCO would treat impacted media within Subarea 1C.	2 Alternative would meet chemical specific SCGs in the shortest period of time for Subareas 1A and 1B. Action- and location-specific ARARs will be met. ISCO would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	2 Alternative will result in permanent reduction in mobility for Subareas 1A and 1B, but does not reduce volume or toxicity (unless treatment performed at disposal facility). ISCO would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	10 Alternative has high potential exposure to contamination during excavation to exposed materials, dust, and volatilized organic vapors. Noise, vibration, increased truck traffic, relocating utilities are all issues related to this alternative. The environmental impact for excavation is high (CO2 emissions, energy use). ISCO would have relatively low environmental footprint (energy use, CO2 emissions). The environmental footprint for MNA is minimal.	2 Alternative (excavation) permanently removes contaminants from Subareas 1A and 1B. ISCO would treat impacted media within Subarea 1C. Impacted media outside of the treatment area would be treated via MNA.	10 Alternative could be implemented, but with difficulty inherent in deep excavation work in soils immediately adjacent to existing buildings and utilities. Noise and vibration due to deep excavation and excavation in roadway also causes difficulties. ISCO can be implemented with relatively low difficulty. There will be more disruption than the previous alternative.	6 Alternative may have the most adverse short term impact; however, backfill and compact ion of the excavation can be implemented to minmize effects to existing geotechnical properties. There will be significant temporary land use disruptions to the greater community due to truck traffic, utility relocation, and soil staging. The ISCO/MNA areas will only result in short-term impacts to land use, including utilities. There will be more disruption than the previous alternative.	9 $12.8 Million	**5**	**43**

Figures

File: P:\60143048-NOR\FS-RA Figures\December 2010\Ithaca Area 1-Alt 2.dwg Layout: FIGURE 6-1 User: SerraJ Plotted: Dec 16, 2010 - 1:56pm Xref's:

LEGEND

- MW-20D — MONITORING WELL
- SB80 — SOIL BORING
- HP-12 — HYDRO PUNCH
- SS-1 — SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
- RW-1 — RECOVERY WELL
- TEST PIT
- CONFIRMATION SAMPLE
- 106(7) — CONFIRMATION SAMPLE ID(DEPTH)
- STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL
- NA — NOT ANALYZED
- HISTORIC FEATURE
- OU-1 BOUNDARY
- REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 - 2005)
- INSTITUTIONAL CONTROLS AND NATURAL ATTENUATION AREAS
- EXCAVATION (AVERAGE 16 FT. BGS.)



NOTES:

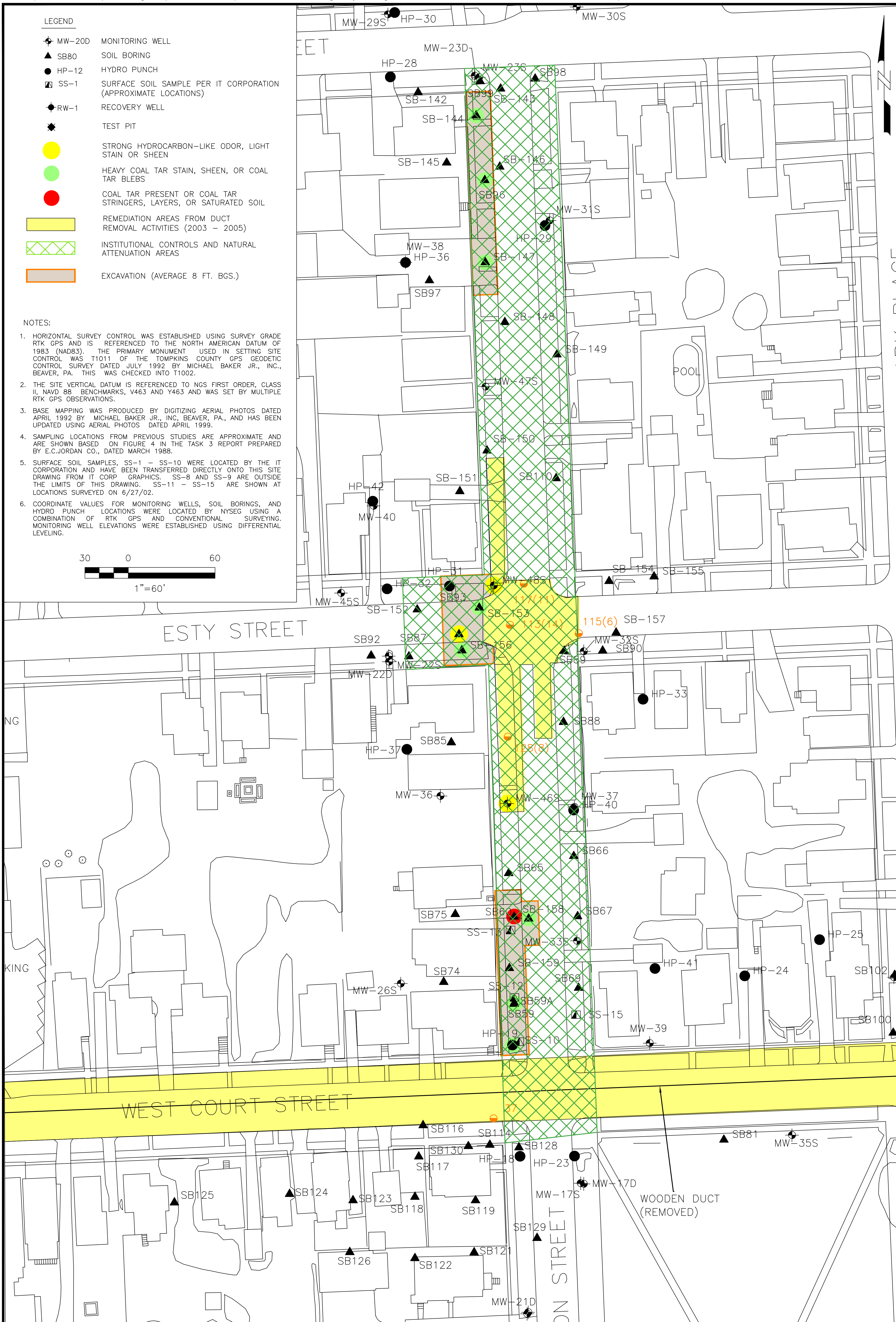
1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
2. THE SITE VERTICAL DATUM IS REFERENCED TO NGS FIRST ORDER, CLASS II, NAVD 88 BENCHMARKS, V463 AND Y463 AND WAS SET BY MULTIPLE RTK GPS OBSERVATIONS.
3. BASE MAPPING WAS PRODUCED BY DIGITIZING AERIAL PHOTOS DATED APRIL 1992 BY MICHAEL BAKER JR., INC, BEAVER, PA., AND HAS BEEN UPDATED USING AERIAL PHOTOS DATED APRIL 1999.
4. SAMPLING LOCATIONS FROM PREVIOUS STUDIES ARE APPROXIMATE AND ARE SHOWN BASED ON FIGURE 4 IN THE TASK 3 REPORT PREPARED BY E.C.JORDAN CO., DATED MARCH 1988.
5. SURFACE SOIL SAMPLES, SS-1 - SS-10 WERE LOCATED BY THE IT CORPORATION AND HAVE BEEN TRANSFERRED DIRECTLY ONTO THIS SITE DRAWING FROM IT CORP GRAPHICS. SS-8 AND SS-9 ARE OUTSIDE THE LIMITS OF THIS DRAWING. SS-11 - SS-15 ARE SHOWN AT LOCATIONS SURVEYED ON 6/27/02.
6. COORDINATE VALUES FOR MONITORING WELLS, SOIL BORINGS, AND HYDRO PUNCH LOCATIONS WERE LOCATED BY NYSEG USING A COMBINATION OF RTK GPS AND CONVENTIONAL SURVEYING. MONITORING WELL ELEVATIONS WERE ESTABLISHED USING DIFFERENTIAL LEVELING.

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

ALTERNATIVE 2 -
AREA 1 EXCAVATION

DATE: 12/16/2010	DRWN: JJS	CHKD: PD	PROJECT No 60189902	FIGURE 6-1



NOTES:

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2. THE SITE VERTICAL DATUM IS REFERENCED TO NGS FIRST ORDER, CLASS II, NAVD 88 BENCHMARKS, V463 AND Y463 AND WAS SET BY MULTIPLE RTK GPS OBSERVATIONS.
3. BASE MAPPING WAS PRODUCED BY DIGITIZING AERIAL PHOTOS DATED APRIL 1992 BY MICHAEL BAKER JR., INC, BEAVER, PA., AND HAS BEEN UPDATED USING AERIAL PHOTOS DATED APRIL 1999.
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AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

ALTERNATIVE 2 -
AREA 2 EXCAVATION

DATE: 12/16/2010	DRWN: JJS	PD	60189902	FIGURE 6-2

LEGEND

MW–20D	MONITORING WELL
SB80	SOIL BORING
HP–12	HYDRO PUNCH
SS–1	SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
RW–1	RECOVERY WELL
	TEST PIT
	CONFIRMATION SAMPLE
106(7)	CONFIRMATION SAMPLE ID(DEPTH)
(yellow)	STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
(green)	HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
(red)	COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL
NA	NOT ANALYZED
	HISTORIC FEATURE
	OU–1 BOUNDARY
	REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
	INSTITUTIONAL CONTROLS AND MNA
	SUB AREAS WITH REMEDIATION

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
2. THE SITE VERTICAL DATUM IS REFERENCED TO NGS FIRST ORDER, CLASS II, NAVD 88 BENCHMARKS, V463 AND Y463 AND WAS SET BY MULTIPLE RTK GPS OBSERVATIONS.
3. BASE MAPPING WAS PRODUCED BY DIGITIZING AERIAL PHOTOS DATED APRIL 1992 BY MICHAEL BAKER JR., INC, BEAVER, PA., AND HAS BEEN UPDATED USING AERIAL PHOTOS DATED APRIL 1999.
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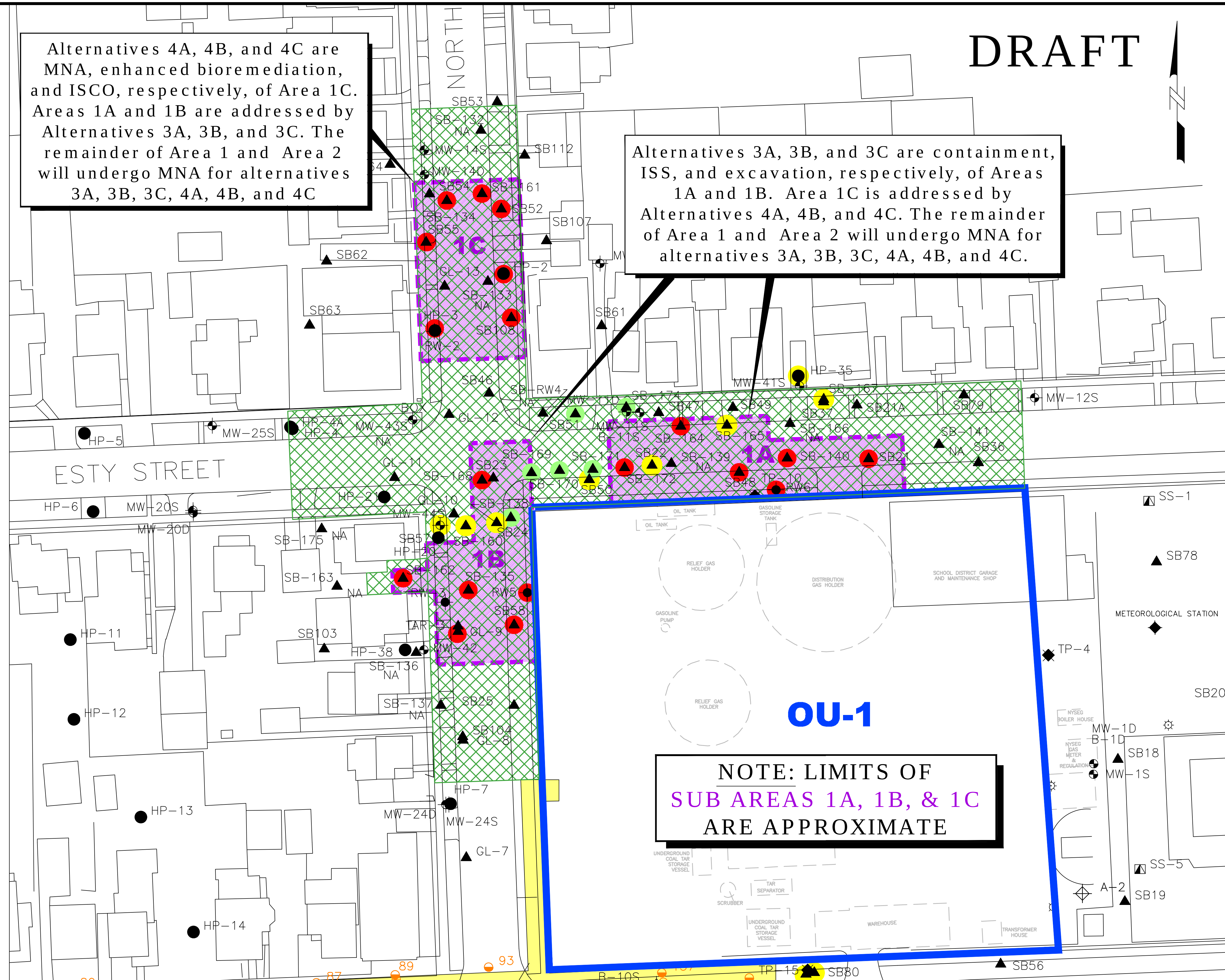

File: P:\60143048-NOR\FS-RA Figures\December 2010\Ithaca Area 1a Alt 3-4.dwg Layout: FIGURE 6-3 User: SerraJ Plotted: Feb 22, 2011 – 6:04pm Xref's:

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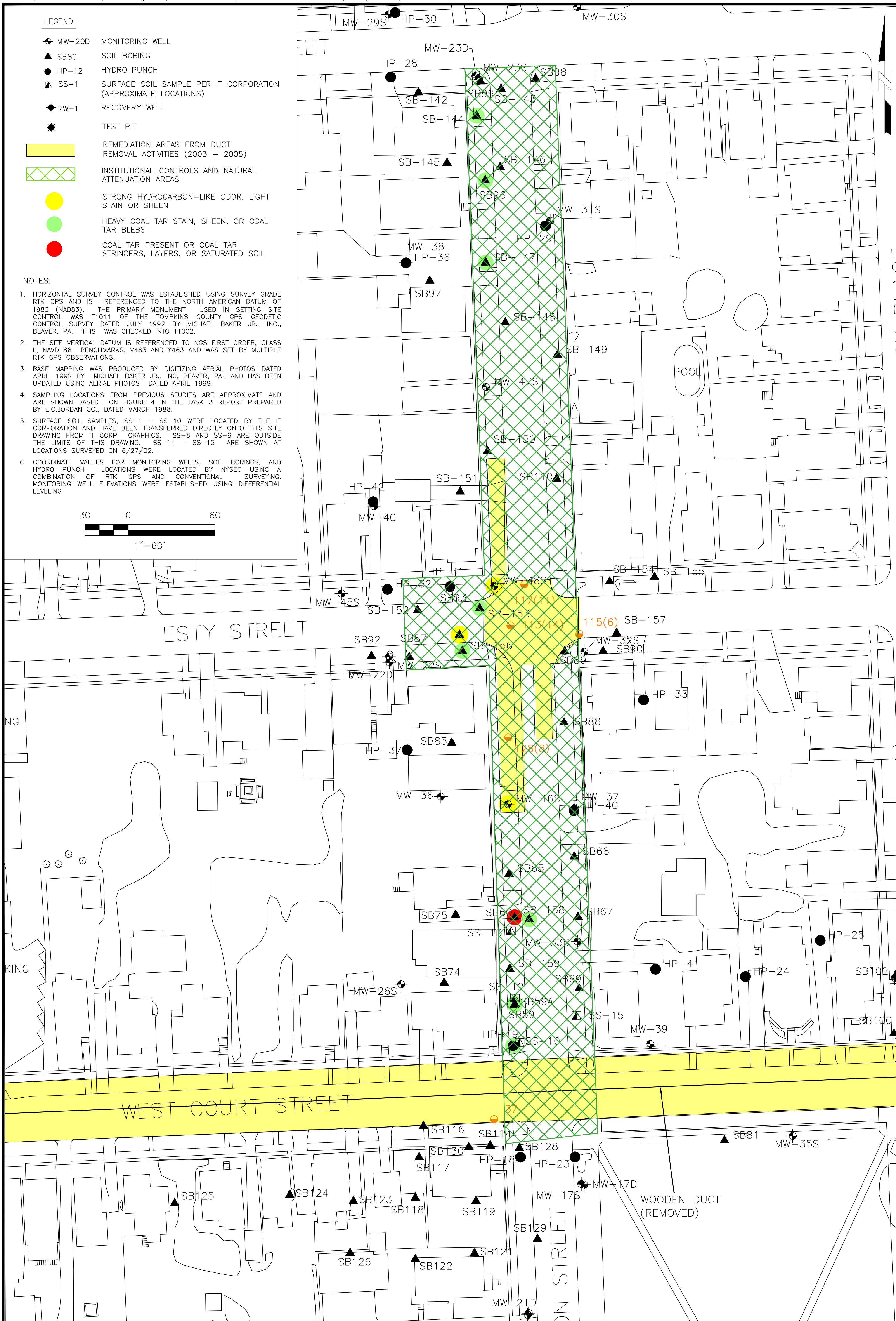
30 0 60
1"=60'

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

ALTERNATIVES 3A, 3B, 3C, 4A, 4B & 4C - REMEDIATION WITHIN AREAS 1A, 1B & 1C

DATE: 12/16/2010 DRWN: JJS CHKD: PD PROJECT No 60189902 FIGURE 6-3



LEGEND

- MW-20D — MONITORING WELL
- SB80 — SOIL BORING
- HP-12 — HYDRO PUNCH
- SS-1 — SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
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- TEST PIT
- REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
- INSTITUTIONAL CONTROLS AND NATURAL ATTENUATION AREAS
- STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
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- COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL

NOTES:

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6. COORDINATE VALUES FOR MONITORING WELLS, SOIL BORINGS, AND HYDRO PUNCH LOCATIONS WERE LOCATED BY NYSEG USING A COMBINATION OF RTK GPS AND CONVENTIONAL SURVEYING. MONITORING WELL ELEVATIONS WERE ESTABLISHED USING DIFFERENTIAL LEVELING.

30 0 60

1"=60'

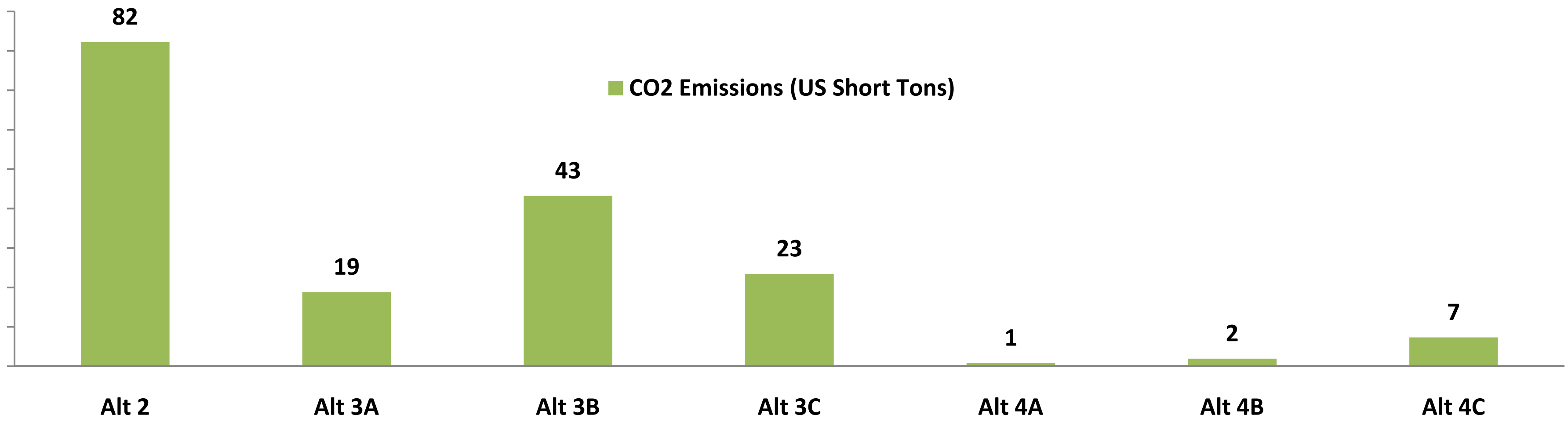
AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

ALTERNATIVES 3A, 3B, 3C, 4A, 4B & 4C - AREA 2 MNA

DATE: 12/16/2010	DRWN: JJS	PD	60189902	FIGURE 6-4

Figure 6-5. Environmental and Energy Use Comparison
Ithaca Court Street MGP OU-2 FS
Ithaca, NY



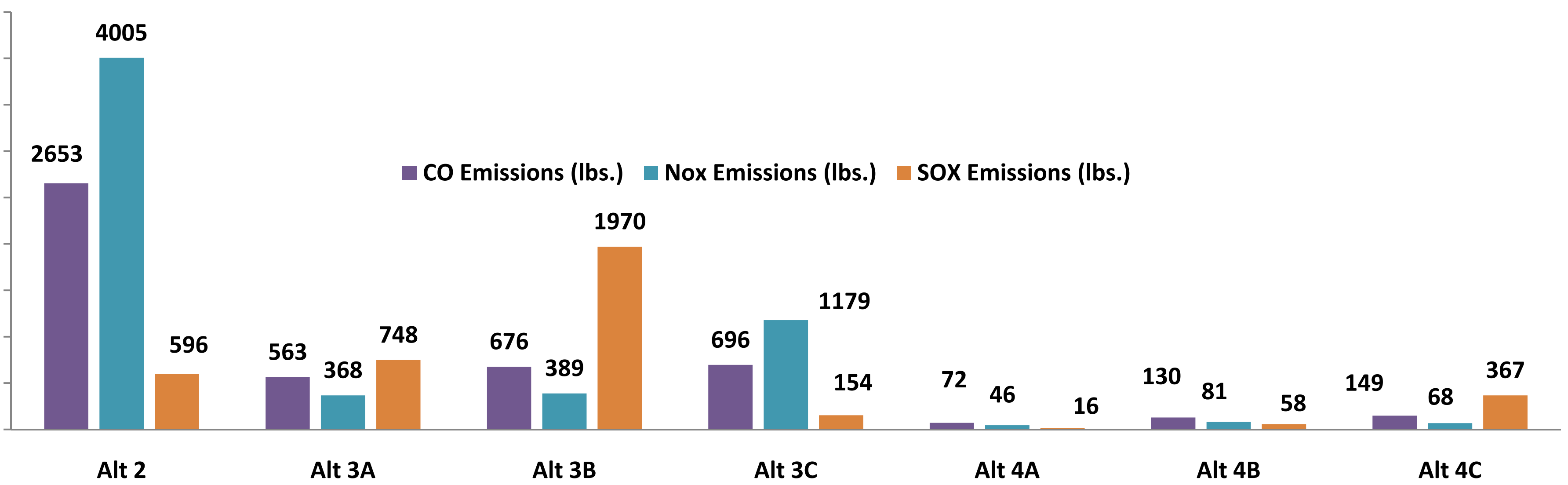
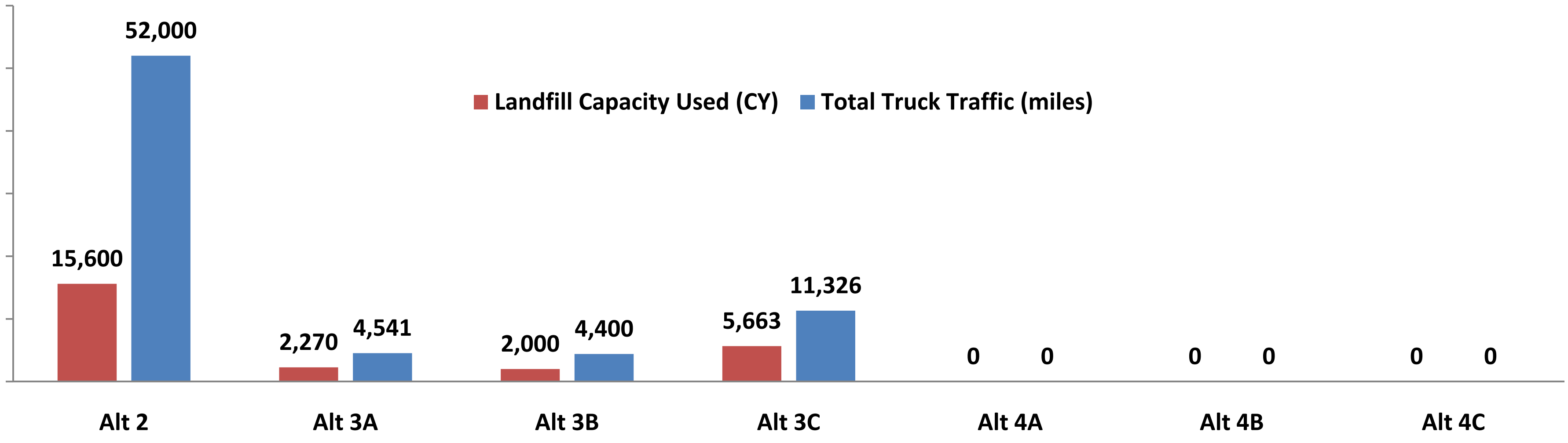
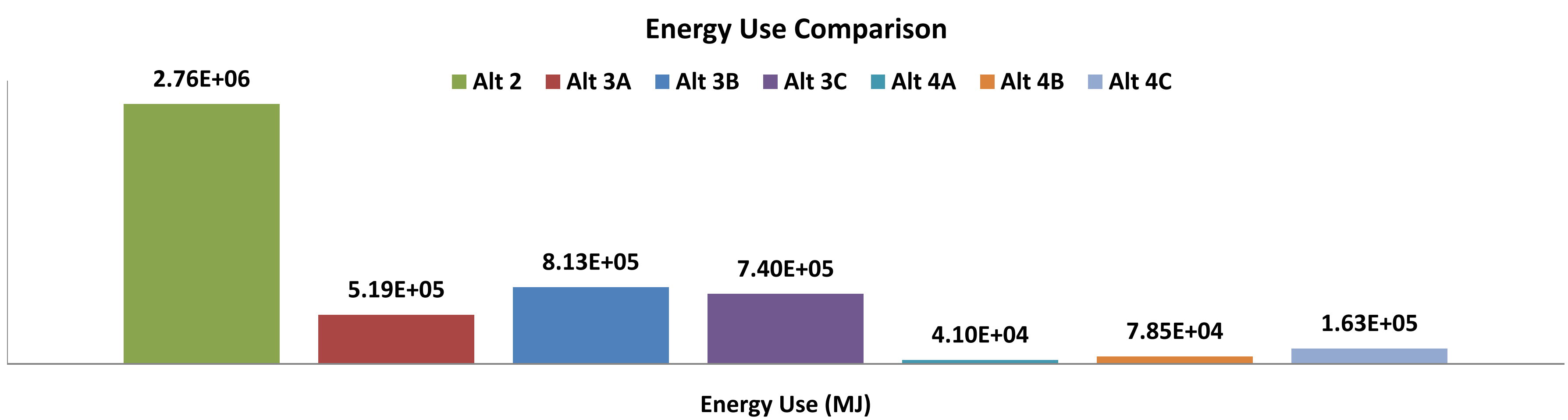


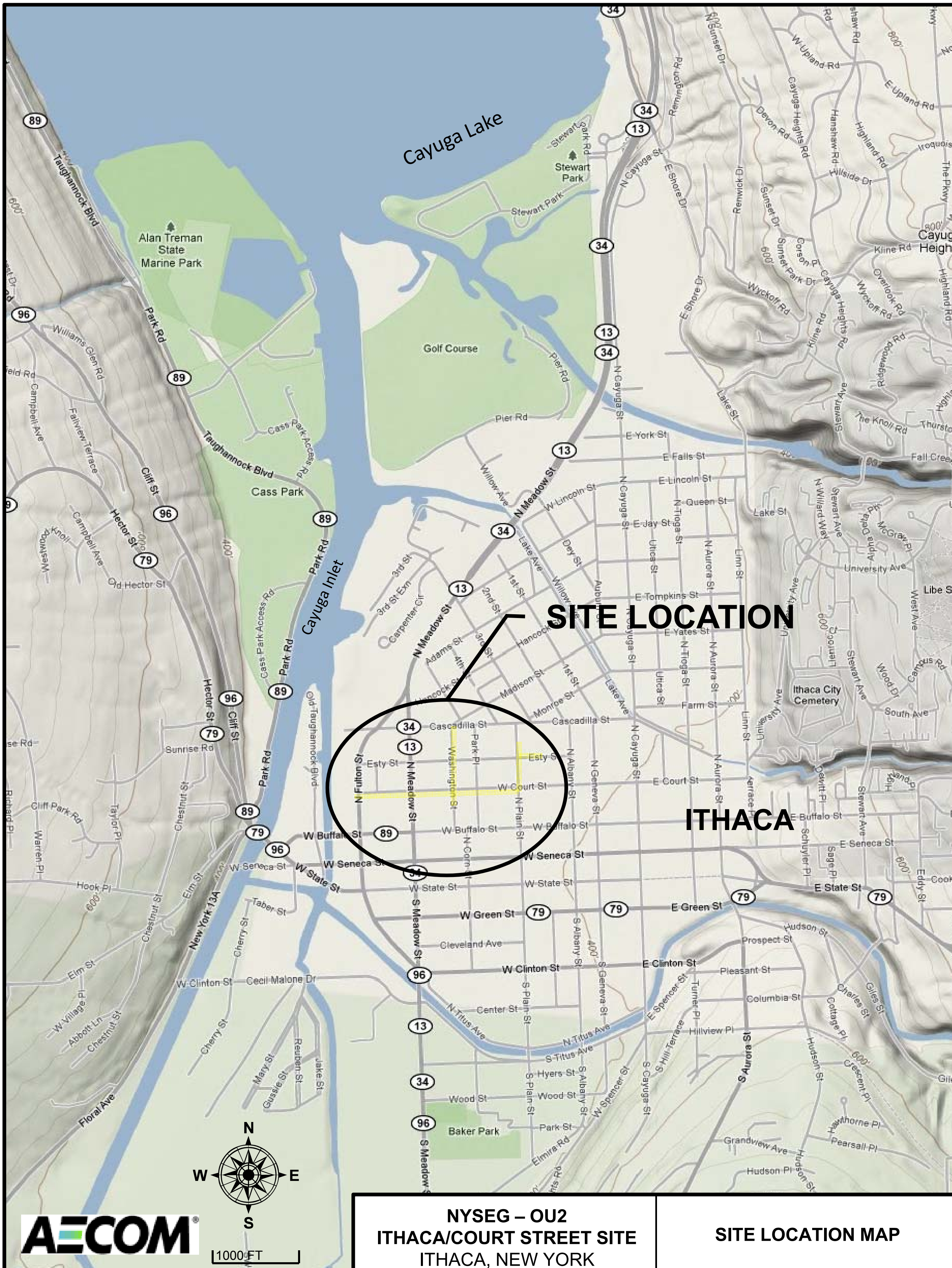
Figure 6-5. Environmental and Energy Use Comparison
Ithaca Court Street MGP OU-2 FS
Ithaca, NY





Appendix A

RI Figures



Source: © 2009Google – Map Data ©2009 Google

AECOM

NYSEG – OU2 ITHACA/COURT STREET SITE ITHACA, NEW YORK	SITE LOCATION MAP
DATE: 06/27/10	FIGURE 2-1

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
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3. BASE MAPPING WAS PRODUCED BY DIGITIZING AERIAL PHOTOS DATED APRIL 1992 BY MICHAEL BAKER JR., INC, BEAVER, PA., AND HAS BEEN UPDATED USING AERIAL PHOTOS DATED APRIL 1999.
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AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 04/29/10 | DRWN: DLS/PGH

SITE PLAN

FIGURE 2-2

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 2-2_SITE PLAN.dwg Layout: ANSI_DI User: PetroskyK Plotted: Jan 20, 2011 – 12:01pm Xref's:

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
2. THE SITE VERTICAL DATUM IS REFERENCED TO NGS FIRST ORDER, CLASS II, NAVD 88 BENCHMARKS, V463 AND Y463 AND WAS SET BY MULTIPLE RTK GPS OBSERVATIONS.
3. BASE MAPPING WAS PRODUCED BY DIGITIZING AERIAL PHOTOS DATED APRIL 1992 BY MICHAEL BAKER JR., INC, BEAVER, PA., AND HAS BEEN UPDATED USING AERIAL PHOTOS DATED APRIL 1999.
4. SAMPLING LOCATIONS FROM PREVIOUS STUDIES ARE APPROXIMATE AND ARE SHOWN BASED ON FIGURE 4 IN THE TASK 3 REPORT PREPARED BY E.C.JORDAN CO., DATED MARCH 1988.
5. SURFACE SOIL SAMPLES, SS-1 - SS-10 WERE LOCATED BY THE IT CORPORATION AND HAVE BEEN TRANSFERRED DIRECTLY ONTO THIS SITE DRAWING FROM IT CORP GRAPHICS. SS-8 AND SS-9 ARE OUTSIDE THE LIMITS OF THIS DRAWING. SS-11 - SS-15 ARE SHOWN AT LOCATIONS SURVEYED ON 6/27/02.
6. COORDINATE VALUES FOR MONITORING WELLS, SOIL BORINGS, AND HYDRO PUNCH LOCATIONS WERE LOCATED BY NYSEG USING A COMBINATION OF RTK GPS AND CONVENTIONAL SURVEYING. MONITORING WELL ELEVATIONS WERE ESTABLISHED USING DIFFERENTIAL LEVELING.

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 06/12/09 DRWN: DLS/PGH

SUBSURFACE UTILITY LOCATION MAP

FIGURE 2-3

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-1a_CROSS SECTION LOCATION MAP & HYDROCARBON EXTENT_AREA 1.dwg Layout: FIGURE 1 User: PetroskyK Plotted: Aug 19, 2010 - 12:43pm Xref's:

LEGEND

MW-20D	MONITORING WELL
SB80	SOIL BORING
HP-12	HYDRO PUNCH
SS-1	SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
RW-1	RECOVERY WELL
	CONFIRMATION SAMPLE
106(7)	CONFIRMATION SAMPLE ID(DEPTH)
	REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
	ELECTRIC LINE
	WATER LINE
	STORM MAIN
	STORM SEWER
	CATCH BASINS
	HYDRANT
	CROSS SECTION LOCATION
	STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
	HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
	COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL

SOURCE:
UTILITY LINES, CATCH BASIN, AND HYDRANT LOCATIONS PROVIDED BY CITY OF ITHACA, WATER AND SEWER DIVISION, 2008. LOCATION INFORMATION PROVIDED LIMITED TO AREAS OF INTEREST.

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
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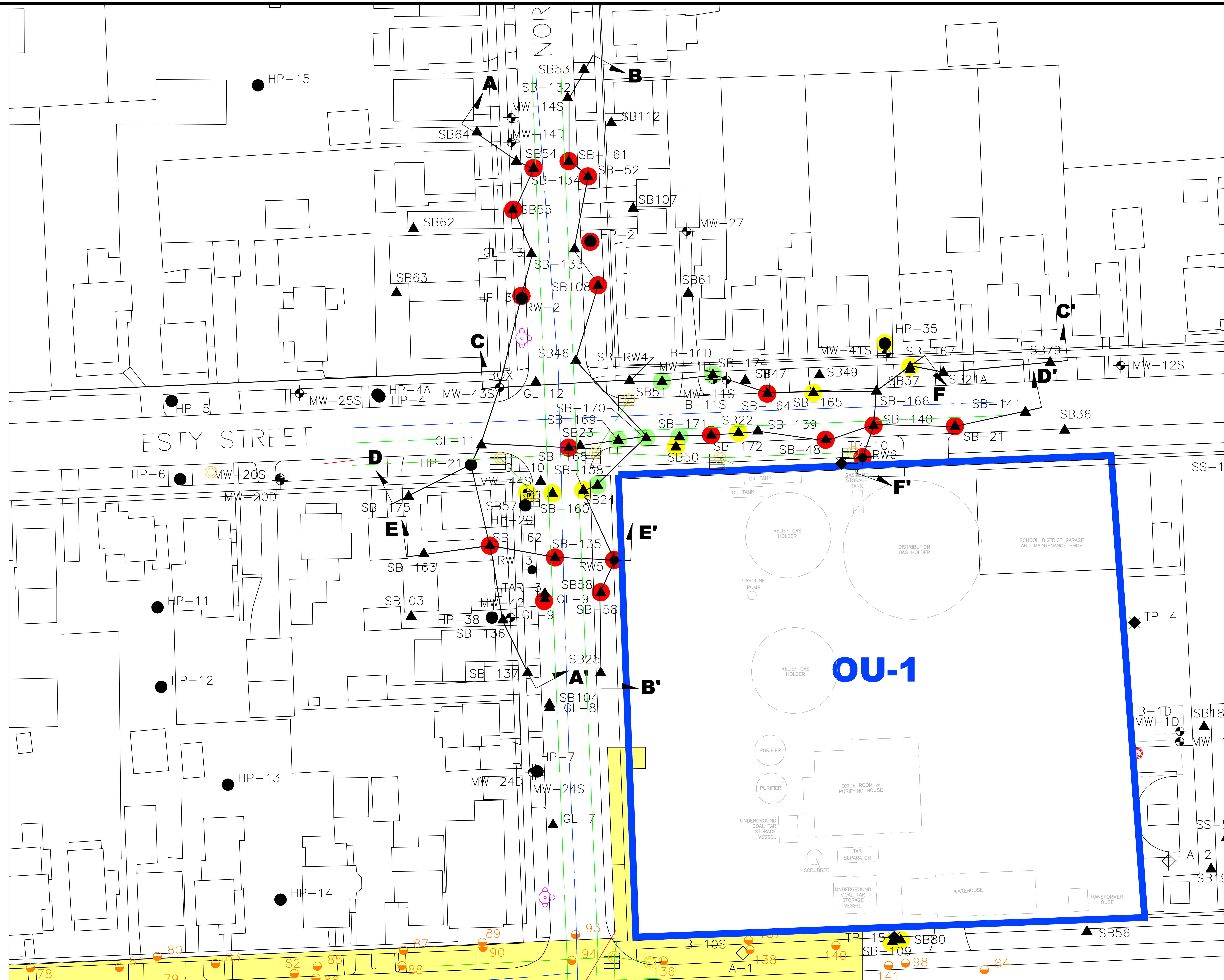
6. COORDINATE VALUES FOR MONITORING WELLS, SOIL BORINGS, AND HYDRO PUNCH LOCATIONS WERE LOCATED BY NYSEG USING A COMBINATION OF RTK GPS AND CONVENTIONAL SURVEYING. MONITORING WELL ELEVATIONS WERE ESTABLISHED USING DIFFERENTIAL LEVELING.

30 0 60



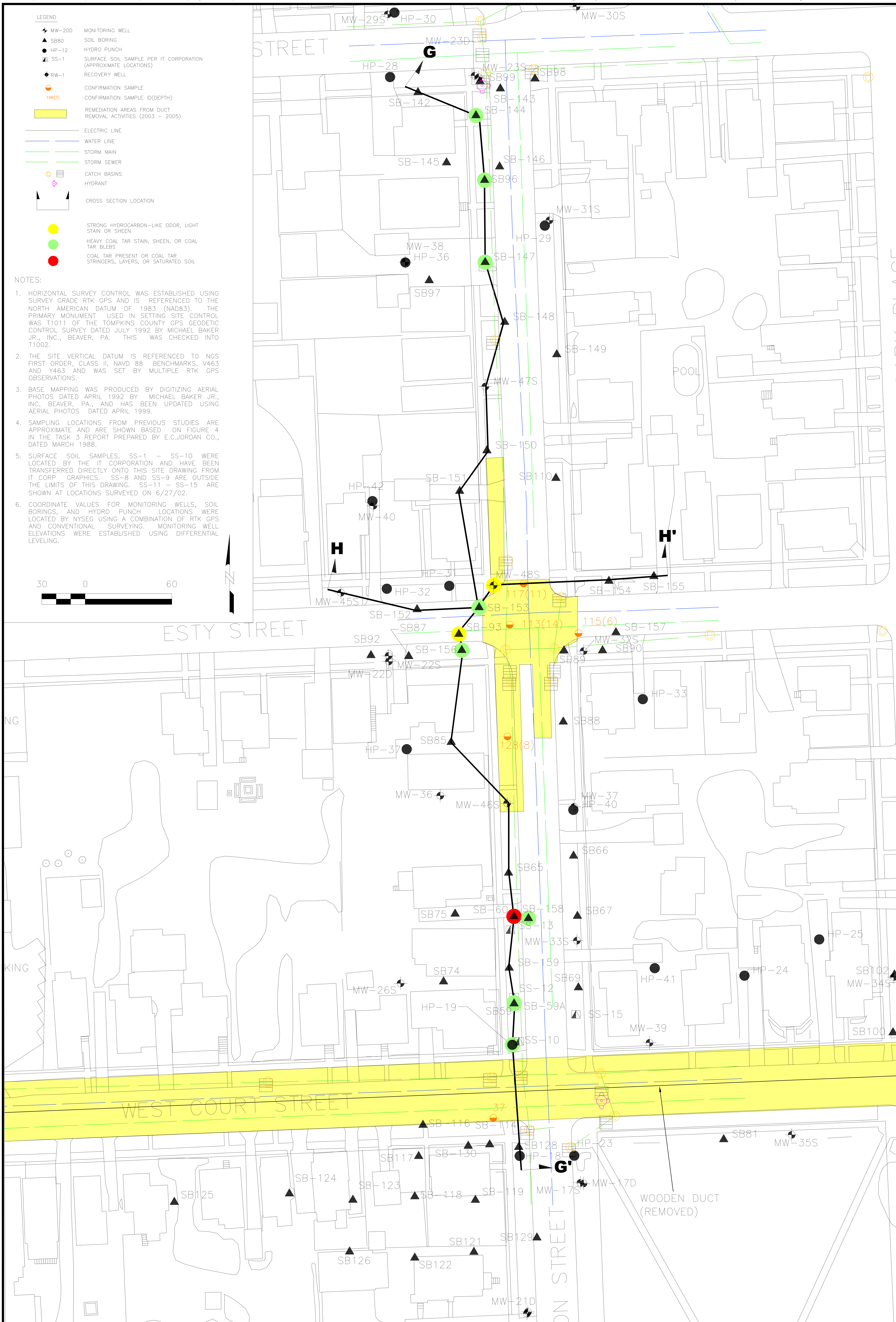
AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 04/29/10 DRWN: DLS/PGH

AREA 1 CROSS SECTION LOCATION MAP AND EXTENT OF OBSERVED HYDROCARBON IMPACTS

FIGURE 4-1a



LEGEND

- MW-20D — MONITORING WELL
- SB80 — SOIL BORING
- HP-12 — HYDRO PUNCH
- SS-1 — SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
- RW-1 — RECOVERY WELL
- CONFIRMATION SAMPLE
- 106(7) — CONFIRMATION SAMPLE ID(DEPTH)
- REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
- ELECTRIC LINE
- WATER LINE
- STORM MAIN
- STORM SEWER
- CATCH BASINS
- HYDRANT
- CROSS SECTION LOCATION
- STRONG HYDROCARBON–LIKE ODOR, LIGHT STAIN OR SHEEN
- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
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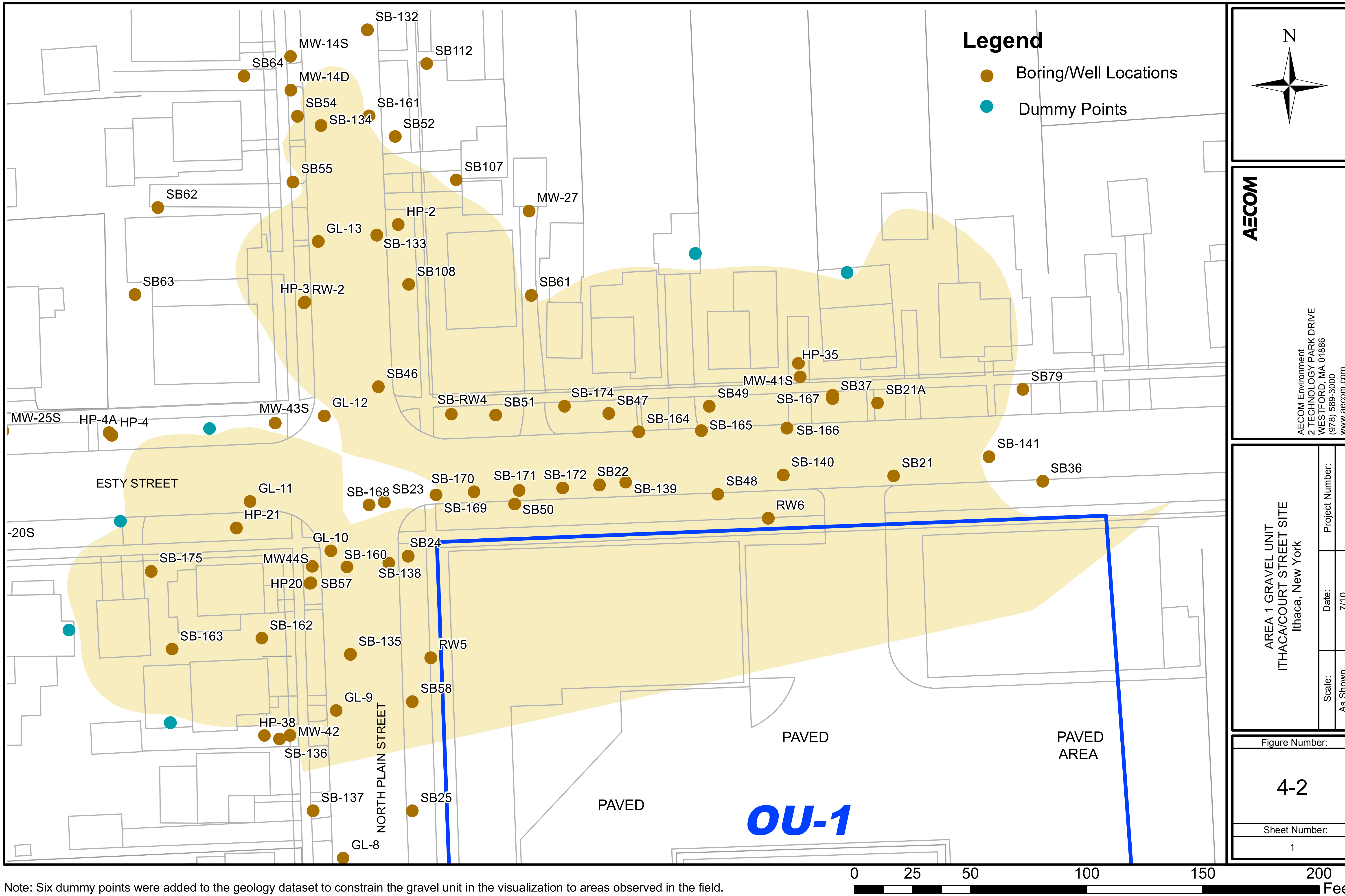
AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

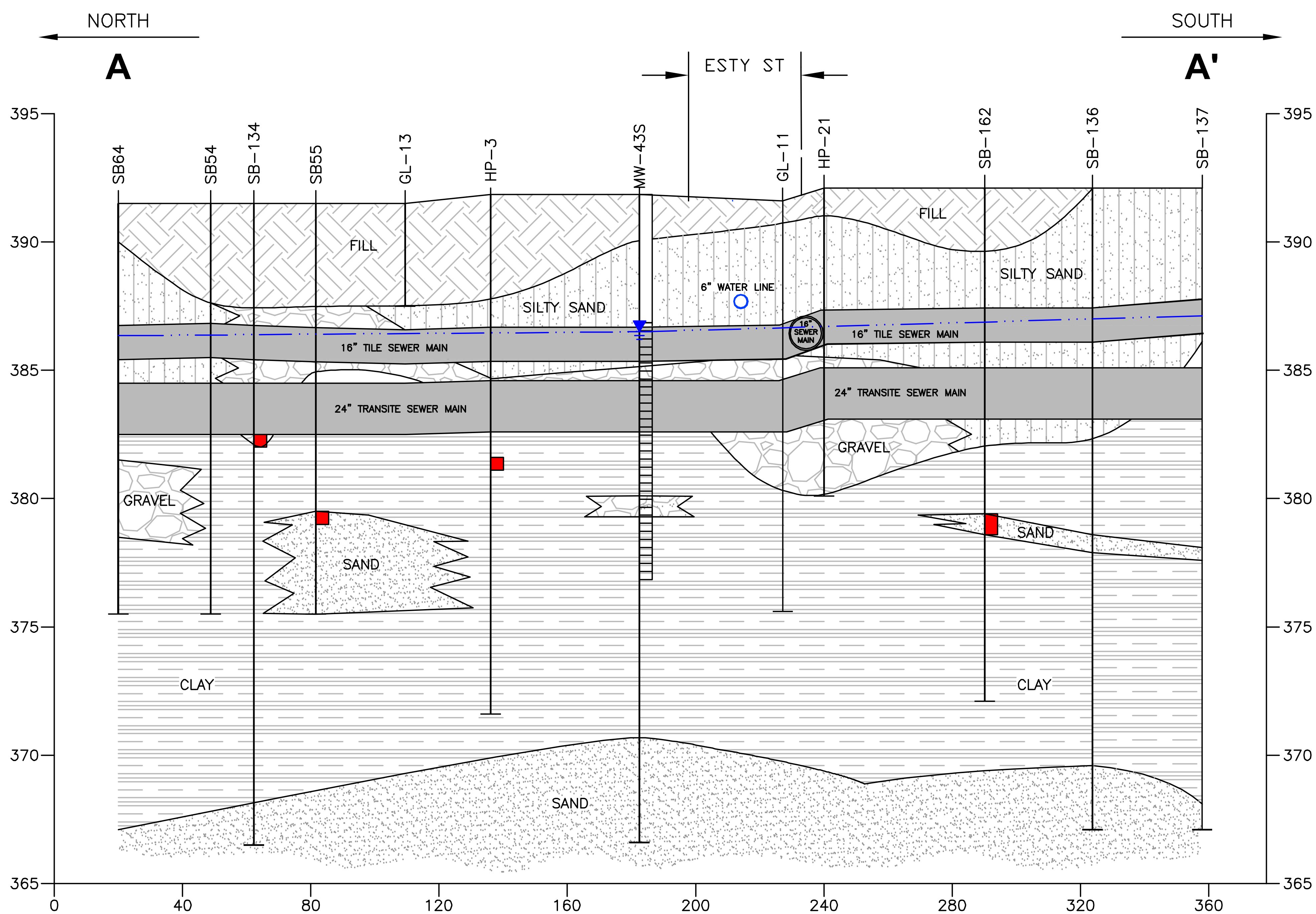
DATE: 04/07/10 | DRWN: DLS/PGH

AREA 2 CROSS SECTION LOCATION MAP AND EXTENT OF OBSERVED HYDROCARBON IMPACTS

FIGURE 4-1b



Note: Six dummy points were added to the geology dataset to constrain the gravel unit in the visualization to areas observed in the field.



OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR ODORS
- COAL TAR PRESENT OR COAL TAR SATURATED

LEGEND

- FILL
- CLAY
- PEAT
- SILTY SAND
- SAND
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

NOTES:
1. THE DESCRIPTIONS AND COLORED PORTIONS OF THE FIGURE ARE GENERAL IN NATURE AND ARE BASED ON A LIMITED NUMBER OF SAMPLES. REFER TO THE BORING LOGS AND THE RESULTS OF THE CHEMICAL ANALYSES FOR SPECIFIC INFORMATION REGARDING THE SUBSURFACE GEOLOGICAL UNITS AND THE DISTRIBUTION OF ANALYTICAL COMPOUNDS.
2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 123.

20 0 40

1"=40'

VERTICAL EXAGGERATION = 8X

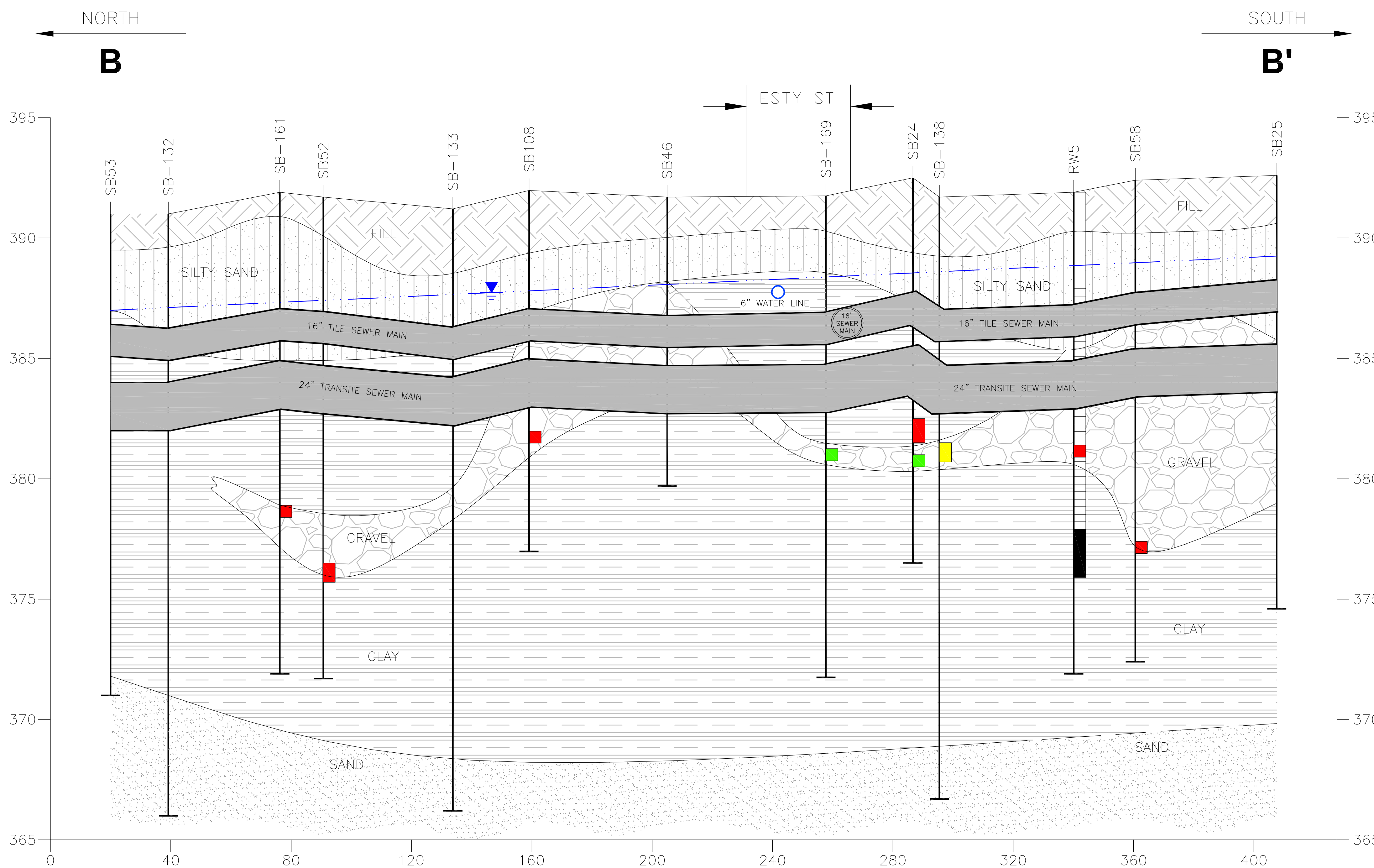
AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

CROSS SECTION A-A'

DATE: 04/29/10 | DRWN: DLS/PGH

FIGURE 4-3



OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR SATURATED
- COAL TAR ODORS

LEGEND

- FILL
- SILTY SAND
- CLAY
- SAND
- PEAT
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

NOTES:
1. THE DESCRIPTIONS AND COLORED PORTIONS OF THE FIGURE ARE GENERAL IN NATURE AND ARE BASED ON A LIMITED NUMBER OF SAMPLES. REFER TO THE BORING LOGS AND THE RESULTS OF THE CHEMICAL ANALYSES FOR SPECIFIC INFORMATION REGARDING THE SUBSURFACE GEOLOGICAL UNITS AND THE DISTRIBUTION OF ANALYTICAL COMPOUNDS.
2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 123.

20 0 40

1"=40'

VERTICAL EXAGGERATION = 8X

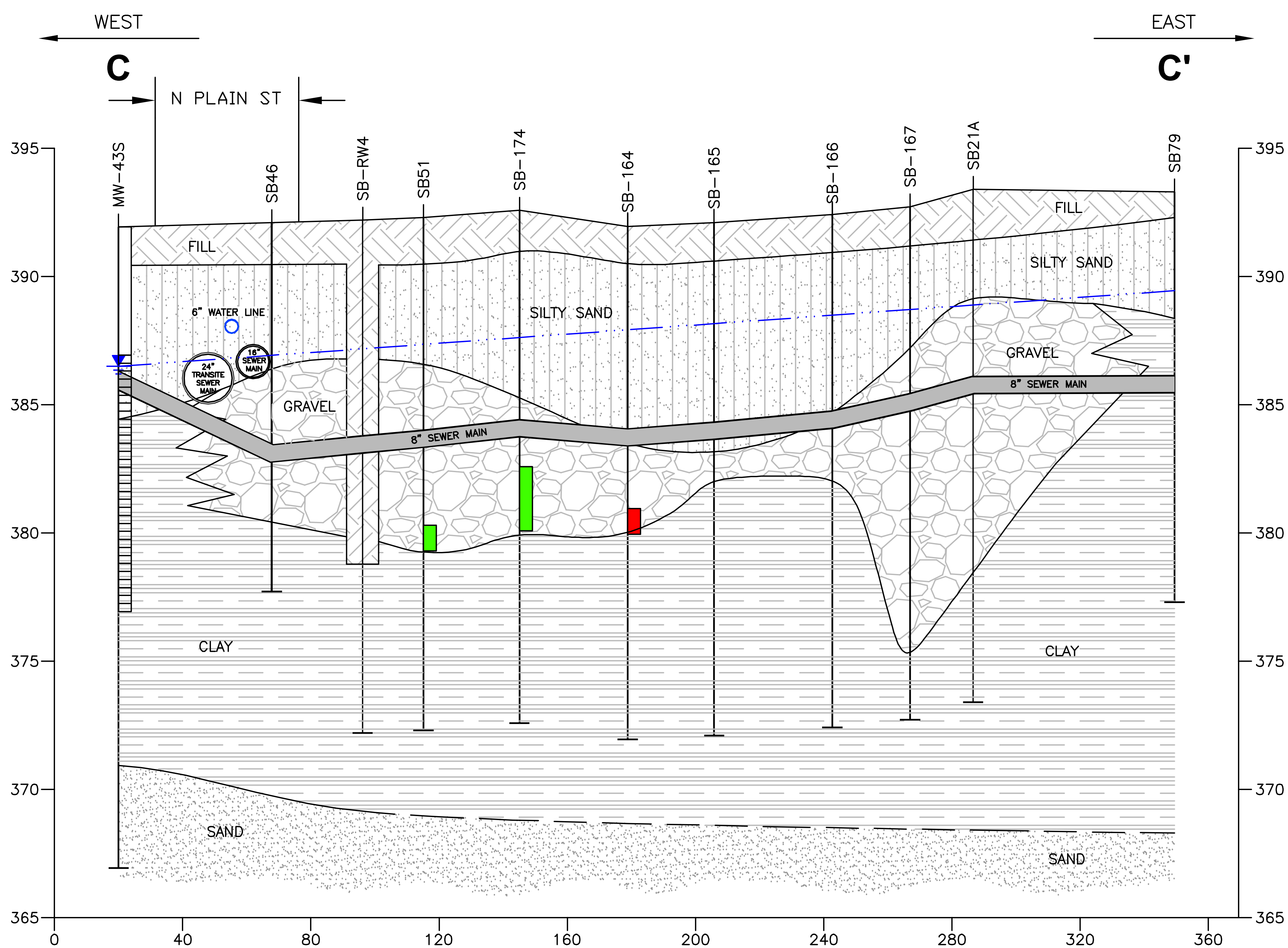
AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

CROSS SECTION B-B'

DATE: 04/29/10 | DRWN: DLS/PGH

FIGURE 4-4



OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR ODORS
- COAL TAR PRESENT OR COAL TAR SATURATED

LEGEND

- FILL
- CLAY
- PEAT
- SILTY SAND
- SAND
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

NOTES:
1. THE DESCRIPTIONS AND COLORED PORTIONS OF THE FIGURE ARE GENERAL IN NATURE AND ARE BASED ON A LIMITED NUMBER OF SAMPLES. REFER TO THE BORING LOGS AND THE RESULTS OF THE CHEMICAL ANALYSES FOR SPECIFIC INFORMATION REGARDING THE SUBSURFACE GEOLOGICAL UNITS AND THE DISTRIBUTION OF ANALYTICAL COMPOUNDS.
2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 88.

20 0 40

1"=40'

VERTICAL EXAGGERATION = 8X

AECOM

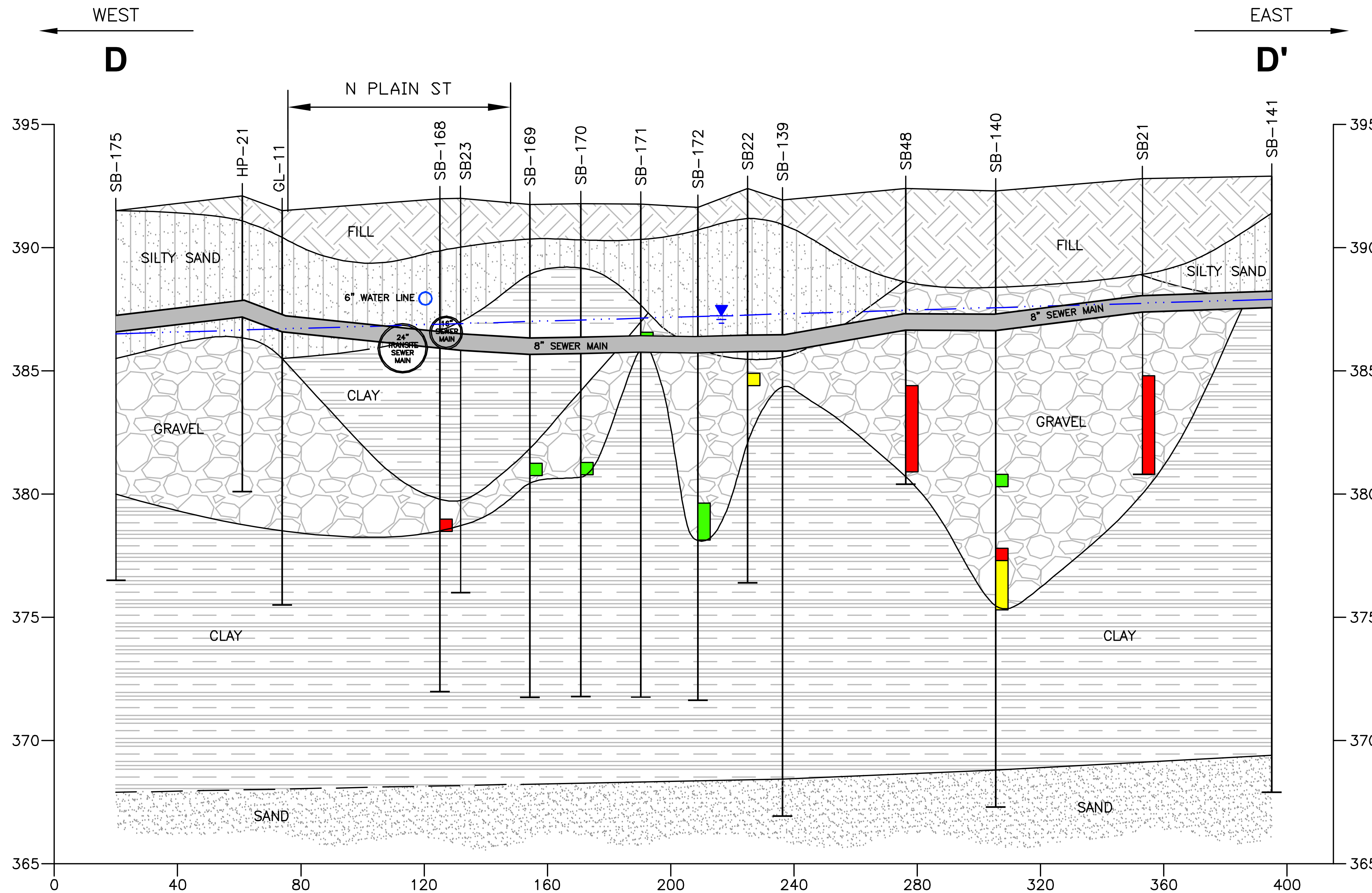
NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 04/29/10 | DRWN: DLS/PGH

CROSS SECTION C-C'

FIGURE 4-5

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-5_CROSS SECTION C-C'.dwg Layout: ANSI_BI-LJ User: PetroskyK Plotted: Jul 30, 2010 - 10:54am Xref's:



NOTES:
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2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 88.

OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR ODORS
- COAL TAR PRESENT OR COAL TAR SATURATED

LEGEND

- FILL
- CLAY
- PEAT
- SILTY SAND
- SAND
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

20 0 40

1"=40'

VERTICAL EXAGGERATION = 8X

AECOM

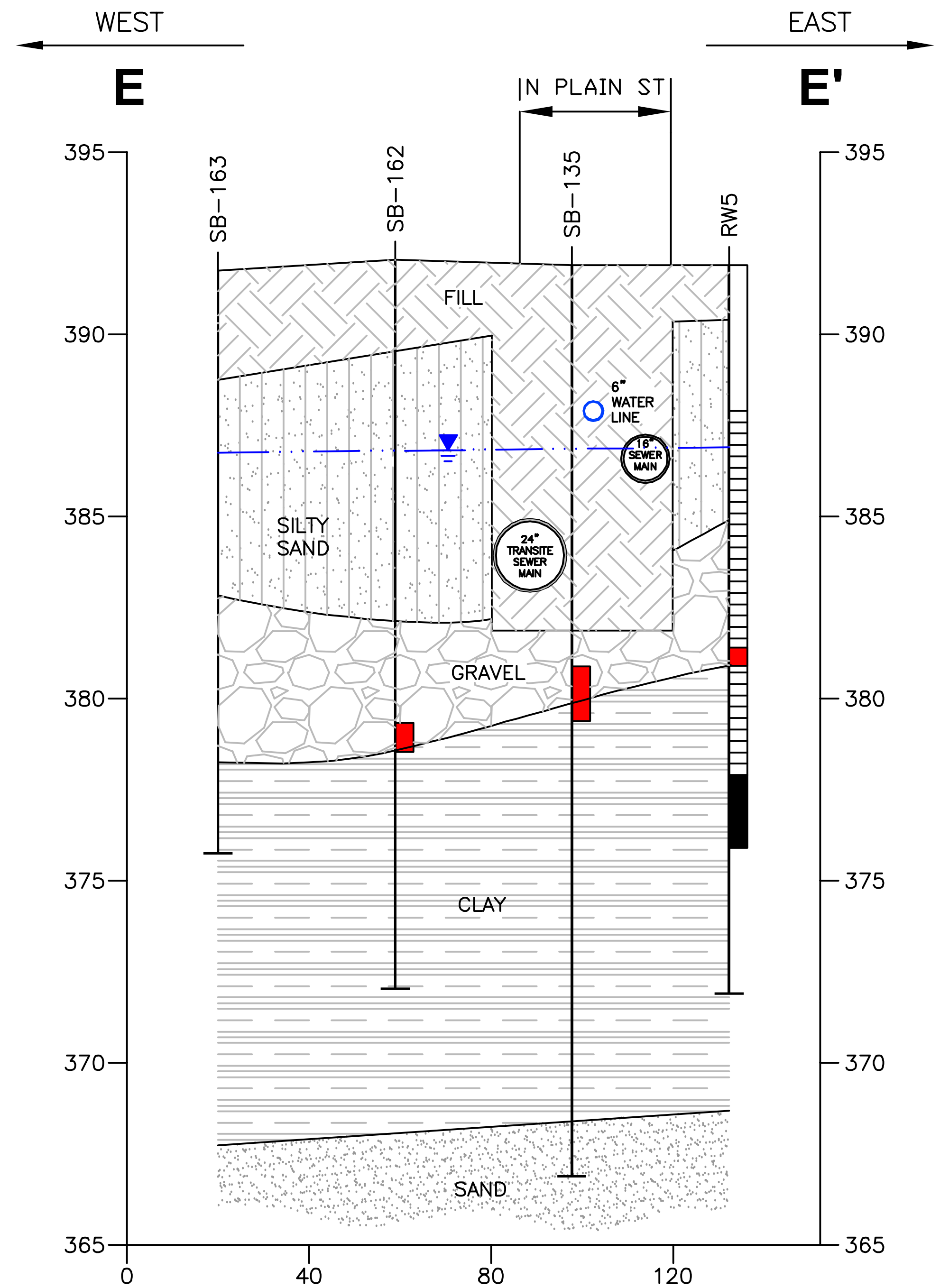
NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 04/29/10 | DRWN: DLS/PGH

CROSS SECTION D-D'

FIGURE 4-6

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-6_CROSS SECTION D-D'.dwg Layout: ANSI_BI-LJ User: PetroskyK Plotted: Jul 30, 2010 - 10:53am Xref's:



NOTES:
1. THE DESCRIPTIONS AND COLORED PORTIONS OF THE FIGURE ARE GENERAL IN NATURE AND ARE BASED ON A LIMITED NUMBER OF SAMPLES. REFER TO THE BORING LOGS AND THE RESULTS OF THE CHEMICAL ANALYSES FOR SPECIFIC INFORMATION REGARDING THE SUBSURFACE GEOLOGICAL UNITS AND THE DISTRIBUTION OF ANALYTICAL COMPOUNDS.
2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2–3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 123.

OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR ODORS
- COAL TAR PRESENT OR COAL TAR SATURATED

LEGEND

- FILL
- CLAY
- PEAT
- SILTY SAND
- SAND
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

20 0 40

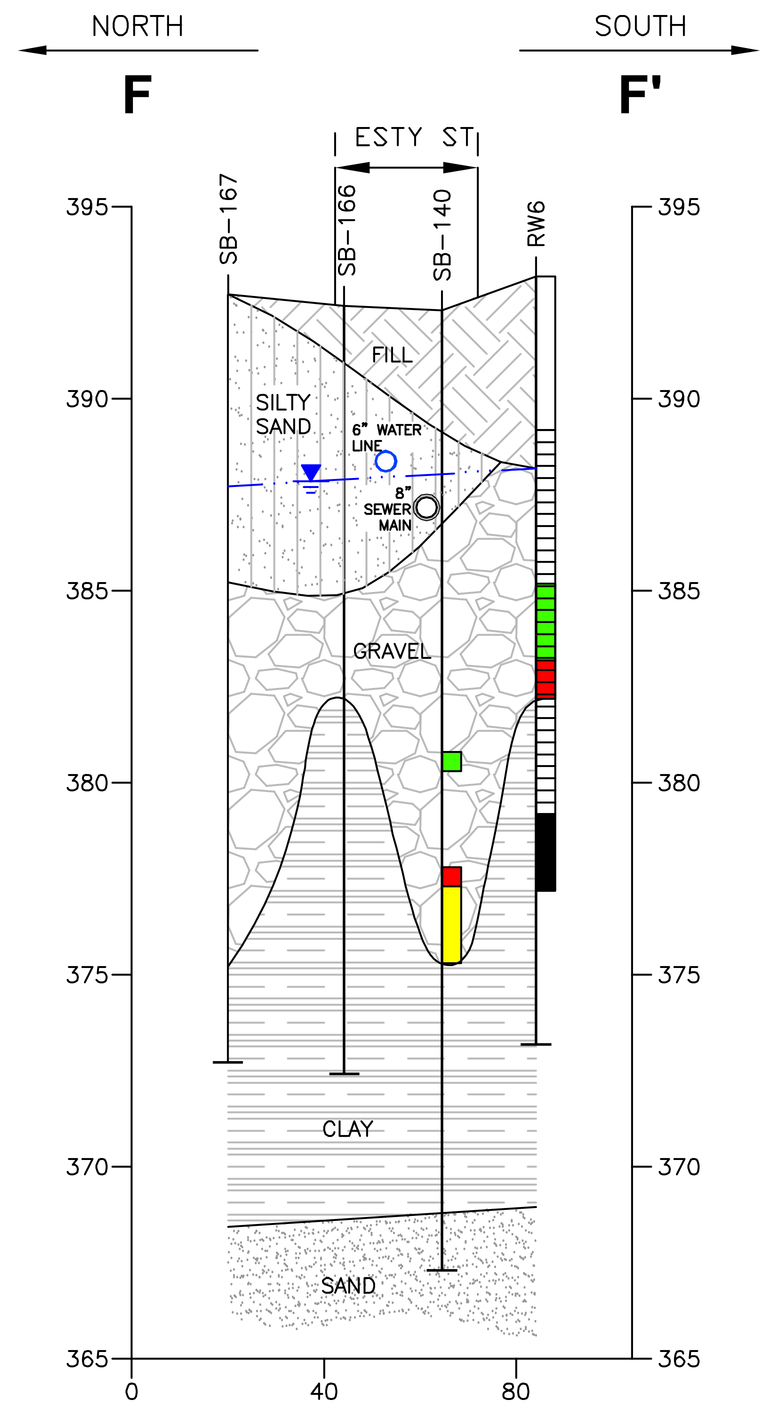
1"=40'

VERTICAL EXAGGERATION = 8X

AECOM

NYSEG - OU2 ITHACA/COURT STREET SITE ITHACA, NEW YORK	CROSS SECTION E-E'
DATE: 04/29/10 DRWN: DLS/PGH	FIGURE 4-7

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-7_CROSS SECTION E-E'.dwg Layout: ANSI_BI-LJ User: PetroskyK Plotted: Jul 30, 2010 - 10:53am Xref's:



OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR SATURATED
- COAL TAR ODORS

LEGEND

- FILL
- SILTY SAND
- CLAY
- SAND
- PEAT
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

NOTES:
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2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 88.

20 0 40

1"=40'

VERTICAL EXAGGERATION = 8X

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

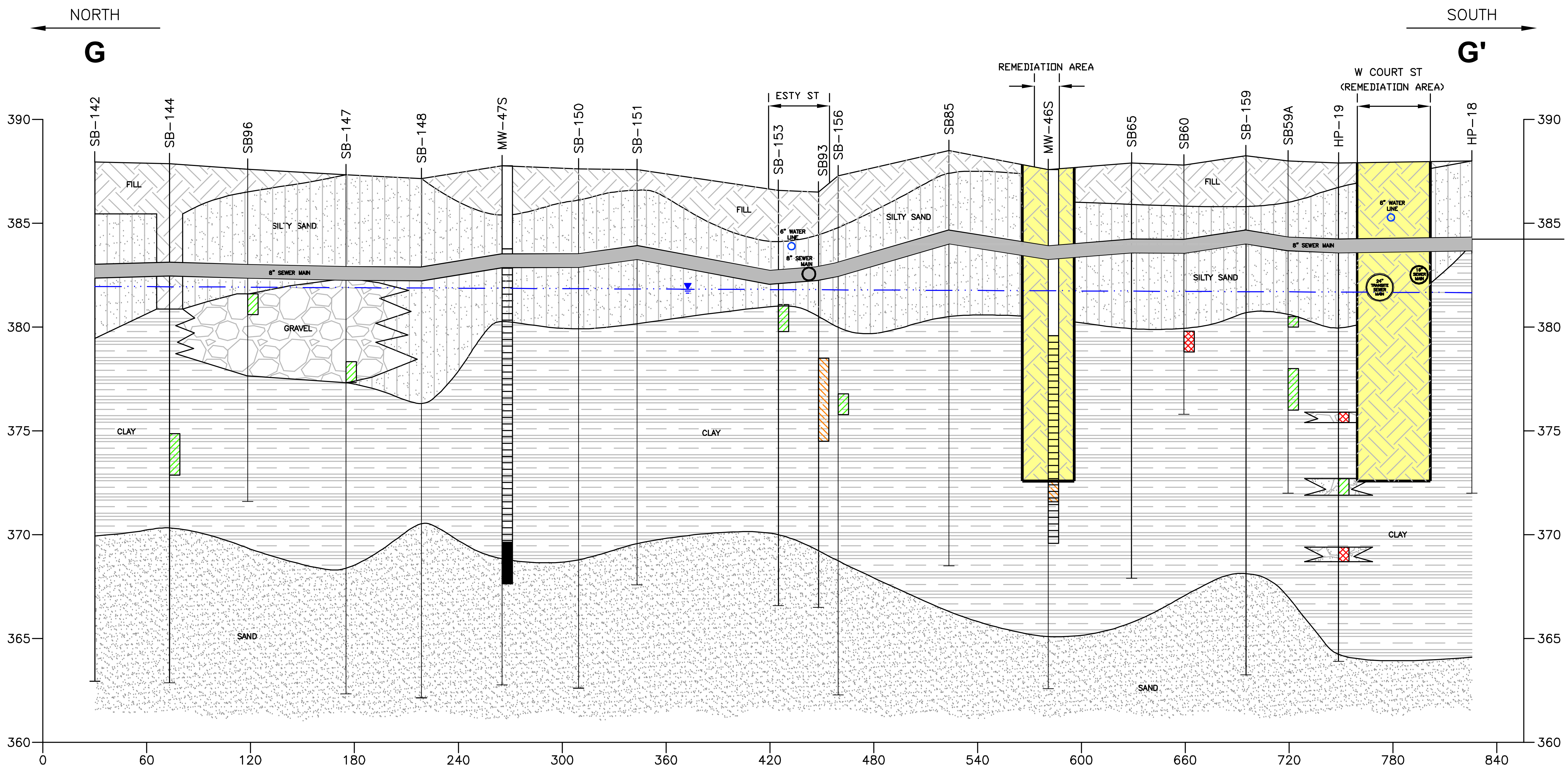
CROSS SECTION F-F'

DATE: 04/29/10 | DRWN: DLS/PGH

FIGURE 4-8

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-8_CROSS SECTION F-F'.dwg Layout: ANSI_BI-LJ User: PetroskyK Plotted: Jul 30, 2010 - 10:53am Xref's:

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-9_CROSS SECTION G-G.dwg Layout: ANSI_BI-LJ User: PetroskyK Plotted: Jul 30, 2010 - 10:52am Xref's:



OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR ODORS
- COAL TAR PRESENT OR COAL TAR SATURATED
- IMPACTS OBSERVED WITHIN THIN SAND LENSES OR ROOT CHANNELS

LEGEND

- FILL
- CLAY
- PEAT
- SILTY SAND
- SAND
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

NOTES:
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2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 117.

30 0 60

1"=60'

VERTICAL EXAGGERATION = 12X

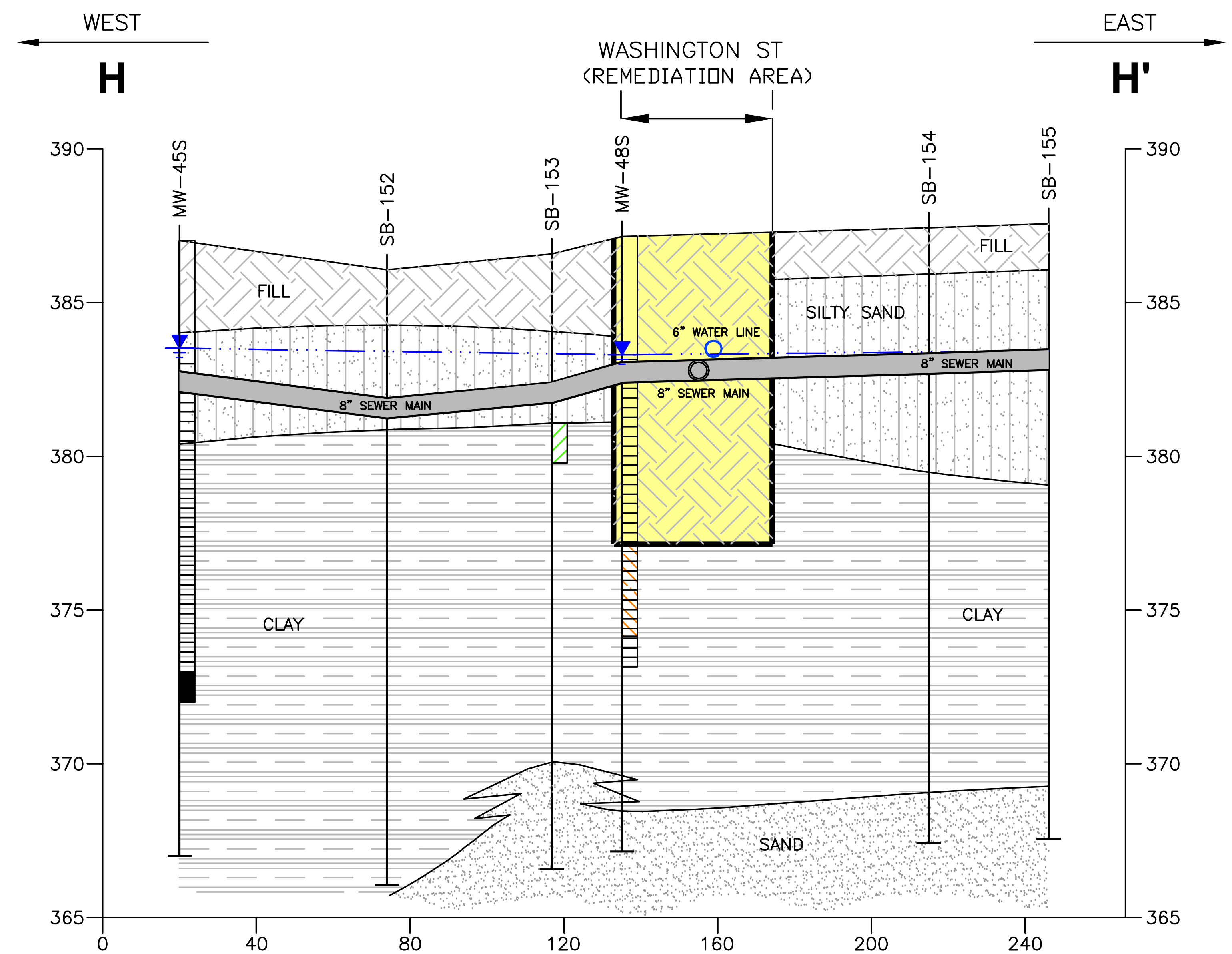
AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

CROSS SECTION G-G'

DATE: 04/29/10 | DRWN: DLS/PGH

FIGURE 4-9



OBSERVED HYDROCARBON IMPACTS

- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR ODORS
- COAL TAR PRESENT OR COAL TAR SATURATED

IMPACTS OBSERVED WITHIN THIN SAND LENSES OR ROOT CHANNELS

LEGEND

- FILL
- CLAY
- PEAT
- SILTY SAND
- SAND
- GRAVEL
- OBSERVED CONTACT
- INFERRED CONTACT
- APPROXIMATE GROUNDWATER ELEVATION (2010)

WELL CONSTRUCTION

- SCREENED INTERVAL
- RISER
- SUMP

NOTES:
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2. SECTION IS POINT TO POINT.
3. UTILITIES ARE NOT ORIENTED ON SAME LINE AS CROSS SECTION. SEE CROSS SECTION LOCATION MAP (FIGURE 2-3).
4. DEPTH TO WATER UTILITIES WERE UNAVAILABLE. DEPTHS ARE ESTIMATED.
5. SOURCE SUBSURFACE UTILITIES: CITY OF ITHACA, DEPARTMENT OF PUBLIC WORKS, WATER AND SEWER DIVISION, SEWER MAP 87.

20 0 40
1"=40'

VERTICAL EXAGGERATION = 8X

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 04/29/10 DRWN: DLS / PGH

CROSS SECTION H-H'

FIGURE 4-10

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
2. THE SITE VERTICAL DATUM IS REFERENCED TO NGS FIRST ORDER, CLASS II, NAVD 88 BENCHMARKS, V463 AND Y463 AND WAS SET BY MULTIPLE RTK GPS OBSERVATIONS.
3. BASE MAPPING WAS PRODUCED BY DIGITIZING AERIAL PHOTOS DATED APRIL 1992 BY MICHAEL BAKER JR., INC, BEAVER, PA., AND HAS BEEN UPDATED USING AERIAL PHOTOS DATED APRIL 1999.
4. SAMPLING LOCATIONS FROM PREVIOUS STUDIES ARE APPROXIMATE AND ARE SHOWN BASED ON FIGURE 4 IN THE TASK 3 REPORT PREPARED BY E.C.JORDAN CO., DATED MARCH 1988.
5. SURFACE SOIL SAMPLES, SS-1 – SS-10 WERE LOCATED BY THE IT CORPORATION AND HAVE BEEN TRANSFERRED DIRECTLY ONTO THIS SITE DRAWING FROM IT CORP GRAPHICS. SS-8 AND SS-9 ARE OUTSIDE THE LIMITS OF THIS DRAWING. SS-11 – SS-15 ARE SHOWN AT LOCATIONS SURVEYED ON 6/27/02.
6. COORDINATE VALUES FOR MONITORING WELLS, SOIL BORINGS, AND HYDRO PUNCH LOCATIONS WERE LOCATED BY NYSEG USING A COMBINATION OF RTK GPS AND CONVENTIONAL SURVEYING. MONITORING WELL ELEVATIONS WERE ESTABLISHED USING DIFFERENTIAL LEVELING.

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\Figure 4-11 Top of Clay.dwg Layout: ANSI_DI User: PetroskyK Plotted: Jul 27, 2010 – 10:44am Xref's:

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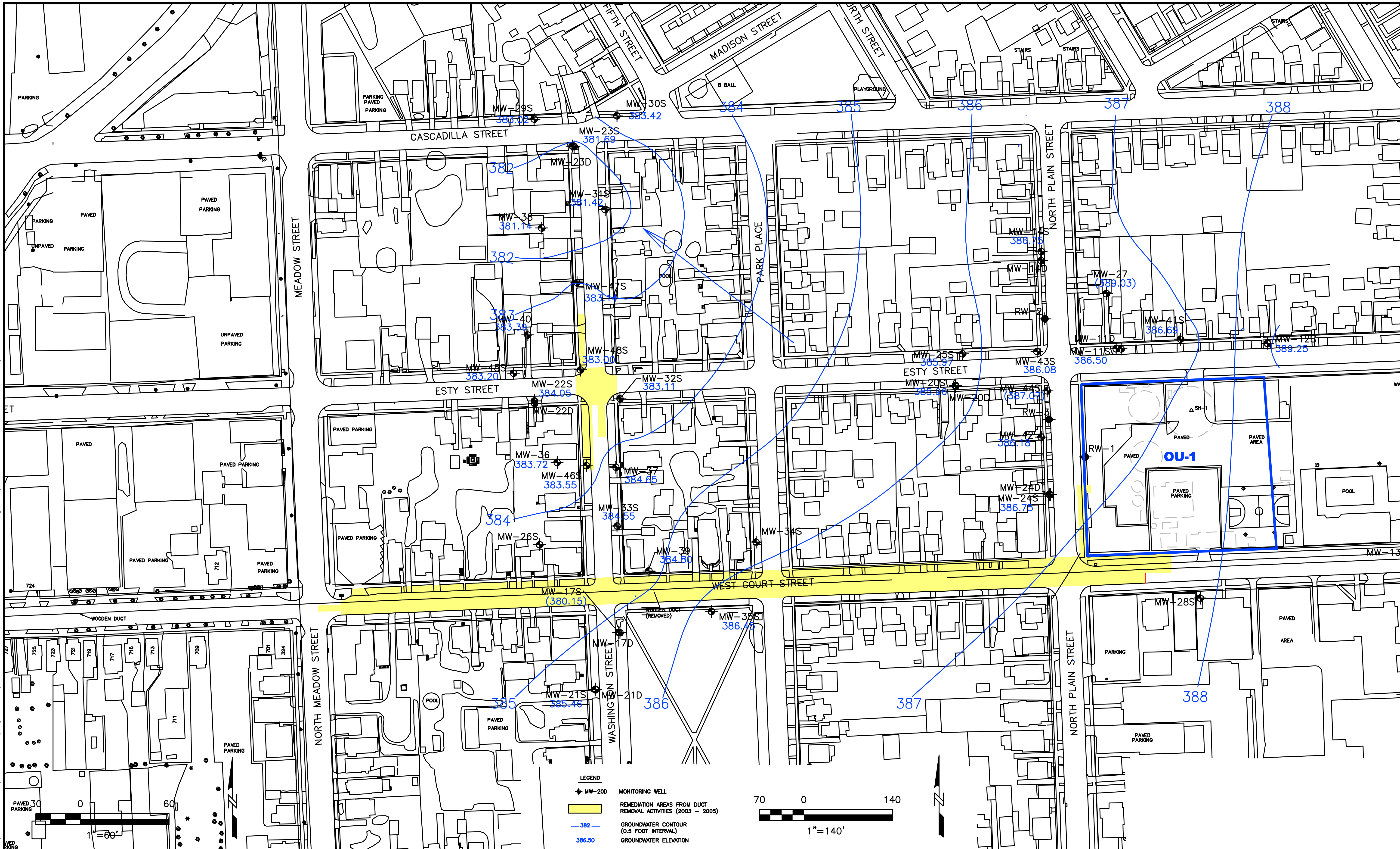
NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 04/29/10 | DRWN: KLP

TOP OF SILTY CLAY CONTOUR MAP

FIGURE 4-11



AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 07/23/10 | DRWN: KLP

SHALLOW GROUNDWATER
MARCH 2010

FIGURE 4-12

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 4-12_SHALLOW GROUNDWATER.dwg Layout: FIGURE 1 User: PetroskyK Plotted: Jul 30, 2010 - 10:39am Xref's:

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NYSEG
ITHACA/COURT STREET SITE
Ithaca, New York

HORIZONTAL EXTENT OF GRAVEL UNIT

Figure 5-1

Legend

Material Type: Fill, Silty Sand, Gravel, Clay, Sand

Impact: Severe, Moderate, Mild

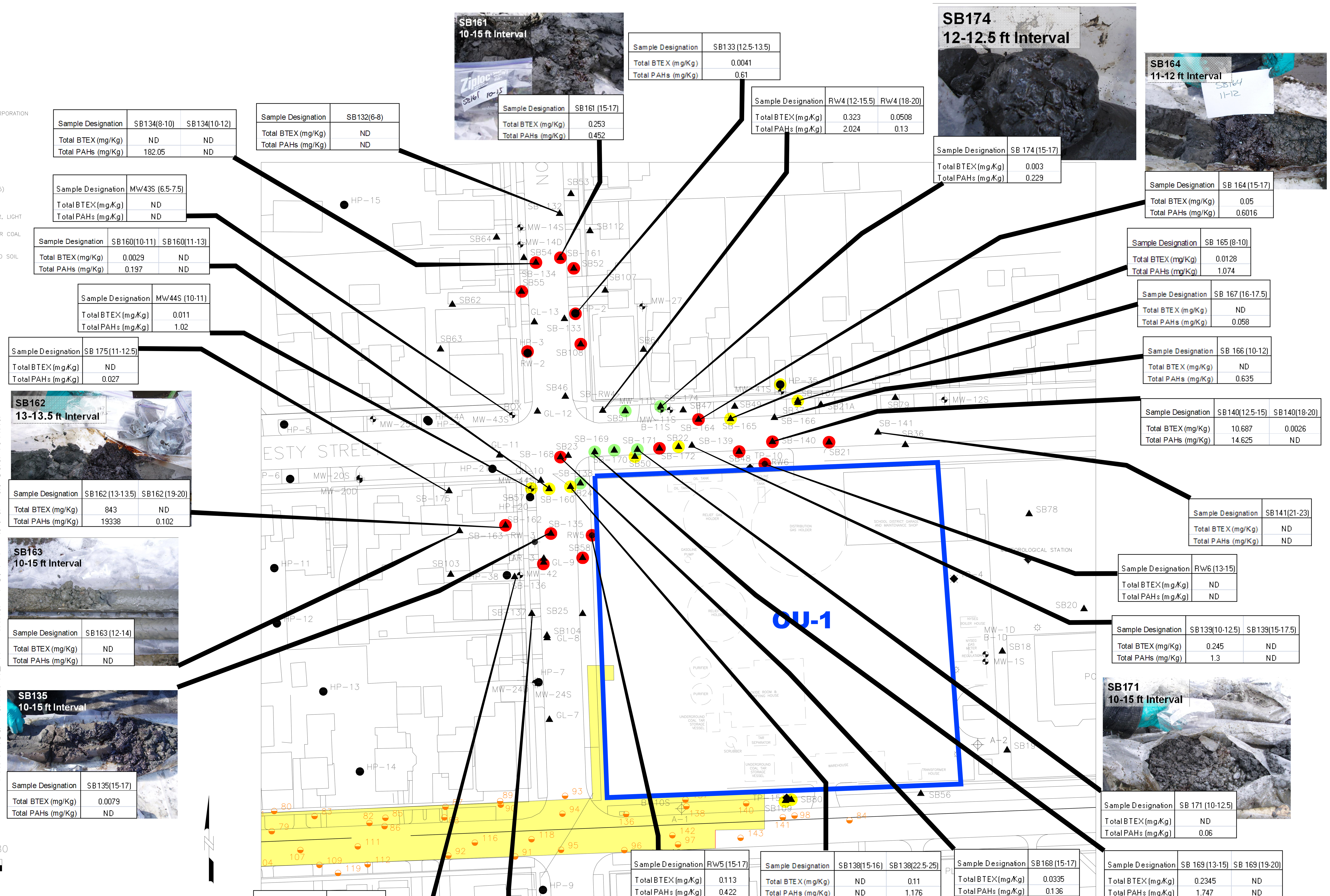
Notes:
Severe – Coal tar present or coal tar stringers, layers or saturated soil.
Moderate – Heavy coal tar stain, sheen or coal tar blebs.
Mild – Strong hydrocarbon-like odor, light stain or sheen.

AECOM

NYSEG
ITHACA/COURT STREET SITE
Ithaca, New York

EXTENT OF VISUAL IMPACTS – AREA 1

Figure 5-2



Sample Designation	SB134(8-10)	SB134(10-12)
Total BTEX (mg/Kg)	ND	ND
Total PAHs (mg/Kg)	182.05	ND

Sample Designation	SB132(6-8)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB161 (15-17)
Total BTEX (mg/Kg)	0.253
Total PAHs (mg/Kg)	0.452

Sample Designation	SB133 (12.5-13.5)
Total BTEX (mg/Kg)	0.0041
Total PAHs (mg/Kg)	0.61

Sample Designation	RW4 (12-15.5)	RW4 (18-20)
Total BTEX (mg/Kg)	0.323	0.0508
Total PAHs (mg/Kg)	2.024	0.13

Sample Designation	SB 174 (15-17)
Total BTEX (mg/Kg)	0.003
Total PAHs (mg/Kg)	0.229

Sample Designation	SB 164 (15-17)
Total BTEX (mg/Kg)	0.05
Total PAHs (mg/Kg)	0.6016

Sample Designation	SB 165 (8-10)
Total BTEX (mg/Kg)	0.0128
Total PAHs (mg/Kg)	1.074

Sample Designation	SB 167 (16-17.5)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.058

Sample Designation	SB 166 (10-12)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.635

Sample Designation	SB140(12.5-15)	SB140(18-20)
Total BTEX (mg/Kg)	10.687	0.0026
Total PAHs (mg/Kg)	14.625	ND

Sample Designation	SB141(21-23)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	RW6 (13-15)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB139(10-12.5)	SB139(15-17.5)
Total BTEX (mg/Kg)	0.245	ND
Total PAHs (mg/Kg)	1.3	ND

Sample Designation	SB 171 (10-12.5)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.06

Sample Designation	SB 169 (13-15)	SB 169 (19-20)
Total BTEX (mg/Kg)	0.2345	ND
Total PAHs (mg/Kg)	1.747	ND

Sample Designation	SB168 (15-17)
Total BTEX (mg/Kg)	0.0335
Total PAHs (mg/Kg)	0.136

Sample Designation	SB138(15-16)	SB138(22.5-25)
Total BTEX (mg/Kg)	ND	0.11
Total PAHs (mg/Kg)	ND	1.176

Sample Designation	RW5 (15-17)
Total BTEX (mg/Kg)	0.113
Total PAHs (mg/Kg)	0.422

Sample Designation	SB137(12.5-15)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB136(12.5-15)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB135(15-17)
Total BTEX (mg/Kg)	0.0079
Total PAHs (mg/Kg)	ND

Sample Designation	SB163 (12-14)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB162 (13-13.5)	SB162 (19-20)
Total BTEX (mg/Kg)	843	ND
Total PAHs (mg/Kg)	19338	0.102

Sample Designation	SB 175(11-12.5)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.027

Sample Designation	MW44S (10-11)
Total BTEX (mg/Kg)	0.011
Total PAHs (mg/Kg)	1.02

Sample Designation	SB160(10-11)	SB160(11-13)
Total BTEX (mg/Kg)	0.0029	ND
Total PAHs (mg/Kg)	0.197	ND

Sample Designation	MW43S (6.5-7.5)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

LEGEND

- MW-20D — MONITORING WELL
- SB80 — SOIL BORING
- HP-12 — HYDRO PUNCH
- SS-1 — SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
- RW-1 — RECOVERY WELL
- TEST PIT
- CONFIRMATION SAMPLE
- 106(7) — CONFIRMATION SAMPLE ID(DEPTH)
- REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
- HISTORIC FEATURE
- STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL
- NA — NOT ANALYZED

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
2. THE SITE VERTICAL DATUM IS REFERENCED TO NGS FIRST ORDER, CLASS II, NAVD 88 BENCHMARKS, V463 AND Y463 AND WAS SET BY MULTIPLE RTK GPS OBSERVATIONS.
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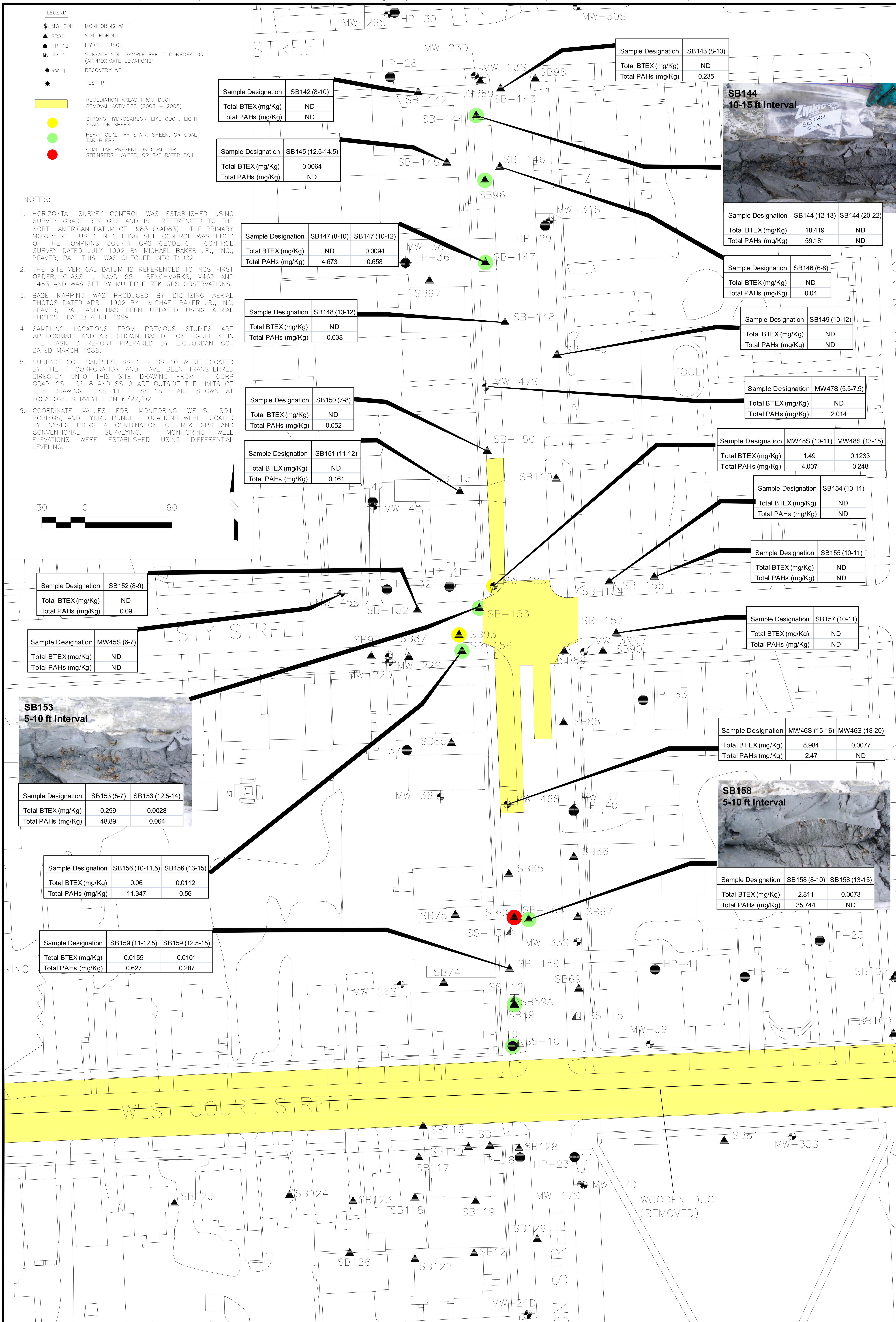
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 07/29/10 DRWN: KLP

AREA 1
SUBSURFACE SOIL SAMPLE RESULTS

FIGURE 6-1

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 6-1_Soil Results AREA 1.dwg Layout: FIGURE 1 User: PetroskyK Plotted: Jul 30, 2010 - 2:30pm Xref's:



Sample Designation	SB143 (8-10)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.235

Sample Designation	SB142 (8-10)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB145 (12.5-14.5)
Total BTEX (mg/Kg)	0.0064
Total PAHs (mg/Kg)	ND

Sample Designation	SB144 (12-13)	SB144 (20-22)
Total BTEX (mg/Kg)	18.419	ND
Total PAHs (mg/Kg)	59.181	ND

Sample Designation	SB147 (8-10)	SB147 (10-12)
Total BTEX (mg/Kg)	4.673	0.0094
Total PAHs (mg/Kg)	4.673	0.658

Sample Designation	SB146 (6-8)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.04

Sample Designation	SB148 (10-12)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.038

Sample Designation	SB149 (10-12)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB150 (7-8)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.052

Sample Designation	MW47S (5.5-7.5)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	2.014

Sample Designation	SB151 (11-12)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.161

Sample Designation	MW48S (10-11)	MW48S (13-15)
Total BTEX (mg/Kg)	1.49	0.1233
Total PAHs (mg/Kg)	4.007	0.248

Sample Designation	SB154 (10-11)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB155 (10-11)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB152 (8-9)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	0.09

Sample Designation	MW45S (6-7)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	SB157 (10-11)
Total BTEX (mg/Kg)	ND
Total PAHs (mg/Kg)	ND

Sample Designation	MW46S (15-16)	MW46S (18-20)
Total BTEX (mg/Kg)	8.984	0.0077
Total PAHs (mg/Kg)	2.47	ND

Sample Designation	SB153 (5-7)	SB153 (12.5-14)
Total BTEX (mg/Kg)	0.299	0.0028
Total PAHs (mg/Kg)	48.89	0.064

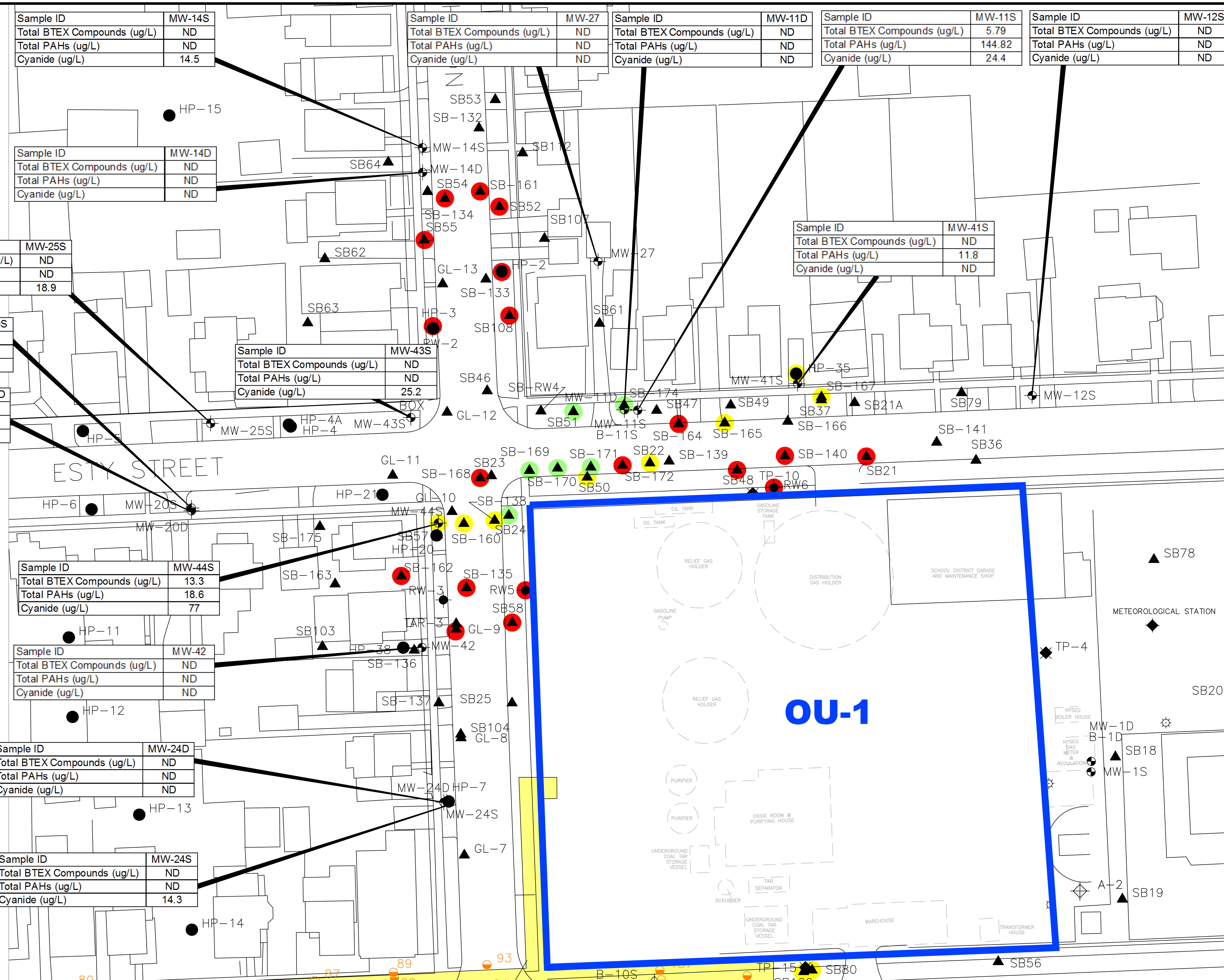
Sample Designation	SB156 (10-11.5)	SB156 (13-15)
Total BTEX (mg/Kg)	0.06	0.0112
Total PAHs (mg/Kg)	11.347	0.56

Sample Designation	SB158 (8-10)	SB158 (13-15)
Total BTEX (mg/Kg)	2.811	0.0073
Total PAHs (mg/Kg)	35.744	ND

Sample Designation	SB159 (11-12.5)	SB159 (12.5-15)
Total BTEX (mg/Kg)	0.0155	0.0101
Total PAHs (mg/Kg)	0.627	0.287

LEGEND

- MW-20D — MONITORING WELL
- SB80 — SOIL BORING
- HP-12 — HYDRO PUNCH
- SS-1 — SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
- RW-1 — RECOVERY WELL
- TEST PIT
- CONFIRMATION SAMPLE
- 106(7) — CONFIRMATION SAMPLE ID(DEPTH)
- REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
- HISTORIC FEATURE
- STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL
- NA — NOT ANALYZED
- CYANIDE DETECTED AT A CONCENTRATION GREATER THAN THE GOUNDWATER STANDARD OF 200 UG/L.



Sample ID	MW-14S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	14.5

Sample ID	MW-27
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-11D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-11S
Total BTEX Compounds (ug/L)	5.79
Total PAHs (ug/L)	144.82
Cyanide (ug/L)	24.4

Sample ID	MW-12S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-14D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-41S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	11.8
Cyanide (ug/L)	ND

Sample ID	MW-25S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	18.9

Sample ID	MW-20S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-43S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	25.2

Sample ID	MW-20D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-44S
Total BTEX Compounds (ug/L)	13.3
Total PAHs (ug/L)	18.6
Cyanide (ug/L)	77

Sample ID	MW-42
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-24D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-24S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	14.3

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
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30 0 60

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 07/27/10 DRWN: KLP

AREA 1
GROUNDWATER SAMPLE RESULTS

FIGURE 6-3

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\FIGURE 6-4_GROUNDWATER SAMPLE RESULTS AREA 2.dwg Layout: ANSI_BVI-CP User: PetroskyK Plotted: Jul 30, 2010 - 2:38pm Xref's:

LEGEND

- MW-20D MONITORING WELL
- SB80 SOIL BORING
- HP-12 HYDRO PUNCH
- SS-1 SURFACE SOIL SAMPLE PER IT CORPORATION (APPROXIMATE LOCATIONS)
- RW-1 RECOVERY WELL
- TEST PIT
- CONFIRMATION SAMPLE
- 106(7) CONFIRMATION SAMPLE ID(DEPTH)
- REMEDIATION AREAS FROM DUCT REMOVAL ACTIVITIES (2003 – 2005)
- STRONG HYDROCARBON-LIKE ODOR, LIGHT STAIN OR SHEEN
- HEAVY COAL TAR STAIN, SHEEN, OR COAL TAR BLEBS
- COAL TAR PRESENT OR COAL TAR STRINGERS, LAYERS, OR SATURATED SOIL
- NA NOT ANALYZED
- CYANIDE DETECTED AT A CONCENTRATION GREATER THAN THE GROUNDWATER STANDARD OF 200 UG/L.

NOTES:

1. HORIZONTAL SURVEY CONTROL WAS ESTABLISHED USING SURVEY GRADE RTK GPS AND IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PRIMARY MONUMENT USED IN SETTING SITE CONTROL WAS T1011 OF THE TOMPKINS COUNTY GPS GEODETIC CONTROL SURVEY DATED JULY 1992 BY MICHAEL BAKER JR., INC., BEAVER, PA. THIS WAS CHECKED INTO T1002.
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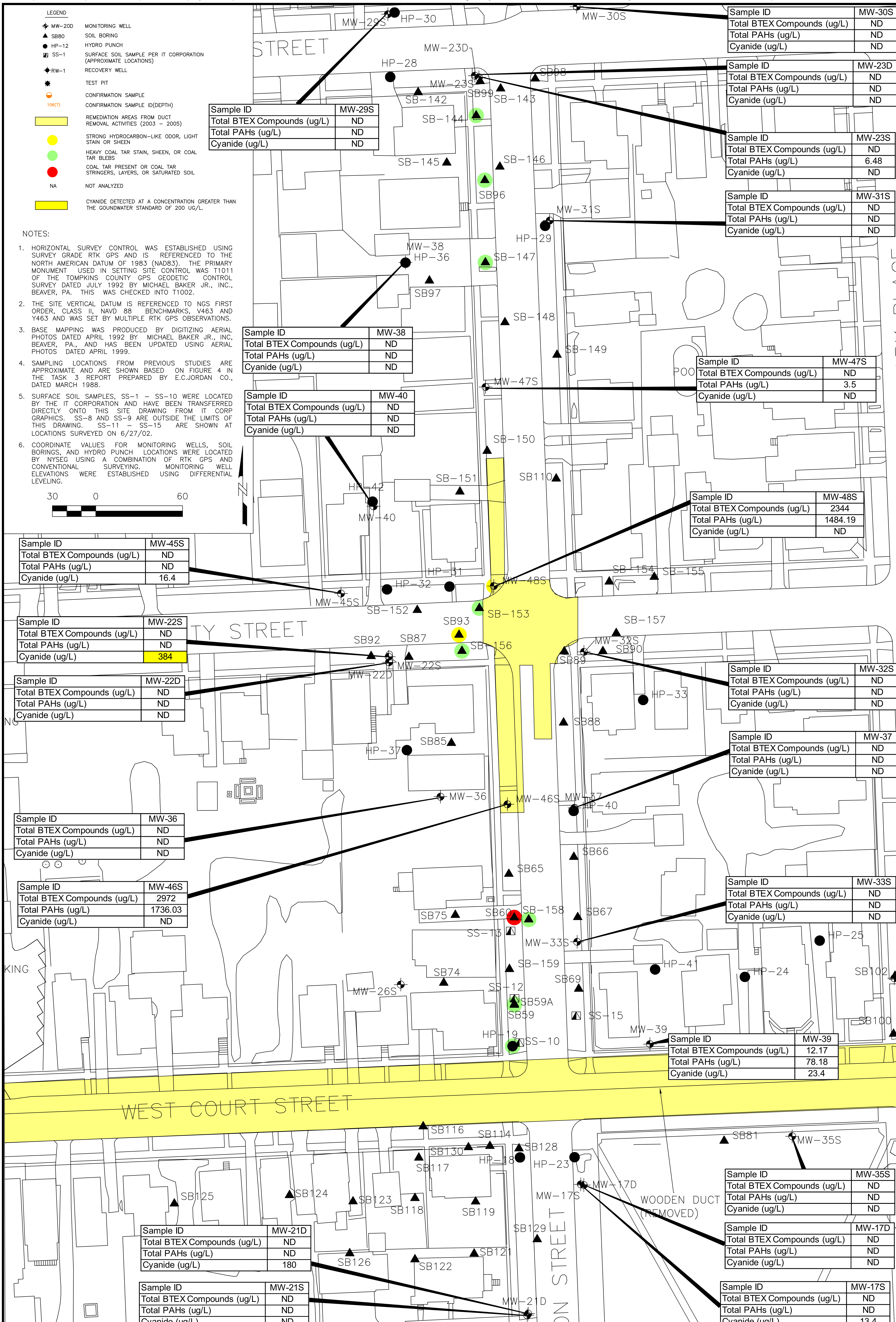


Sample ID	MW-30S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-23D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-29S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-23S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	6.48
Cyanide (ug/L)	ND

Sample ID	MW-31S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-38
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-47S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	3.5
Cyanide (ug/L)	ND

Sample ID	MW-40
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-48S
Total BTEX Compounds (ug/L)	2344
Total PAHs (ug/L)	1484.19
Cyanide (ug/L)	ND

Sample ID	MW-45S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	16.4

Sample ID	MW-22S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	384

Sample ID	MW-22D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-32S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-37
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-36
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-46S
Total BTEX Compounds (ug/L)	2972
Total PAHs (ug/L)	1736.03
Cyanide (ug/L)	ND

Sample ID	MW-33S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-39
Total BTEX Compounds (ug/L)	12.17
Total PAHs (ug/L)	78.18
Cyanide (ug/L)	23.4

Sample ID	MW-35S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-17D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-21D
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	180

Sample ID	MW-21S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	ND

Sample ID	MW-17S
Total BTEX Compounds (ug/L)	ND
Total PAHs (ug/L)	ND
Cyanide (ug/L)	13.4

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 07/26/10 DRWN: KLP

AREA 2
GROUNDWATER SAMPLE RESULTS

FIGURE 6-4

MW-29S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-31S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-38				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-47S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	NS	ND
Total PAHs	NS	NS	NS	**3.5**
Total CN	NS	NS	NS	ND

MW-40				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-48S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	NS	**2344**
Total PAHs	NS	NS	NS	**1484.19**
Total CN	NS	NS	NS	ND

MW-45S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	NS	ND
Total PAHs	NS	NS	NS	ND
Total CN	NS	NS	NS	**16.4**

MW-22S				
Analyte	2002	2004	2007	2010
Total BTEX	**0.85**	NS	**9.79**	ND
Total PAHs	**2.0**	NS	NS	ND
Total CN	**47**	NS	NS	**384**

MW-22D				
Analyte	2002	2004	2007	2010
Total BTEX	**0.27**	NS	ND	ND
Total PAHs	ND	NS	NS	ND
Total CN	ND	NS	NS	ND

MW-36				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-16S				
Analyte	2002	2004	2007	2010
Total BTEX	**24000**	NS	NS	NS
Total PAHs	**7100**	NS	NS	NS
Total CN	ND	NS	NS	NS

MW-46S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	NS	**2972**
Total PAHs	NS	NS	NS	**1736.03**
Total CN	NS	NS	NS	ND

MW-37				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-33S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-18S				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	NS
Total PAHs	ND	NS	NS	NS
Total CN	ND	NS	NS	NS

MW-18D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	NS
Total PAHs	ND	NS	NS	NS
Total CN	ND	NS	NS	NS

MW-19D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	NS
Total PAHs	ND	NS	NS	NS
Total CN	ND	NS	NS	NS

MW-39				
Analyte	2002	2004	2007	2010
Total BTEX	NS	**140**	NS	**12.17**
Total PAHs	NS	**726**	NS	**78.18**
Total CN	NS	NS	NS	**23.4**

MW-17S				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	ND
Total PAHs	**0.8**	NS	NS	ND
Total CN	ND	NS	NS	**13.4**

MW-17D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	ND
Total PAHs	**0.8**	NS	NS	ND
Total CN	ND	NS	NS	ND

MW-23D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	ND
Total PAHs	ND	NS	NS	ND
Total CN	ND	NS	NS	ND

MW-23S				
Analyte	2002	2004	2007	2010
Total BTEX	**182.7**	NS	NS	ND
Total PAHs	**231**	NS	NS	**6.48**
Total CN	**11**	NS	NS	ND

MW-30S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-20S				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	ND	ND
Total PAHs	ND	NS	ND	ND
Total CN	ND	NS	NS	ND

MW-32S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-20D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	ND	ND
Total PAHs	ND	NS	**2.9**	ND
Total CN	ND	NS	NS	ND

MW-25S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	ND
Total PAHs	NS	ND	ND	ND
Total CN	NS	NS	NS	**18.9**

MW-14S				
Analyte	2002	2004	2007	2010
Total BTEX	ND	ND	ND	ND
Total PAHs	**0.9**	ND	ND	ND
Total CN	ND	NS	NS	**14.5**

MW-14D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	ND	ND
Total PAHs	ND	NS	ND	ND
Total CN	ND	NS	NS	ND

MW-27				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	ND
Total PAHs	NS	ND	ND	ND
Total CN	NS	NS	NS	ND

MW-43S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	**25.2**

MW-11D				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	**7.2**	ND
Total PAHs	NS	NS	**189.2**	ND
Total CN	NS	NS	NS	ND

MW-11S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	**20**	**7.7**	**5.79**
Total PAHs	NS	**158**	**160.9**	**144.82**
Total CN	NS	NS	NS	**24.4**

MW-41S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	ND
Total PAHs	NS	**42**	**12.3**	**11.8**
Total CN	NS	NS	NS	ND

MW-12S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	ND
Total PAHs	NS	ND	**14.2**	ND
Total CN	NS	NS	NS	ND

MW-24D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	ND	ND	ND
Total PAHs	ND	ND	ND	ND
Total CN	ND	NS	NS	ND

MW-24S				
Analyte	2002	2004	2007	2010
Total BTEX	**2.21**	NS	ND	ND
Total PAHs	ND	NS	ND	ND
Total CN	ND	NS	NS	**14.3**

MW-5S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	**88**	**93.66**	NS
Total PAHs	NS	**108**	**130.2**	NS
Total CN	NS	NS	NS	NS

MW-5D				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	**101.66**	NS
Total PAHs	NS	NS	**159.4**	NS
Total CN	ND	NS	NS	NS

MW-10S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	ND
Total PAHs	NS	ND	**0.2**	ND
Total CN	NS	NS	NS	NS

MW-21D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	ND	ND
Total PAHs	ND	NS	NS	ND
Total CN	ND	NS	NS	**180**

MW-15S				
Analyte	2002	2004	2007	2010
Total BTEX	**163.5**	NS	NS	NS
Total PAHs	**255**	NS	NS	NS
Total CN	**30**	NS	NS	NS

MW-21S				
Analyte	2002	2004	2007	2010
Total BTEX	**0.44**	NS	ND	ND
Total PAHs	ND	NS	NS	ND
Total CN	ND	NS	NS	ND

MW-15D				
Analyte	2002	2004	2007	2010
Total BTEX	**0.46**	NS	NS	NS
Total PAHs	**0.7**	NS	NS	NS
Total CN	ND	NS	NS	NS

MW-34S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	NS
Total PAHs	NS	ND	NS	NS
Total CN	NS	ND	NS	NS

MW-35S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	NS	ND
Total PAHs	NS	ND	NS	ND
Total CN	NS	NS	NS	ND

MW-44S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	NS	NS	**13.3**
Total PAHs	NS	NS	NS	**18.6**
Total CN	NS	NS	NS	**77**

MW-42				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	ND
Total PAHs	NS	ND	ND	ND
Total CN	NS	NS	NS	ND

MW-28S				
Analyte	2002	2004	2007	2010
Total BTEX	NS	ND	ND	NS
Total PAHs	NS	ND	ND	NS
Total CN	NS	NS	NS	NS

MW-13S				
Analyte	2002	2004	2007	2010
Total BTEX	**0.24**	ND	NS	NS
Total PAHs	ND	ND	NS	NS
Total CN	ND	NS	NS	NS

MW-13D				
Analyte	2002	2004	2007	2010
Total BTEX	ND	NS	NS	NS
Total PAHs	ND	NS	NS	NS
Total CN	ND	NS	NS	NS

Legend

- MW-21S Monitoring Well
- MW-26S Abandoned Monitoring Well
- Remediation Areas From Duct Removal Activities (2003-2005)
- MW-16S Monitoring Well Removed
- 382 Groundwater Contour (March 2010) (0.5 Foot Interval)
- Groundwater Flow Direction
- NS Not Sampled
- ND Not Detected

Notes

1) **Bold** values represent detected concentrations in µg/L.

2) Highlight value represents Cyanide detected at a concentration greater than the corresponding groundwater standard of 200 µg/L.

AECOM

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

DATE: 09/21/10 DRWN: KLP

SUMMARY OF GROUNDWATER RESULTS 2002 - 2010

FIGURE 7-1

File: \\Usmvl1fp001\projects\04964_OU2\Court Street\RI REPORT\July 2010\7-1 Summary of Groundwater Results.dwg Layout: FIGURE 1 User: PetroskyK Plotted: Sep 27, 2010 – 2:16pm Xref's:

NYSEG - OU2
ITHACA/COURT STREET SITE
ITHACA, NEW YORK

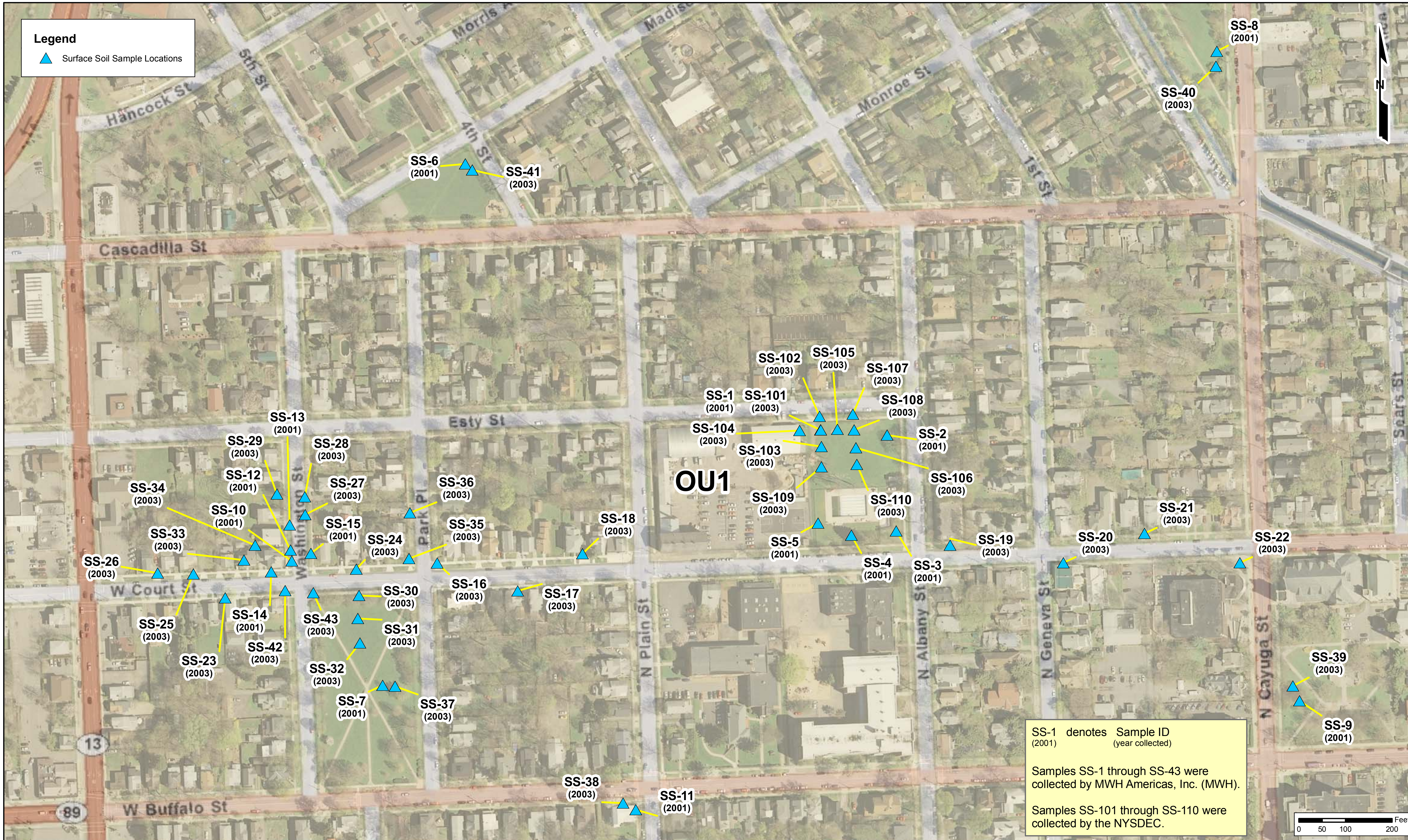
DATE: 09/21/10 DRWN: KLP

AECOM

SVI SAMPLE LOCATIONS 2002-2010

FIGURE 7-2

File: F:\04964_OU2\Court Street\RI REPORT\July 2010\Figure 7-2 SVI Sample Locations.dwg Layout: FIGURE 1 User: PetroskyK Plotted: Oct 11, 2010 - 1:21pm Xref's:



T:\NYSEG_Granville\Projects\SurfSoils.mxd

AECOM

NYSEG - OU2 Ithaca/Court Street Site NYSEG, Ithaca, NY (60143516)	Surface Soil Sample Locations
DATE: 12/14/10 DRWN: HAJ/Ith Revision: 0	FIGURE 7-3

Appendix B

Feasibility Study Cost Estimates

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 2 **Area 1 and Area 2: Excavation for subsurface soils for Unrestricted Future Use**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS				
Mobilization, Site Preparation, and Misc. Activities			**Task Sub-Total**	**$2,273,907**
Construct material staging and water treatment containment areas	Lump Sum (LS)	1	$50,000	$50,000
Mobilize equipment to site	Lump Sum (LS)	1	$25,000	$25,000
Sheet pile contractor mobilization	Lump Sum (LS)	1	$150,000	$150,000
Police detail	Man Hour(s)	1250	$70	$87,500
Road opening permit	Lump Sum (LS)	1	$1,000	$1,000
Set-up temporary electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Set-up temporary sewer/water utility services	Lump Sum (LS)	1	$1,015,407	$1,015,407
Temporary erosion controls	Linear Foot (LF)	4000	$15	$60,000
Water treatment system mobilization & setup	Lump Sum (LS)	1	$50,000	$50,000
Purchase Existing Residential Properties	Each	2	$210,000	$420,000
Demolition of Residential Properties with Disposal	Each	2	$25,000	$50,000
Clear & grub	Lump Sum (LS)	1	$10,000	$10,000
Survey control & documentation	Lump Sum (LS)	1	$50,000	$50,000
Excavation Shoring			**Task Sub-Total**	**$4,754,440**
Sheet pile material (130% of excavation depth x excavation perimeter)	Square Foot (SF)	82167	$33	$2,711,500
Sheet pile material (130% of excavation depth x center line length) Area 1	Square Foot (SF)	14280	$33	$471,240
Sheet pile installation (hydraulic press)/removal, bracing install/removal	Square Foot (SF)	96447	$15	$1,446,700
Pre-excavation & clearing of obstructions	Lump Sum (LS)	1	$100,000	$100,000
Sheet pile design	Lump Sum (LS)	1	$25,000	$25,000
Excavation & Material Handling			**Task Sub-Total**	**$817,500**
Excavation & Material Handling	Cubic Yard (CY)	27500	$25	$687,500
Soil Re-Use (Assume 100% is suitable for reuse)	Cubic Yard (CY)	14500		
Soil for Disposal	Cubic Yard (CY)	13000		
Dust, vapor & odor control	Week(s)	40	$2,000	$80,000
Bottom and Sidewall Soil Sampling	Lump Sum (LS)	1	$50,000	$50,000
Excavation Dewatering			**Task Sub-Total**	**$200,000**
Weekly maintenance	Week(s)	40	$5,000	$200,000
Transportation and Off-Site Disposal			**Task Sub-Total**	**$1,475,500**
T&D (Hazardous) (10%)	Cubic Yard (CY)	1300	$225	$292,500
T&D (Non-Hazardous) (85%)	Cubic Yard (CY)	11050	$100	$1,105,000
T&D (Non-Hazardous) Debris (5%)	Cubic Yard (CY)	650	$120	$78,000
Backfill & Site Restoration			**Task Sub-Total**	**$2,123,457**
Clean fill material	Cubic Yard (CY)	15600	$15	$234,000
Place & compact	Cubic Yard (CY)	30100	$10	$301,000
Compaction testing	Each	66	$125	$8,250
Replacement electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Replacement sewer/water utility services	Lump Sum (LS)	1	$1,015,407	$1,015,407
Clean topsoil material (OU-1 & OU-2)	Square Foot (SF)	29400	$3	$88,200
Hydro-seeding (OU-1 & OU-2)	Square Foot (SF)	29400	$2	$58,800
Pavement restoration	Square Foot (SF)	37600	$3	$112,800
Demobilization			**Task Sub-Total**	**$167,500**
Demobilization	Lump Sum (LS)	1	$167,500	$167,500
Air Monitoring			**Task Sub-Total**	**$290,500**
Manager	Man Hour(s)	500	$125	$62,500
Technician	Man Hour(s)	1250	$100	$125,000
Equipment	Week(s)	40	$1,000	$40,000
Laboratory analysis	Each	100	$350	$35,000
Noise monitoring	Week(s)	40	$200	$8,000
Travel expenses/ miscellaneous	Week(s)	40	$500	$20,000
SUB-TOTAL CONTRACTOR				**$12,102,805**
Contingency	30%			**$3,630,841**
Total Contractor				**$15,733,646**

Court Street MGP Site - OU-2
NYSEG **COST WORKSHEET**
Ithaca, New York

Alternative 2 **Area 1 and Area 2: Excavation for subsurface soils for Unrestricted Future Use**

ENGINEER COSTS - CAPITAL/OVERSIGHT				
Pre-Design Investigation & Design			**Task Sub-Total**	**$275,000**
Design/remedial action work plan (RAWP)/ permitting	Man Hour(s)	2000	$100	$200,000
Additional soil sampling/delineation	Lump Sum (LS)	1	$50,000	$50,000
Drilling oversight	Man Hour(s)	250	$100	$25,000
Project Management, Support & Construction Oversight, Reporting			**Task Sub-Total**	**$1,041,267**
Construction support facilities	Month(s)	9	$3,000	$26,667
Health & safety officer	Week(s)	40	$6,250	$250,000
Construction manager	Man Hour(s)	1040	$125	$130,000
Resident engineer	Man Hour(s)	2600	$115	$299,000
Office engineer	Man Hour(s)	2080	$100	$208,000
Administration	Man Hour(s)	1040	$65	$67,600
Travel expenses/ miscellaneous	Week(s)	40	$1,500	$60,000
Post-Excavation Sampling			**Task Sub-Total**	**$278,500**
Scientist	Man Hour(s)	1000	$85	$85,000
Confirmation sample analysis	Each	150	$750	$112,500
Excavated soil waste class sample analysis	Each	90	$900	$81,000
SUB-TOTAL COSTS				**$1,594,767**
Contingency	30%			**$478,430**
Total				**$2,073,197**
TOTAL CAPITAL COSTS (Includes Contingency)				**$17,806,843**
FUTURE COSTS (Net Present Value)				
SUB-TOTAL FUTURE COSTS				**$0**
GRAND TOTAL				**$17,806,843**

- It is assumed that 100% of clean soil is suitable for reuse. A portion of this may be deemed unsuitable during the construction process. This unknown factor is accounted for in the contingenc

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 3A **SubArea 1A&1B: Contaminant containment for subsurface soils with NAPL recovery**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS				
Mobilization & Site Preparation			**Task Sub-Total**	**$1,685,092**
Mobilization	Lump Sum (LS)	1	$25,000	$25,000
Slurry wall contractor mobilization	Lump Sum (LS)	1	$150,000	$150,000
Police detail	Man Hour(s)	500	$70	$35,000
Road opening permit	Lump Sum (LS)	1	$1,000	$1,000
Set-up temporary electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Set-up temporary sewer/water utility services	Lump Sum (LS)	1	$579,092	$579,092
Temporary erosion controls	Linear Foot (LF)	2000	$15	$30,000
Water treatment system mobilization & setup	Lump Sum (LS)	1	$25,000	$25,000
Purchase Existing Residential Properties	Each	2	$210,000	$420,000
Demolition of Residential Properties with Disposal	Each	2	$25,000	$50,000
Demobilization	Lump Sum (LS)	1	$40,000	$40,000
Survey control & documentation	Lump Sum (LS)	1	$25,000	$25,000
Pilot Testing			**Task Sub-Total**	**$36,000**
Bench scale study	Lump Sum (LS)	1	$25,000	$25,000
Drill rig for soil sample collection for bench scale study	Each	1	$11,000	$11,000
Slurry Wall			**Task Sub-Total**	**$600,000**
Slurry wall	Vertical Square Foot (VSF)	30000	$20	$600,000
NAPL Recovery Wells			**Task Sub-Total**	**$35,000**
Installation of Wells	Each	10	$3,500	$35,000
Transportation and Off-Site Disposal			**Task Sub-Total**	**$357,778**
T&D (Hazardous) (20% Hazardous)	Cubic Yard (CY)	556	$225	$125,000
T&D (Non-Hazardous) (70% Non-Hazardous)	Cubic Yard (CY)	1944	$100	$194,444
T&D (Non-Hazardous) Debris (10% Non-Hazardous)	Cubic Yard (CY)	278	$120	$33,333
Soil Cuttings from Well Installation	Lump Sum (LS)	1	$5,000	$5,000
Backfill & Site Restoration			**Task Sub-Total**	**$954,092**
Replacement electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Replacement sewer/water utility services	Lump Sum (LS)	1	$579,092	$579,092
Clean topsoil material	Square Foot (SF)	5000	$3	$15,000
Hydro-seeding	Square Foot (SF)	5000	$2	$10,000
Pavement restoration	Square Foot (SF)	15000	$3	$45,000
Air Monitoring			**Task Sub-Total**	**$76,800**
Manager	Man Hour(s)	160	$120	$19,200
Technician	Man Hour(s)	400	$75	$30,000
Equipment	Week(s)	8	$1,000	$8,000
Laboratory analysis	Each	40	$350	$14,000
Noise monitoring	Week(s)	8	$200	$1,600
Travel expenses/ miscellaneous	Week(s)	8	$500	$4,000
SUB-TOTAL CONTRACTOR				**$3,744,761**
Contingency	30%			**$1,123,428**
Total Contractor				**$4,868,189**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 3A **SubArea 1A&1B: Contaminant containment for subsurface soils with NAPL recovery**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

ENGINEER COSTS - CAPITAL/OVERSIGHT				
Pre-Design Investigation & Design			**Task Sub-Total**	**$82,500**
Design/remedial action work plan (RAWP)/ permitting	Man Hour(s)	500	$110	$55,000
Additional soil sampling/delineation	Lump Sum (LS)	1	$15,000	$15,000
Drilling (NAPL recovery wells and bench study soil)	Man Hour(s)	100	$125	$12,500
Project Management, Support & Construction Oversight, Reporting			**Task Sub-Total**	**$261,150**
Construction support facilities	Month(s)	3	$3,000	$7,500
Health & safety officer	Week(s)	10	$6,250	$62,500
Construction manager	Man Hour(s)	260	$125	$32,500
Resident engineer	Man Hour(s)	650	$115	$74,750
Office engineer	Man Hour(s)	520	$100	$52,000
Administration	Man Hour(s)	260	$65	$16,900
Travel expenses/ miscellaneous	Week(s)	10	$1,500	$15,000
NAPL Recovery			**Task Sub-Total**	**$10,200**
Well installation oversight	Man Hour(s)	120	$85	$10,200
SUB-TOTAL COSTS				**$353,850**
Contingency	30%			**$106,155**
Total				**$460,005**

TOTAL CAPITAL COSTS **$5,328,194** (Includes Contingency)

FUTURE COSTS (Net Present Value)				
Task Description	**Unit**	**Qty**	**Rate**	**Total Cost**
NAPL Recovery Operation and & Maintenance			**Task NPV**	**$343,295**
Technician	Man Hour(s)	12	$75	$900
Technician	Man Hour(s)	12	$85	$1,020
Waste disposal	Event	1	$2,500	$2,500
Travel expenses/miscellaneous	Event	1	$250	$250
Equipment	Event	1	$250	$250
Subtotal for Event	Event	1		$4,920

Future Year	Events Per Year	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)	Net Present Value
1	12	$59,040	1.00	$ 59,040
2	12	$59,040	0.96	$ 56,498
3	12	$59,040	0.92	$ 54,065
4	12	$59,040	0.88	$ 51,737
5	12	$59,040	0.84	$ 49,509
6	4	$19,680	0.80	$ 15,792
7	4	$19,680	0.77	$ 15,112
8	4	$19,680	0.73	$ 14,461
9	4	$19,680	0.70	$ 13,839
10	4	$19,680	0.67	$ 13,243
NPV (Inflation Rate = 2%, Discount Rate = 6.5%)				$343,295
SUB-TOTAL FUTURE COSTS				**$343,295**
Contingency	30%			**$102,988**
Total Future Costs (Net Present Value)				**$446,283**
GRAND TOTAL (NET PRESENT VALUE)				**$5,774,478**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 3B **SubArea 1A & 1B: In-situ solidification (ISS) using auger mixing for subsurface soils**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS				
Mobilization & Site Preparation			**Task Sub-Total**	**$1,821,092**
Mobilization	Lump Sum (LS)	1	$25,000	$25,000
Mobilization (ISS contractor)	Lump Sum (LS)	1	$300,000	$300,000
Police detail	Man Hour(s)	800	$70	$56,000
Road opening permit	Lump Sum (LS)	1	$1,000	$1,000
Set-up temporary electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Set-up temporary sewer/water utility services	Lump Sum (LS)	1	$579,092	$579,092
Temporary erosion controls	Linear Foot (LF)	2000	$15	$30,000
Water treatment system mobilization & setup	Lump Sum (LS)	1	$25,000	$25,000
Purchase Existing Residential Properties	Each	2	$210,000	$420,000
Demolition of Residential Properties with Disposal	Each	2	$25,000	$50,000
Clear & grub	Lump Sum (LS)	1	$5,000	$5,000
Survey control & documentation	Lump Sum (LS)	1	$25,000	$25,000
Pilot Testing			**Task Sub-Total**	**$36,000**
Bench scale study	Lump Sum (LS)	1	$25,000	$25,000
Drill rig for soil sample collection for bench scale study	Each	1	$11,000	$11,000
In-Situ Stabilization (ISS)			**Task Sub-Total**	**$629,258**
Excavate Clean Soil (Min. Depth = 4 ft bgs, Ave. Depth = 7 ft bgs)	Cubic Yard (CY)	3837	$25	$95,925
Soil Re-Use (Assume 100% is Suitable for Reuse)	Cubic Yard (CY)	3837		
Soil mixing (auger) (7 to 19 ft bgs)	Cubic Yard (CY)	6667	$80	$533,333
Spoils of Mixing Zone (30%)	Cubic Yard (CY)	2000		
Transportation and Off-Site Disposal			**Task Sub-Total**	**$275,000**
T&D (Hazardous) (20%)	Cubic Yard (CY)	440	$225	$99,000
T&D (Non-Hazardous)	Cubic Yard (CY)	1760	$100	$176,000
Backfill & Site Restoration			**Task Sub-Total**	**$1,005,462**
Replacement electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Replacement sewer/water utility services	Lump Sum (LS)	1	$579,092	$579,092
Prepare Utility Trench - Sub-Area 1A (Disposal Included Above)	Cubic Yard (CY)	100	$35	$3,500
Prepare Utility Trench - Sub-Area 1B (Disposal Included Above)	Cubic Yard (CY)	100	$35	$3,500
Clean fill material	Cubic Yard (CY)	240	$15	$3,600
Place & compact	Cubic Yard (CY)	4077	$10	$40,770
Clean topsoil material	Square Foot (SF)	5000	$3	$15,000
Hydro-seeding	Square Foot (SF)	5000	$2	$10,000
Pavement restoration	Square Foot (SF)	15000	$3	$45,000
Air Monitoring			**Task Sub-Total**	**$180,200**
Manager	Man Hour(s)	340	$125	$42,500
Technician	Man Hour(s)	850	$100	$85,000
Equipment	Week(s)	17	$1,000	$17,000
Laboratory analysis	Each	68	$350	$23,800
Noise monitoring	Week(s)	17	$200	$3,400
Travel expenses/ miscellaneous	Week(s)	17	$500	$8,500
SUB-TOTAL CONTRACTOR				**$3,947,012**
Contingency	30%			**$1,184,104**
Total Contractor				**$5,131,115**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 3B **SubArea 1A & 1B: In-situ solidification (ISS) using auger mixing for subsurface soils**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

ENGINEER COSTS - CAPITAL/OVERSIGHT				
Pre-Design Investigation & Design			**Task Sub-Total**	**$82,500**
Design/remedial action work plan (RAWP)/ permitting/Benchscale Testing	Man Hour(s)	500	$110	$55,000
Additional soil sampling/delineation	Lump Sum (LS)	1	$15,000	$15,000
Pilot test management & oversight	Man Hour(s)	100	$125	$12,500
Project Management, Support & Construction Oversight, Reporting			**Task Sub-Total**	**$522,300**
Construction support facilities	Month(s)	5	$3,000	$15,000
Health & safety officer	Week(s)	20	$6,250	$125,000
Construction manager	Man Hour(s)	520	$125	$65,000
Resident engineer	Man Hour(s)	1300	$115	$149,500
Office engineer	Man Hour(s)	1040	$100	$104,000
Administration	Man Hour(s)	520	$65	$33,800
Travel expenses/ miscellaneous	Week(s)	20	$1,500	$30,000
SUB-TOTAL COSTS				**$604,800**
Contingency	30%			**$181,440**
Total				**$786,240**
TOTAL CAPITAL COSTS (Includes Contingency)				**$5,917,355**
FUTURE COSTS (Net Present Value)				
SUB-TOTAL FUTURE COSTS				**$0**
GRAND TOTAL (NET PRESENT VALUE)				**$5,917,355**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 3C **SubArea 1A & 1B: Excavation for subsurface soils**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS				
Mobilization & Site Preparation			**Task Sub-Total**	**$1,735,092**
Construct material staging and water treatment containment areas	Lump Sum (LS)	1	$50,000	$50,000
Mobilize equipment to site	Lump Sum (LS)	1	$25,000	$25,000
Sheet pile contractor mobilization	Lump Sum (LS)	1	$150,000	$150,000
Police detail	Man Hour(s)	1000	$70	$70,000
Road opening permit	Lump Sum (LS)	1	$1,000	$1,000
Set-up temporary electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Set-up temporary sewer/water utility services	Lump Sum (LS)	1	$579,092	$579,092
Temporary erosion controls	Linear Foot (LF)	2000	$15	$30,000
Water treatment system mobilization & setup	Lump Sum (LS)	1	$25,000	$25,000
Purchase Existing Residential Properties	Each	2	$210,000	$420,000
Demolition of Residential Properties with Disposal	Each	2	$25,000	$50,000
Clear & grub	Lump Sum (LS)	1	$5,000	$5,000
Survey control & documentation	Lump Sum (LS)	1	$25,000	$25,000
Excavation Shoring			**Task Sub-Total**	**$1,391,140**
Sheet pile material (130% of excavation depth x excavation perimeter)	Square Foot (SF)	22667	$33	$748,000
Sheet pile material (130% of excavation depth x center line length) Area 1 - 1A	Square Foot (SF)	3853	$33	$127,160
Sheet pile material (130% of excavation depth x center line length) Area 1 - 1B	Square Foot (SF)	3060	$33	$100,980
Sheet pile installation (hydraulic press)/removal, bracing install/removal	Square Foot (SF)	22667	$15	$340,000
Pre-excavation & clearing of obstructions	Lump Sum (LS)	1	$50,000	$50,000
Sheet pile design	Lump Sum (LS)	1	$25,000	$25,000
Excavation & Material Handling			**Task Sub-Total**	**$282,500**
Excavation & Material Handling	Cubic Yard (CY)	9500	$25	$237,500
Soil Re-Use (Assume 100% of Soil w/ Ave. Depth of 7 ft bgs is Suitable for Reuse)	Cubic Yard (CY)	3837		
Soil for Disposal	Cubic Yard (CY)	5663		
Dust, vapor & odor control	Week(s)	10	$2,000	$20,000
Bottom and Sidewall Soil Sampling	Lump Sum (LS)	1	$25,000	$25,000
Excavation Dewatering			**Task Sub-Total**	**$50,000**
Weekly maintenance	Week(s)	10	$5,000	$50,000
Transportation and Off-Site Disposal			**Task Sub-Total**	**$642,751**
T&D (Hazardous) (10%)	Cubic Yard (CY)	566	$225	$127,418
T&D (Non-Hazardous) (85%)	Cubic Yard (CY)	4814	$100	$481,355
T&D (Non-Hazardous) Debris (5%)	Cubic Yard (CY)	283	$120	$33,978
Backfill & Site Restoration			**Task Sub-Total**	**$1,165,185**
Clean fill material	Cubic Yard (CY)	6796	$15	$101,934
Place & compact	Cubic Yard (CY)	10633	$10	$106,326
Compaction testing	Each	23	$125	$2,833
Replacement electrical/gas utility services	Lump Sum (LS)	1	$305,000	$305,000
Replacement sewer/water utility services	Lump Sum (LS)	1	$579,092	$579,092
Clean topsoil material	Square Foot (SF)	5000	$3	$15,000
Hydro-seeding	Square Foot (SF)	5000	$2	$10,000
Pavement restoration	Square Foot (SF)	15000	$3	$45,000
Demobilization			**Task Sub-Total**	**$142,500**
Demobilization	Lump Sum (LS)	1	$142,500	$142,500
Air Monitoring			**Task Sub-Total**	**$246,000**
Manager	Man Hour(s)	480	$125	$60,000
Technician	Man Hour(s)	1200	$100	$120,000
Equipment	Week(s)	24	$1,000	$24,000
Laboratory analysis	Each	72	$350	$25,200
Noise monitoring	Week(s)	24	$200	$4,800
Travel expenses/ miscellaneous	Week(s)	24	$500	$12,000
SUB-TOTAL CONTRACTOR				**$5,655,167**
Contingency	30%			**$1,696,550**
Total Contractor				**$7,351,717**

Court Street MGP Site - OU-2
NYSEG **COST WORKSHEET**
Ithaca, New York

Alternative 3C **SubArea 1A & 1B: Excavation for subsurface soils**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

ENGINEER COSTS - CAPITAL/OVERSIGHT				
Pre-Design Investigation & Design			**Task Sub-Total**	**$70,000**
Design/remedial action work plan (RAWP)/ permitting	Man Hour(s)	500	$110	$55,000
Additional soil sampling/delineation	Lump Sum (LS)	1	$15,000	$15,000
Project Management, Support & Construction Oversight, Reporting			**Task Sub-Total**	**$675,855**
Construction support facilities	Month(s)	6	$3,000	$18,000
Health & safety officer	Week(s)	27	$6,250	$168,750
Construction manager	Man Hour(s)	702	$125	$87,750
Resident engineer	Man Hour(s)	1755	$115	$201,825
Office Engineer	Man Hour(s)	1404	$100	$140,400
Administration	Man Hour(s)	702	$65	$45,630
Travel expenses/ miscellaneous	Week(s)	27	$500	$13,500
Post-Excavation Sampling			**Task Sub-Total**	**$133,700**
Technician	Man Hour(s)	500	$85	$42,500
Confirmation sample analysis	Each	60	$845	$50,700
Excavated soil waste class sample analysis	Each	45	$900	$40,500
SUB-TOTAL COSTS				**$879,555**
Contingency	30%			**$263,867**
Total				**$1,143,422**
TOTAL CAPITAL COSTS (Includes Contingency)				**$8,547,139**
FUTURE COSTS (Net Present Value)				
SUB-TOTAL FUTURE COSTS				**$0**
GRAND TOTAL				**$8,547,139**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 4A **SubArea 1C: MNA**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the re

DESCRIPTION		UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS					
Monitoring Well Installation				**Task Sub-Total**	**$13,000**
Installation of additional wells (Area 1C)		Each	4	$3,250	$13,000
Transportation and Off-Site Disposal				**Task Sub-Total**	**$2,000**
Soil Cuttings from Well Installation		Lump Sum (LS)	1	$2,000	$2,000
SUB-TOTAL CONTRACTOR					**$15,000**
Contingency		30%			**$4,500**
Total Contractor					**$19,500**
ENGINEER COSTS - MONITORED NATURAL ATTENUATION (MNA)					
Monitored Natural Attenuation				**Task Sub-Total**	**$21,150**
Design/remedial action work plan (RAWP)/ permitting		Man Hour(s)	100	$110	$11,000
Drilling oversight		Man Hour(s)	50	$90	$4,500
Project Manager		Man Hour(s)	20	$125	$2,500
Geologist		Man Hour(s)	20	$100	$2,000
Administration		Man Hour(s)	10	$65	$650
Travel Expenses/ Miscellaneous		Week(s)	1	$500	$500
SUB-TOTAL CONTRACTOR					**$21,150**
Contingency		30%			**$6,345**
Total Contractor					**$27,495**
TOTAL CAPITAL COSTS		(Includes Contingency)			**$46,995**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 4A **SubArea 1C: MNA**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the re

DETAILED FUTURE COSTS (Net Present Value [NPV])					
Task Description		**Unit**	**Qty**	**Rate**	**Total Cost**
Monitored Natural Attenuation (MNA) (Per Event)				**Task NPV**	
Scientist		Man Hour(s)	20	$85	$1,700
Geologist		Man Hour(s)	20	$85	$1,700
Equipment rental		Event	2	$500	$1,000
Laboratory analysis		Lump Sum (LS)	1	$4,000	$4,000
Data Evaluation/Reporting		Man Hour(s)	40	$100	$4,000
Management/coordination		Man Hour(s)	10	$125	$1,250
Travel expenses/miscellaneous		Week(s)	1	$500	$500
Subtotal ODCs					$5,500
Subtotal Labor					$8,650
Subtotal for one MNA Event (Area 1 C)		Event			$14,150

Future Year	Events Per Year	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)		Net Present Value
1	4	$56,600	1.00		$56,600
2	4	$56,600	0.96		$54,163
3	1	$14,150	0.92		$12,958
4	1	$14,150	0.88		$12,400
5	1	$14,150	0.84		$11,866
6	1	$14,150	0.80		$11,355
7	1	$14,150	0.77		$10,866
8	1	$14,150	0.73		$10,398
9	1	$14,150	0.70		$9,950
10	1	$14,150	0.67		$9,522
11	1	$14,150	0.64		$9,112
12	1	$14,150	0.62		$8,719
13	1	$14,150	0.59		$8,344
14	1	$14,150	0.56		$7,984
15	1	$14,150	0.54		$7,641
16	1	$14,150	0.52		$7,312
17	1	$14,150	0.49		$6,997
18	1	$14,150	0.47		$6,695
19	1	$14,150	0.45		$6,407
20	1	$14,150	0.43		$6,131

FUTURE COSTS (Net Present Value)					
Monitored Natural Attenuation (NPV)					**Total Cost**
SUB-TOTAL FUTURE COSTS					**$358,042**
2 Years Quarterly MNA activities		Lump Sum (LS)	1	$110,763	$110,763
Contingency (2 Years Quarterly Monitoring)		30%			$33,229
Year 3-20 Annual MNA activities			1	$164,654	$164,654
Contingency (3-20 Years Monitoring)		30%			$49,396

TOTAL CAPITAL COSTS (Includes Contingency)				**$46,995**	
FUTURE COSTS (Net Present Value)					
SUB-TOTAL FUTURE COSTS				**$358,042**	
GRAND TOTAL				**$405,037**	

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 4B **Sub Area 1C: Enhanced Aerobic Biodegradation**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS				
Mobilization & Site Preparation			**Task Sub-Total**	**$16,000**
Road opening permit	Lump Sum (LS)	1	$1,000	$1,000
Survey control & documentation	Lump Sum (LS)	1	$15,000	$15,000
Monitoring Well Installation			**Task Sub-Total**	**$13,000**
Installation of 4 additional performance monitoring wells (Area 1C)	Each	4	$3,250	$13,000
Pilot Testing			**Task Sub-Total**	**$50,000**
Field pilot test (installation, operation, sampling)	Lump Sum (LS)	1	$50,000	$50,000
NAPL Recovery Wells			**Task Sub-Total**	**$21,000**
Installation of Wells	Each	6	$3,500	$21,000
Transportation and Off-Site Disposal			**Task Sub-Total**	**$15,000**
Soil Cuttings from Well Installation	Lump Sum (LS)	1	$15,000	$15,000
Bioremediation Wells			**Task Sub-Total**	**$195,000**
iSOC oxygen diffusion devices	Each	20	$4,500	$90,000
Oxygen vault	Each	20	$2,000	$40,000
Installation of wells	Each	20	$3,250	$65,000
SUB-TOTAL CONTRACTOR				**$310,000**
Contingency	30%			**$93,000**
Total Contractor				**$403,000**
ENGINEER COSTS - CAPITAL/OVERSIGHT				
Pre-Design Investigation & Design			**Task Sub-Total**	**$64,000**
Design/remedial action work plan (RAWP)/ permitting	Man Hour(s)	250	$110	$27,500
Drilling oversight (new monitoring wells and pilot study)	Man Hour(s)	200	$100	$20,000
Pilot test management, sampling, & oversight	Man Hour(s)	150	$110	$16,500
Project Management, Support & Oversight			**Task Sub-Total**	**$128,220**
Health & safety officer	Week(s)	6	$6,250	$37,500
Construction manager	Man Hour(s)	156	$125	$19,500
Project field engineer	Man Hour(s)	390	$115	$44,850
Office engineer	Man Hour(s)	156	$100	$15,600
Administration	Man Hour(s)	78	$65	$5,070
Travel expenses/ miscellaneous	Week(s)	6	$500	$3,000
Air monitoring equipment	Week(s)	6	$450	$2,700
Performance Monitoring (1st Year)			**Task Sub-Total**	**$116,500**
Performance monitoring oversight/evaluation	Man Hour(s)	150	$110	$16,500
Performance monitoring sampling	Event	4	$25,000	$100,000
SUB-TOTAL ENGINEERING COSTS				**$308,720**
Contingency	30%			**$92,616**
Total				**$401,336**
TOTAL CAPITAL COSTS (Includes Contingency)				**$804,336**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 4B **Sub Area 1C: Enhanced Aerobic Biodegradation**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DETAILED FUTURE COSTS (Net Present Value)

Task Description	Unit	Qty	Rate	Total Cost
NAPL Recovery Operation and & Maintenance			**Task NPV**	
Technician	Man Hour(s)	12	$75	$900
Technician	Man Hour(s)	12	$85	$1,020
Waste disposal from and maintenance	Per Event	1	$2,500	$2,500
Travel expenses/miscellaneous	Week(s)	1	$500	$500
Subtotal for Event	Event	1		$4,920
Future Year	Events Per Year	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)	Net Present Value
1	4	$19,680	1.00	$ 19,680
2	4	$19,680	0.96	$ 18,833
3	4	$19,680	0.92	$ 18,022
4	2	$9,840	0.88	$ 8,623
5	2	$9,840	0.84	$ 8,251
6	2	$9,840	0.80	$ 7,896
7	1	$4,920	0.77	$ 3,778
8	1	$4,920	0.73	$ 3,615
9	1	$4,920	0.70	$ 3,460
10	1	$4,920	0.67	$ 3,311
NPV (Inflation Rate = 2%, Discount Rate = 6.5%)				$126,376
Bioremediation Operation & Maintenance			**Task NPV**	
Oxygen supply	Each	20	$150	$3,000
Maintenance	Year	1	$5,000	$5,000
Technician	Man Hour(s)	80	$75	$6,000
Technician	Man Hour(s)	80	$85	$6,800
Management/coordination	Man Hour(s)	50	$135	$6,750
Travel expenses/miscellaneous	Week(s)	4	$500	$2,000
Subtotal for 4 Events per Year	Year(s)	1		$29,550
Future Year	Wells Operating	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)	Net Present Value
1	20	$29,550	1.00	$ 29,550
2	20	$29,550	0.96	$ 28,278
3	20	$29,550	0.92	$ 27,060
4	20	$29,550	0.88	$ 25,895
5	20	$29,550	0.84	$ 24,779
6	20	$29,550	0.80	$ 23,712
7	20	$29,550	0.77	$ 22,691
8	20	$29,550	0.73	$ 21,714
9	20	$29,550	0.70	$ 20,779
10	20	$29,550	0.67	$ 19,884
NPV (Inflation Rate = 2%, Discount Rate = 6.5%)				$253,624
SUB-TOTAL FUTURE COSTS				**$379,999**
Contingency	30%			**$114,000**
Total Future Costs (Net Present Value)				**$493,999**
GRAND TOTAL (NET PRESENT VALUE)				**$1,298,335**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 4C **Sub Area 1C: In-situ oxidation**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS				
Mobilization & Site Preparation			**Task Sub-Total**	**$16,000**
Road opening permit	Lump Sum (LS)	1	$1,000	$1,000
Survey control & documentation	Lump Sum (LS)	1	$15,000	$15,000
Monitoring Well Installation			**Task Sub-Total**	**$13,000**
Installation of 4 additional performance monitoring wells (Area 1C)	Each	4	$3,250	$13,000
Bench and Pilot Testing			**Task Sub-Total**	**$109,500**
Bench scale study	Lump Sum (LS)	1	$25,000	$25,000
Drill rig for soil sample collection for bench scale study	Each	1	$9,500	$9,500
Field pilot test	Lump Sum (LS)	1	$75,000	$75,000
In-Situ Oxidation			**Task Sub-Total**	**$298,000**
Injection point installation (all injection points)	Event	2	$24,000	$48,000
ISCO treatment program (all injection points)	Event	2	$120,000	$240,000
Consulting/reporting/technical review	Lump Sum (LS)	1	$10,000	$10,000
NAPL Recovery Wells			**Task Sub-Total**	**$19,500**
Installation of Wells	Each	6	$3,250	$19,500
Transportation and Off-Site Disposal			**Task Sub-Total**	**$5,000**
Soil Cuttings from Well Installation	Lump Sum (LS)	1	$5,000	$5,000
SUB-TOTAL CONTRACTOR				**$461,000**
Contingency	30%			**$138,300**
Total Contractor				**$599,300**
ENGINEER COSTS - CAPITAL/OVERSIGHT				
Pre-Design Investigation & Design			**Task Sub-Total**	**$57,250**
Design/remedial action work plan (RAWP)/ permitting	Man Hour(s)	300	$100	$30,000
Drilling oversight (new monitoring wells and bench study soil)	Man Hour(s)	100	$100	$10,000
Pilot test management & oversight	Man Hour(s)	150	$115	$17,250
Project Management, Support & Oversight			**Task Sub-Total**	**$116,520**
Health & safety officer	Week(s)	6	$6,250	$37,500
Construction manager	Man Hour(s)	94	$125	$11,700
Project field engineer	Man Hour(s)	390	$105	$40,950
Office engineer	Man Hour(s)	156	$100	$15,600
Administration	Man Hour(s)	78	$65	$5,070
Travel expenses/ miscellaneous	Week(s)	6	$500	$3,000
Air monitoring equipment	Week(s)	6	$450	$2,700
Performance Monitoring (1st Year)				**$66,500**
Performance monitoring oversight/evaluation	Man Hour(s)	150	$110	$16,500
Performance monitoring sampling	Event	2	$25,000	$50,000
SUB-TOTAL ENGINEERING COSTS				**$240,270**
Contingency	30%			**$72,081**
Total				**$312,351**
TOTAL CAPITAL COSTS (Includes Contingency)				**$911,651**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Alternative 4C **Sub Area 1C: In-situ oxidation**

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

DETAILED FUTURE COSTS (Net Present Value)				
Task Description	**Unit**	**Qty**	**Rate**	**Total Cost**
In-Situ Chemical Oxidation Future Injections			**Task NPV**	**$508,520**
Injection point installation	Event	2	$24,000	$48,000
Treatment program	Event	2	$120,000	$240,000
Field implementation oversight	Lump Sum (LS)	1	$116,520	$116,520
Performance monitoring oversight/evaluation	Man Hour(s)	150	$110	$16,500
Performance monitoring sampling	Event	3	$25,000	$75,000
Remedial Design Update/Management/coordination	Man Hour(s)	100	$125	$12,500
Future Year	Fraction of Initial Injection Program	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)	Net Present Value
1	0.75	$381,390	1.00	$ 381,390
2	0.50	$254,260	0.96	$ 243,311
3	0.25	$127,130	0.92	$ 116,417
NPV (Inflation Rate = 2%, Discount Rate = 6.5%)				**$741,118**
NAPL Recovery Operation and & Maintenance			**Task NPV**	**$0**
Technician	Man Hour(s)	12	$75	$900
Technician	Man Hour(s)	12	$85	$1,020
Waste disposal from and maintenance	Per Event	1	$2,500	$2,500
Travel expenses/miscellaneous	Week(s)	1	$500	$500
Subtotal for Event	Event	1		$4,920
Future Year	Events Per Year	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)	Net Present Value
1	4	$19,680	1.00	$ 19,680
2	2	$9,840	0.96	$ 9,416
3	0	$0	0.92	$ -
NPV (Inflation Rate = 2%, Discount Rate = 6.5%)				**$29,096**
SUB-TOTAL FUTURE COSTS				**$770,214**
Contingency	30%			**$231,064**
Total Future Costs (Net Present Value)				**$1,001,278**
GRAND TOTAL (NET PRESENT VALUE)				**$1,912,929**

Court Street MGP Site - OU-2
NYSEG **COST WORKSHEET**
Ithaca, New York

Cost Worksheet **MNA in the Remainder of Area 1 and in Area 2**
For Use with Alternatives 3 (A,B,C) and 4 (A,B,C)

Cost estimates include a 30% contingency and should be used for planning purposes only. Engineering cost estimates should be redeveloped during the rer

DESCRIPTION		UNIT	QUANTITY	RATE	TOTAL COST
CONTRACTOR COSTS					
Monitoring Well Installation				**Task Sub-Total**	**$65,000**
Installation of additional wells (Area 1 and OU-1)		Each	10	$3,250	$32,500
Installation of additional wells (Area 2)		Each	10	$3,250	$32,500
Transportation and Off-Site Disposal				**Task Sub-Total**	**$5,000**
Soil Cuttings from Well Installation		Lump Sum (LS)	1	$5,000	$5,000
SUB-TOTAL CONTRACTOR					**$70,000**
Contingency		30%			**$21,000**
Total Contractor					**$91,000**
ENGINEER COSTS - CAPITAL					
Pre-Design Investigation & Design				**Task Sub-Total**	**$15,000**
Design/remedial action work plan (RAWP)/ permitting		Man Hour(s)	150	$100	$15,000
Additional soil sampling/delineation		Lump Sum (LS)	0	$30,000	$0
SUB-TOTAL COSTS					**$15,000**
Contingency		30%			**$4,500**
Total					**$19,500**
ENGINEER COSTS - SITE MANAGEMENT PLAN					
Site Management Plan				**Task Sub-Total**	**$37,500**
Engineer provides assistance to NYSEG to develop management plans		Lump Sum (LS)	1	$35,000	$35,000
Other Direct Costs (ODCs)		Lump Sum (LS)	1	$2,500	$2,500
SUB-TOTAL CONTRACTOR					**$37,500**
Contingency		30%			**$11,250**
Total Subcontractor					**$48,750**
ENGINEER COSTS - MONITORED NATURAL ATTENUATION (MNA)					
Monitored Natural Attenuation				**Task Sub-Total**	**$96,700**
MNA initial work plan		Man Hour(s)	150	$110	$16,500
Drilling oversight		Man Hour(s)	200	$95	$19,000
Synoptic round of groundwater sampling with report		Lump Sum (LS)	1	$50,000	$50,000
Project Manager		Man Hour(s)	20	$125	$2,500
Engineer/Geologist		Man Hour(s)	40	$110	$4,400
Administration		Man Hour(s)	20	$65	$1,300
Travel Expenses/ Miscellaneous		Week(s)	2	$1,500	$3,000
SUB-TOTAL ENGINEER					**$96,700**
Contingency		30%			**$29,010**
Total Engineer					**$125,710**
TOTAL CAPITAL COSTS		(Includes Contingency)			**$284,960**

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Cost Worksheet **MNA in the Remainder of Area 1 and in Area 2**
For Use with Alternatives 3 (A,B,C) and 4 (A,B,C)

DETAILED FUTURE COSTS (Net Present Value [NPV])

Task Description		Unit	Qty	Rate	Total Cost
Monitored Natural Attenuation (MNA)					
Scientist		Man Hour(s)	100	$85	$8,500
Geologist		Man Hour(s)	100	$85	$8,500
Equipment rental		Event	2	$1,000	$2,000
Laboratory analysis		Lump Sum (LS)	2	$16,575	$33,150
Data Evaluation/Reporting		Man Hour(s)	100	$110	$11,000
Annual Period Review Report		Lump Sum (LS)	1	$15,000	$15,000
Management/coordination		Man Hour(s)	20	$125	$2,500
Travel expenses/miscellaneous		Week(s)	2	$500	$1,000
Subtotal ODCs					$36,150
Subtotal Labor					$45,500
Subtotal for one MNA Event (Area 1 + Area 2)		Event			$81,650

Future Year	Events Per Year	Base Cost	NPV Discount Factor (assume Real Discount Rate of 4.5%)		Net Present Value
1	4	$326,600	1.00		$326,600
2	4	$326,600	0.96		$312,536
3	1	$81,650	0.92		$74,769
4	1	$81,650	0.88		$71,550
5	1	$81,650	0.84		$68,469
6	1	$81,650	0.80		$65,520
7	1	$81,650	0.77		$62,699
8	1	$81,650	0.73		$59,999
9	1	$81,650	0.70		$57,415
10	1	$81,650	0.67		$54,943
11	1	$81,650	0.64		$52,577
12	1	$81,650	0.62		$50,313
13	1	$81,650	0.59		$48,146
14	1	$81,650	0.56		$46,073
15	1	$81,650	0.54		$44,089
16	1	$81,650	0.52		$42,190
17	1	$81,650	0.49		$40,373
18	1	$81,650	0.47		$38,635
19	1	$81,650	0.45		$36,971
20	1	$81,650	0.43		$35,379
21	1	$81,650	0.41		$33,856
22	1	$81,650	0.40		$32,398
23	1	$81,650	0.38		$31,003
24	1	$81,650	0.36		$29,668
25	1	$81,650	0.35		$28,390
26	1	$81,650	0.33		$27,167
27	1	$81,650	0.32		$25,998
28	1	$81,650	0.30		$24,878
29	1	$81,650	0.29		$23,807
30	1	$81,650	0.28		$22,782

Court Street MGP Site - OU-2

NYSEG **COST WORKSHEET**

Ithaca, New York

Cost Worksheet **MNA in the Remainder of Area 1 and in Area 2**
For Use with Alternatives 3 (A,B,C) and 4 (A,B,C)

FUTURE COSTS (Net Present Value)					
Monitored Natural Attenuation (NPV)					
SUB-TOTAL FUTURE COSTS					
2 Years Quarterly MNA activities		Lump Sum (LS)	1	$639,136	$639,136
Contingency (2 Years Quarterly Monitoring)		30%			$191,741
Year 3-15 Annual MNA activities			1	$756,560	$756,560
Contingency (3-15 Years Monitoring)		30%			$226,968
Year 16-20 Annual MNA activities			1	$193,549	$193,549
Contingency (16-20 Years Monitoring)		30%			$58,065
				Subtotal	**$2,066,018**
TOTAL CAPITAL COSTS (Includes Contingency)				**$284,960**	
FUTURE COSTS (Net Present Value)					
SUB-TOTAL FUTURE COSTS				**$2,066,018**	
GRAND TOTAL				**$2,350,978**	

NYSEG-Ithaca Court Street Former MGP Site OU-2
Water and Sewer Utility Relocation Option Cost Estimate

Cost estimates should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

Alternatives 3A, 3B, 3C

Contract Item	Estimated Quantity	Units	Unit Price	Cost
Mobilization	1	LS	$ 50,000.00	$50,000
Utility Removal & Disposal				
Sanitary Trunk Line	800	LF	$ 20.00	$16,000
Water Main	400	LF	$ 20.00	$8,000
Fire Hydrant	2	each	$ 625.00	$1,250
Utility Installation				
Excavation	1500	CY	$ 20.00	$30,000
Backfill w/ Clean Material	1500	CY	$ 20.00	$30,000
Loading Transportation & Disposal	2531	ton	$ 100.00	$253,125
24" NPS Ductile Iron Pipe(Sewer)	800	LF	$ 140.00	$112,000
5ft. diam. Manhole structure (assume 2)	6	LF	$ 2,000.00	$12,000
6NPS Ductile Cast Iron Cement Lined Pipe (Water)	400	LF	$ 105.00	$42,000
Fire Hydrant	2	each	$ 2,800.00	$5,600
Bypass Pumping of Sewage	1	LS	$ 60,000.00	$60,000
Modification/Reconstruction of 5'dia. Manholes	2	each	$ 2,000.00	$4,000
Excavation Support and Dewatering				
Mobilization	1	LS	$ 20,000.00	$20,000
Excavation Shoring System (i.e. trench box)	1	LS	$ 5,000.00	$5,000
Installation of Wellpoint System	1	LS	$ 25,000.00	$25,000
Wastewater disposal	500000	gal.	$ 0.25	$125,000
Road Repair (included in restoration line items for alternatives)				
Miscellaneous Cold Milling of Bituminous Concrete	0	sq. ft.	$ 1.40	$0
HMA Topcoat	0	ton	$ 100.00	$0
Finishing (Curb Repair, Line Painting, etc.)	0	LS	$ 20,000.00	$0
Road Repair Subtotal				$0
Relocation Total				$798,975
Quantities made possible by relocating utilities				
Excavation	1500	CY	$ 20.00	$30,000
Backfill w/ Clean Material	1500	CY	$ 20.00	$30,000
Loading Transportation & Disposal	2430	ton	$ 100.00	$243,000
Dewatering & disposal	100994	gal.	$ 0.25	$25,248
Remediation Area Subtotal				$328,248
Highway and Traffic				
Basic Work Zone Traffic Control	1	LS	$ 15,000.00	$15,000
Temporary Concrete Barrier (Pinned)	840	LF	$ 19.00	$15,960
Highway and Traffic Subtotal				$30,960
Total				$1,158,183

Cost Each for Relocation/Replacement (Each = 50% of Total) $579,092

NYSEG-Ithaca Court Street Former MGP Site OU-2
Water and Sewer Utility Relocation Option Cost Estimate

Cost estimates should be used for planning purposes only. Engineering cost estimates should be redeveloped during the remedial design phase.

Alternative 2				
Contract Item	**Estimated Quantity**	**Units**	**Unit Price**	**Cost**
Mobilization	1	LS	$ 50,000.00	$50,000
Utility Removal & Disposal				
Sanitary Trunk Line	1510	LF	$ 20.00	$30,200
Water Main	630	LF	$ 20.00	$12,600
Fire Hydrant	2	each	$ 625.00	$1,250
Utility Installation				
Excavation	2815	CY	$ 20.00	$56,296
Backfill w/ Clean Material	2815	CY	$ 20.00	$56,296
Loading Transportation & Disposal	4750	ton	$ 100.00	$475,000
24" NPS Ductile Iron Pipe(Sewer)	1510	LF	$ 140.00	$211,400
5ft. diam. Manhole structure (assume 5)	15	LF	$ 2,000.00	$30,000
6NPS Ductile Cast Iron Cement Lined Pipe (Water)	630	LF	$ 105.00	$66,150
Fire Hydrant	4	each	$ 2,800.00	$11,200
Bypass Pumping of Sewage	1	LS	$ 60,000.00	$60,000
Modification/Reconstruction of 5'dia. Manholes	5	each	$ 2,000.00	$10,000
Excavation Support and Dewatering				
Mobilization	1	LS	$ 20,000.00	$20,000
Excavation Shoring System (i.e. trench box)	1	LS	$ 5,000.00	$5,000
Installation of Wellpoint System	1	LS	$ 25,000.00	$25,000
Wastewater disposal	1000000	gal.	$ 0.25	$250,000
Road Repair (included in restoration line items for alternatives)				
Miscellaneous Cold Milling of Bituminous Concrete	0	sq. ft.	$ 1.40	$0
HMA Topcoat	0	ton	$ 100.00	$0
Finishing (Curb Repair, Line Painting, etc.)	0	LS	$ 20,000.00	$0
Road Repair Subtotal				$0
Relocation Total				$1,370,393
Quantities made possible by relocating utilities				
Excavation	2815	CY	$ 20.00	$56,296
Backfill w/ Clean Material	2815	CY	$ 20.00	$56,296
Loading Transportation & Disposal	4560	ton	$ 100.00	$456,000
Dewatering & disposal	189519	gal.	$ 0.25	$47,380
Remediation Area Subtotal				$615,972
Highway and Traffic				
Basic Work Zone Traffic Control	1	LS	$ 15,000.00	$15,000
Temporary Concrete Barrier (Pinned)	1550	LF	$ 19.00	$29,450
Highway and Traffic Subtotal				$44,450
Total				$2,030,815

Cost Each for Relocation/Replacement (Each = 50% of Total) $1,015,407