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Revised
Remedial Investigation Report for the Ilion (East Street) Site

TETRA TECH EC, INC.

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1.0 INTRODUCTION

This Remedial Investigation (RI) Report for the Ilion (East Street) Former MGP Site (the Site) has been prepared by Tetra Tech EC, Inc. (TtEC), on behalf of National Grid (NG). Preparation of this report is in accordance with the requirements set forth in the New York State Department of Environmental Conservation (NYSDEC) Order on Consent, Index Number A4-0473-0000, and NYSDEC-approved plans. Applicable requirements as set forth in Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) [42 USC 9601 et seq], as amended; the National Contingency Plan (NCP) of March 8, 1990 [40 CFR Part 300]; and the United States Environmental Protection Agency (EPA) guidance documents were also considered during preparation of this report.

1.1 PURPOSE OF REPORT

This report summarizes the activities and results of the RI conducted at the Ilion (East Street) Former Manufactured Gas Plant (MGP) Site. The purpose and scope of the RI was to gather data to characterize the Site, near Site area, and off-site study area setting, and assess the nature and extent of potential impacts to media originating from the MGP facility. Additionally, the off-site study area open swale investigation was implemented to evaluate whether or not impacts observed in the open swale are related to the former MGP. The RI Report was performed to supplement information generated during the Preliminary Site Assessment/Interim Remedial Measure (PSA/IRM) Study completed by Parsons Engineering Science, Inc. on behalf of NG. The PSA/IRM results are incorporated into this report, as applicable.

1.2 PROJECT OBJECTIVES

The objectives of the RI include the following:

- Evaluate the horizontal and vertical extent of MGP-related impacts for the soils and groundwater on Site;
- Evaluate the horizontal and vertical extent of MGP-related impacts for the soil and groundwater at the Off-Site Study Area, located to the northeast of the Site;
- Investigate whether MGP-related volatile organics in soil and groundwater are volatilizing and migrating off-site as soil vapor;
- Characterize “background” soil located in areas not likely impacted by MGP-related activities;
- Evaluate if impacts identified in the open swale are related to the former MGP or other local sources;
- Assess the potential fate and transport of detected contaminants; and

- Develop the technical database for the completion of a feasibility study (FS) to address mitigation of possible impacts.

1.3 SITE BACKGROUND

Relevant information concerning the historical and present status of the Site, including former MGP operations, is provided in this section. This information includes a description of the Site and vicinity, a summary of its history, and descriptions of previous investigations conducted at or relating to the Site.

1.3.1 Site Description

The study of the Ilion (East Street) Former MGP has been divided into three areas. Throughout this RI Report, these areas are referred to as the Site and near Site area (comprised of the Site proper and areas immediately adjacent to the Site), the off-site study area (defined on Figure 1-2), and the background areas.

The Ilion (East Street) Former MGP Site is a 1.3-acre parcel located in a mixed commercial/residential part of the Village of Ilion, Herkimer County, New York (Figure 1-1). The Site is generally bounded by East Clark Street and residential properties to the north, East Street to the east, State Street (formerly Canal Street) to the south, and a commercial property and several residences to the west (Figure 1-2). State Street overlies the location of the former Erie Canal.

The Site is generally “L” shaped and surrounded by an eight-foot chain link fence topped with barbed wire. Two locked access gates are located along East Street and East Canal Street, respectively. The Site currently houses a gas regulator station in a small building near the facility gate off East Street. The Site ground surface slopes gently from south to north.

The southeastern portion of the Site was, until recently, occupied by buildings that originally housed former gas operations and later housed electrical substation facilities. The last of these buildings (except for the regulator station) was demolished in September 2000. Some rubble from the building demolition, including building and wall foundations, steel piping, and appurtenances remain in the ground. A gravel driveway and parking area surround the northern and western sides of the former buildings. The northern and western portions of the Site are grass-covered, and a number of large coniferous trees are present across the central portion of the property.

The off-site study area comprises approximately four acres and extends generally north of the Site (Figure 1-2), along a storm sewer that extends north from the vicinity of the Site and ultimately discharges to an open swale. The open swale is a 1,100 foot long linear feature approximately 1,500 feet north-northeast of the Site. From the intersection of East Street and East/North Clark Street, the storm sewer proceeds north beneath East Street and east beneath East North Street Extension. The storm sewer then proceeds north beneath the field on the north side of the East North Street Extension and to an open swale. This storm sewer line collects drainage from areas upgradient of the Site, from streets in the vicinity of the Site, and from streets between the Site and the field north of the East North Street Extension. The open swale is positioned within a relatively low-lying area and is comprised of four segments separated by culverts. The first and second segments are positioned south of New York State Route 5S. The open swale passes underneath Route 5S, which is located along a former railroad line. The third and fourth segments are located north of Route 5S, with the end of the fourth segment terminating at the confluence of the swale with the Mohawk River, located approximately 2,200 feet north of the Site.

The field on the north side of East North Street Extension (based on observations made during the RI) is an area in which refuse was formerly deposited and is currently being used for disposal of construction debris. The off-site study area is bounded generally on the south and west by residential properties along East Street that back up to the East North Street Extension, residential properties on East Street and East Clark Street, the Site, and the Village of Ilion Department of Public Works (DPW). The off-site study area is bounded to the north and east by the Mohawk River and disposal areas, respectively.

Much of the off-site study area is within a relatively low-lying area that includes portions of the former Ilion landfill (see Section 1.3.3), an open parcel of land, approximately 25 acres in size, to the northeast of the Site (EA, 1988). The limits of the former Ilion landfill are shown on Figure 1-1. The former landfill site was used by the Village of Ilion between 1933 and 1971 as a dump to dispose municipal waste, including wastes from Remington Arms and other local industries. The area currently occupied by the Village of Ilion DPW is situated within the former Ilion landfill, and both sides of the open swale abut the former disposal area. The area west of the open swale and north of Route 5S was also formerly a sewage disposal plant (Figure 1-1).

1.3.2 Site History

The Ilion (East Street) Site was the location of a former gas manufacturing plant from the 1870s through 1912 (Figure 1-3). Subsequently, the Site was used for various utility operations (including gas storage and distribution), electrical substation applications, and as a service center. A detailed Site operational history was provided in the Preliminary Site Assessment/Interim Remedial Measures Report (Parsons, 1998). A brief summary is provided below.

In 1874, the first parcel (0.7 acres) was purchased by the Ilion Mohawk Gas Light Company at the corner of East Street and the north tow path for the Erie Canal, the former bed of the Erie Canal being directly south of the Site (Figure 1-3). By 1881, the Site contained an octagonal gasholder at the corner of East and East State Streets and a gashouse with a coal shed to the west of the gasholder. In 1890, the Site was expanded north to East Clark Street with the purchase of an additional 0.31 acre parcel.

An electric light station was added to the north side of the gas works building around 1891. By 1897, an 80,000 cubic-foot gasholder was constructed north of the gas plant, adjacent to East Street, and the octagonal gasholder was taken out of service. By 1912, the gas plant was no longer in operation. In 1917, a 200,000 cubic-foot gasholder was constructed adjacent to the former gas plant to store manufactured gas from the Harbor Point MGP in Utica, New York.

The Erie Canal was filled in 1921, and East Canal Street (now State Street) was realigned to the south. In 1940, an outdoor substation was constructed at the corner of East and East State Streets, covering the foundation of the former octagonal gasholder. By 1940, the 80,000 cubic foot gasholder had been removed. Circa 1950/1951, an auto repair shop, gasoline station, auto dealers, and a junkyard were located south and west of the Site, and natural gas replaced manufactured gas in Ilion.

In 1956, the 200,000 cubic foot gasholder and most of the remaining gas equipment were removed from the Site. In 1995, Niagara Mohawk (NM) submitted an oil spill report to NYSDEC “due to the presence of visibly stained soil underneath and adjacent to electrical equipment” at the on-site substation. The top 6-inches of soil below the substation were removed and properly disposed to remediate the reported spill (Parsons, 1998). The substation was decommissioned and removed in 1997. The last of the buildings associated with former gas manufacturing operations were demolished in September 2000.

1.3.3 Summary of Previous Investigations

The following investigations were completed in the vicinity of the Site prior to the RI and the data collected were used in this RI report, as appropriate, to characterize current site conditions:

Engineering Investigations at Inactive Hazardous Waste Sites, Phase II Investigation, Ilion Landfill Site no. 622004, Village of Ilion, Herkimer County. EA Science and Technology, 1988. This investigation was conducted for NYSDEC to investigate an area to the north of the Site used for disposal of municipal wastes. During drilling, a “tar-like” substance was encountered in one boring south of the open swale. No boring log or analytical data are available for this boring. The presence of this material suggested the possibility of off-site impacts of coal gas manufacturing activities at the Site.

Draft PSA/IRM Study Ilion (East Street) Site. Parsons Engineering Science, 1998. As a result of its former use as an MGP, the Site is one of the properties that NM was required to address under its original 1992 Order on Consent with NYSDEC (Number DO-001-9210). Parsons Engineering Science (Parsons) conducted a PSA/IRM at the Site under the 1992 Order on behalf of NM to:

- Determine whether MGP by-products, other utility related substances, or non-utility chemical constituents possibly contributed by others are present at the Site, and, if present, the nature of the respective constituents;
- Determine if detected chemical constituents can be attributed to other possible sources or parties;

- Determine whether any detected substances constitute a significant threat to public health or the environment;
- Determine if additional remedial investigations are necessary at the Site; and
- Determine if IRMs might be appropriate based on the results of the PSA.

Based on the results of the PSA, it was determined that additional information was necessary to adequately evaluate site conditions, address specific data gaps identified in the PSA, and determine the potential risks posed by the Site. In its review, NYSDEC concurred with these conclusions and requested that the data gaps be addressed in a RI/FS. In addition, the NYSDEC also requested that the investigation be extended to evaluate whether off-site study area impacts, encountered during a separate study of the former Ilion landfill (EA, 1988), were associated with former MGP operations at the Site.

1.4 ORGANIZATION OF REPORT

NG previously submitted to the NYSDEC in June 2008 a Revised RIR summarizing the results of RI activities performed at the Site through February 2008. This Revised RIR includes the information presented in the June 2008 report and incorporates the observations and results of additional field activities conducted in December 2008 in accordance with the methods outlined in the October 2008 Additional Soil Vapor Sampling Work Plan (SVSWP). The analytical data tables presenting the results of the field activities performed in December 2008 is presented as Appendix P. Field observations and evaluation of the RI activities conducted through December 2008 are presented within the text, figures, tables, and appendices, as appropriate. This RIR is organized into the sections described below.

Section 1, the Introduction, describes the purpose and objectives of the Report. The Site background, which includes a Site description and a summary review of the Site history and previous investigations, is also presented.

Section 2 presents the scope-of-work activities performed during the RI field programs. Sampling, monitoring well installation, soil boring, test pit excavation procedures, and open swale area reconnaissance and research are described and the chemical sampling program is also outlined.

Section 3 describes the Site topography, geology, surface water hydrology, and groundwater hydrology based on the data generated to date.

Section 4 summarizes the nature and extent of MGP-related impacts based on the data collected during the RI. The type, concentration, and extent of the constituents of concern detected in each media are described.

Section 5 details the fate and transport of constituents detected in each media. The section includes summaries of potential routes of migration, persistence of each contaminant and/or contaminant class, and migration pathways.

Section 6 presents a qualitative assessment of potential exposure pathways and potential receptors for each media.

Section 7 presents the conclusions and recommendations for the Site based on the RI information presented.

References used in preparation of this Report are presented in Section 8.

Appendices include the soil and sediment boring logs and monitoring well construction diagrams, test pit excavation records, monitoring well purge forms, tables of the laboratory analytical data, and the Data Usability Summary Reports (DUSRs).

2.0 SCOPE OF WORK

2.1 INTRODUCTION

This section describes the tasks performed as part of the various RI field programs, the associated methods and/or procedures that were utilized, and modifications to the scope of work necessary to complete the field activities. In addition, summary descriptions of the applicable activities performed as part of the PSA (Parsons, 1998) are provided. The scope of work for the RI field activities, and methods used, were originally presented in the following plans:

- Remedial Investigation/Feasibility Study Work Plan for NG's Ilion (East Street) Site, dated June 1999;
- Letter outlining off-site test pit investigation, sent to NYSDEC by NG, dated December 2, 1999;
- Supplemental Off-Site Work Plan Addendum, dated August 2000;
- Data Summary and Work Plan Addendum, dated July 2001;
- Supplemental Remedial Investigation/Feasibility Study Work Plan, dated January 2004 as modified by correspondence with NYSDEC from March through June 2004, as summarized below:
  - Letter of conditional approval of work plan from NYSDEC with requested scope modifications, dated March 17, 2004;
  - Letter submitted by NM with response and clarifications on the modifications, dated April 5, 2004;
  - Letter from NYSDEC concurring with most responses/clarifications on work plan modifications. Also, additional discussion of issues related to the project schedule, dated April 23, 2004;
  - Letter from NG documenting proposed resolution of project schedule issues, dated May 17, 2004; and
  - Letter from NYSDEC documenting that project schedule issues are resolved, dated June 2, 2004.
- Supplemental Remedial Investigation/Feasibility Study Work Plan, dated February 2006 as modified by correspondence with NYSDEC from March 2006 through May 2006, as summarized below:
  - Letter from NYSDEC with comments on 2006 Supplemental Remedial Investigation Work Plan (SRIWP), dated March 24, 2006;
  - Letter from NG in response to March 2006 letter from NYSDEC and request for clarification, dated April 26, 2006;
  - Letter from NYSDEC with additional scope modifications, dated April 28, 2006;
  - Letter from NG in response to April 2006 letter from NYSDEC, dated May 22, 2006; and
  - Letter of approval for SRIWP from NYSDEC based on NG responses, dated May 26, 2006.

- Supplemental Remedial Investigation Work Plan, dated November 2007 as modified and revised by correspondence with NYSDEC from November and December 2007, as summarized below:
    - Letter from NYSDEC with comments on 2006 Supplemental Remedial Investigation Work Plan (SRIWP), dated November 26, 2007; and
    - Letter from NG responding to the comments presented in the November 2007 letter from NYSDEC and presenting the submittal of one copy of the revised SRIWP (December 2007) incorporating the NYSDEC comments from the November 2007 letter, dated December 18, 2007.
- Additional Soil Vapor Sampling Work Plan, dated October 2008.

The RI performed by TtEC consisted of both Site and off-site study area investigations executed over multiple mobilizations: August/September 1999, December 1999, February 2000, December 2000, January/February 2001, March 2001, January/February 2002, September/October/ November 2004, August 2006, February 2008, and December 2008. Site investigations were conducted within the property boundary of the former MGP site, and off-site study area investigations were conducted immediately adjacent to or nearby (within 0.5 miles) the former MGP property. A large portion of the off-site study area investigations occurred at the area of the former Ilion landfill (at the Village of Ilion DPW facility) and at the field north of the East North Street Extension. The former Ilion landfill area is north-northeast of the Site (Figure 1-1). Sample locations are shown on Figures 2-1 (Site and near Site area), 2-2 (off-site study area), and 2-3 (background).

2.2 PRE-INVESTIGATION ACTIVITIES

Approximately three to five days prior to the commencement of the various RI field activities, Dig Safely New York was contacted to mark out underground utilities at the Site and on adjacent properties. In addition, NG gas and electric personnel marked out subsurface utilities in the vicinity of the sampling locations. The Site reconnaissance task included the identification of utilities and mark out of all soil borings and monitoring wells and was performed prior to mobilization or the first day of mobilization. Each location was evaluated with respect to overhead and underground obstructions. In addition, a staging area for equipment and materials was identified by NG during the reconnaissance task.

2.3 SURFACE SOIL SAMPLING

Surface soils were sampled to assess the potential risk to possible receptors through direct contact. Samples were collected at the Site, within the property boundary of the former MGP, and the near Site area, immediately adjacent to or nearby the property boundary. To evaluate this pathway, soil samples were collected from within the top six inches of the soil column and analyzed for polycyclic aromatic hydrocarbons (PAHs), a common by-product of coal gas production. Since PAHs are present in other products ubiquitous within our environment including fuels, asphalt, internal combustion engine exhaust, and other petroleum based products and byproducts, background samples were collected from areas not likely to be impacted by Site activities to determine PAH concentrations found in the surrounding suburban, commercial, and industrial environment. The purpose of the background soil sampling was solely to evaluate and compare the concentrations detected in surface soil samples collected at the Site and near site study areas to a representative concentration obtained from the background surface soil samples collected from areas surrounding the site not believed to be impacted by Site operations. The concentrations detected in the background surface soil samples will not be used as screening values for the Site surface soil sample concentrations nor will they be used for delineation purposes or for selection of a remedial action. Surface soil sampling was performed during the PSA and over multiple phases during the RI, as described in the following sections. The analytical results for surface soil sampling are discussed in Sections 4.2.2.1 and 4.3.2.2.

2.3.1 Preliminary Site Assessment

Surface soil samples (0 to 2-inch bgs depth interval) were collected from four locations (SS-01 through SS-04) on the Site property on July 16, 1997 by Parsons (Figures 2-1). Three samples were also collected from the 0 to 2-inch beneath ground surface (bgs) depth interval at background locations BKG SS-05A, BKG SS-06A, and BKG-SS-07A (Figure 2-3). The PSA surface soil samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), TCL pesticides and polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, total cyanide, and total organic carbon (TOC) (Parsons, 1998).

2.3.2 Remedial Investigation

September 1999

The two objectives of surface soil sampling during this portion of the RI were [1] to determine the lateral extent of PAHs in the vicinity of previous surface soil sample SS-02, along the southwest side of the then existing building (Figure 2-1), and [2] to collect and analyze additional background surface soil samples to develop a better understanding of background soil conditions in the general vicinity of the Site. Five Site locations, denoted as SS-05 through SS-09, were sampled from 0 to 2 inches bgs and analyzed for PAHs. Four additional background surface soil samples (BKG SS-10 to BKG SS-13) and a duplicate sample were collected in nearby areas within the Village of Ilion. Background sample locations were selected upon discussion with NYSDEC, NM, review of the locations sampled during the PSA, and reconnaissance of appropriate sample areas.

At each sampling location, the surface was cleared of vegetation and debris. Samples were collected on September 9, 1999 using a decontaminated stainless steel trowel/spoon, which was advanced to a depth of 2 inches bgs. Samples were transferred to laboratory-supplied glassware and immediately placed on ice, pending delivery to the laboratory for analysis. The Site samples were analyzed for PAHs. The background samples were submitted for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX), PAHs, metals, total cyanide, and TOC.

December 2000

A supplemental background sample was collected on December 12, 2000, utilizing the same procedure as the September 1999 investigation. This location was originally denoted as SS-07. However, as this identification was previously used, the sample was renamed as SS-BKG. Soil was collected to a depth of 2 inches bgs and analyzed for PAHs.

To further delineate the potential surface soil impacts in the vicinity of the Site, 13 locations (SS-10 through SS-22) were selected around the perimeter of the former MGP property (Figure 2-1). On December 12, 2000, soil from 0 to 2 inches bgs was collected from each of these locations, using a decontaminated stainless steel spoon and following the procedures outlined above. These near Site area samples were shipped to the laboratory for analysis of PAHs.

March 2001

A determination having been made by NYSDEC and NYSDOH that additional background samples were required for the RI, on March 1, 2001, six surface soil samples (BKG-01 through BKG-06) were collected from 0 to 2 inches bgs for PAH analysis, from properties not likely impacted by Site activities. The locations for these samples were determined by reconnaissance of appropriate areas, which were then discussed with NM, NYSDEC and NYSDOH, prior to sampling.

January/February 2002

Additional near Site area surface soil samples were collected in January and February 2002. Ten samples were collected from locations SS-23 through SS-32. At each sampling location, surficial materials were removed, and a sample was collected to a depth of 6 inches bgs utilizing a decontaminated stainless steel spoon/trowel. Samples were transferred to laboratory-supplied glassware and placed immediately on ice. Laboratory analyses for these shallow soils included PAHs and total cyanide.

October 2004

Surface soil samples from 0 to 2 inches bgs were collected in the off-site study area, to determine the concentration of carcinogenic PAHs, if any, in off-site study area surface soils in the field north of the East North Street Extension. Four samples were collected, one from each soil boring location TtDP-01 through TtDP-04. Samples were collected, using disposable plastic scoops, from aliquots of soil removed with a shovel from the upper 2 inches. Soil was homogenized in disposable, aluminum food storage/cooking trays prior to being transferred to sample jars.

2.4 CATCH BASIN MATERIAL SAMPLING

December 2000

Site Investigations
No catch basins exist on the Site property and therefore no sampling was performed.

Off-Site Study Area Investigation
During the Remedial Investigation phase, material from within four catch basins was collected to evaluate the potential for non Site-related impacts to the open swale (*e.g.*, road runoff). A total of eight catch basin samples were collected from the four locations, designated SWR-01 through SWR-04 (Figures 2-1 and 2-2). The catch basins drain to the storm sewer line that extends from the intersection of East Street and East/North Clark Street to the open swale in the off-site study area. Sampling was completed on December 12, 2000, and the samples were submitted for BTEX and PAH analyses.

2.5 SOIL BORING DRILLING AND TESTING

Subsurface drilling activities were performed both at the Site and near Site area to evaluate potential impacts from the former MGP operations and to obtain stratigraphic information. Locations were logged during field activities, and soil boring logs, including soil descriptions, field instrumentation readings, observations of impacts, and analytical sampling information, were completed for each of the investigation locations. These logs are presented in Appendix A. Information obtained from the advancement of the soil borings was utilized to determine Site-specific geologic conditions, as discussed in Section 3.4. The analytical results are discussed in Section 4.2.2 and 4.3.2.

Open Swale Area
Six rounds of subsurface soil borings were installed in the open swale area in the off-site study area during the RI. No subsurface soil borings were installed in the open swale during the PSA. Soil borings locations are depicted on Figure 2-2. Logs for soil borings are provided in Appendix A.

2.5.1 Preliminary Site Assessment

During the PSA, seven soil borings (SB-01 through SB-07) were advanced on the property from July 8 to 15, 1997, using hollow-stem auger drilling methods with the collection of split-spoon samples on a continuous basis (Parsons, 1998). A total of 25 soil samples were collected from the borings and submitted for laboratory analysis of BTEX, PAHs, total cyanide, and TOC (18 samples) or TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, total cyanide, and TOC (7 samples). In addition, 3 samples were sent for geotechnical analyses (1 sample for permeability testing and grain size analysis and 2 samples for grain size analysis only). Geotechnical analytical results are presented in Appendix B. In addition, four samples were collected from 0 to 2 feet bgs at locations SS-01 through SS-04.

2.5.2 Remedial Investigation

August/September 1999

Mobilization for this portion of the subsurface soil investigation started on August 30, at which time the drilling subcontractor, Lyon Drilling, mobilized their equipment and supplies to the Site.

Site Investigation

In order to further identify the extent of impacts on the Site, specifically in the area of monitoring well MW-2 (which is located immediately north of the former gas house and downgradient from the former octagonal gasholder), 13 soil borings (SB-08 through SB-16, SB-12A, SB-13A, MW-07, and MW-08) were drilled at Site locations between August 30 and September 10, 1999. The soil borings were advanced using a truck-mounted hollow-stem auger drill rig and continuous split-spoon soil sampling. The split-spoons were field screened for visual and olfactory indications of contamination and were screened for organic vapors with an organic vapor analyzer. The depths of the soil borings ranged from approximately 11 feet bgs (SB-10, SB-11, and SB-14) to 61.5 feet bgs (SB-12).

A total of 29 soil samples and 1 duplicate sample collected from these boring locations were submitted for laboratory analysis of BTEX, PAHs, metals, total cyanide, and TOC. In addition, four samples were sent for geotechnical parameters, one sample was sent for source fingerprinting, and one sample was sent for Toxicity Characteristic Leaching Procedure (TCLP) parameters. Geotechnical analyses performed were as follows: 1 sample for modified Proctor with oversize correction and 3 samples for density, moisture content, grain size, and Atterberg limits. Geotechnical analytical results are presented in Appendix B. Upon completion of soil boring and sampling activities, the boreholes (with the exceptions of MW-07 and MW-08, which were converted to monitoring wells) were abandoned with a cement/bentonite grout in accordance with NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-88-4008.

Off-Site Study Area Investigation

Previously, an investigation had been performed at the Ilion landfill area located near the current Department of Public Works (DPW) facility, to the north-northeast of the Site (EA, 1988). During this effort, a “tar-like” material was encountered in one boring (IL-TB), in the vicinity of the storm sewer. An off-site study area investigation was proposed as part of the RI to determine if this material may have originated from coal gas manufacturing activities at the Site and to evaluate the nature and extent of potential MGP-related impacts.

Soil borings were advanced northeast of the Site to evaluate the geologic setting and to collect samples for chemical and fingerprinting analyses to evaluate the possibility of off-site migration. TtEC performed direct push soil probing at 17 locations in the off-site study area. The borings (GP-01 through GP-17) were placed primarily along two parallel grid lines and were generally in the vicinity of previous NYSDEC boring IL-TB, located near the small wading pool east of East Avenue (Figure 2-2). The direct push boring locations were based on the hypothesized location for a theorized former stormwater swale, on the location of an existing open swale located north-northeast of the Site receiving flow from a storm sewer, and on assistance from Village of Ilion personnel. It was considered likely that, if a swale formerly existed, the storm sewer conduit would have been positioned within the former swale.

The direct push cores were field screened for visual and olfactory indication of contamination and for organic vapors with a photoionization detector (PID). Soil descriptions, field instrumentation readings, observations of impacts, and analytical sampling information were logged during the program. One sample was collected from each boring (exception GP-17). Samples of the bedding material that resides directly beneath the storm sewer conduit were collected if encountered; otherwise, the sample was biased to the most contaminated interval based on organic vapors, odors, and/or visual observations. Sampling depths ranged from approximately 5 to 12 feet bgs. The subsurface soil samples were submitted for laboratory analysis of BTEX and PAHs. Completed boreholes were properly abandoned through tremie-grouting with cement/bentonite grout.

Open Swale Area
Subsurface soils in the south end of the first segment of the open swale, near the outfall of the 24-inch culvert, were manually probed. The probing consisted of advancing a 9-foot long threaded rod downwards until it could be advanced no further. The rod was then pulled up from the subsurface soils and the rod was screened for odors at various depths. Special attention was given to observing the development of sheens on the water surface. The rod was advanced to depth at approximately 15 locations within 25 feet of the outfall of the pipe (see Figure 2-2). At most locations, the full nine feet of rod were advanced into the subsurface soils. The soil probing resulted in the generation of several local sheens on the standing stagnant surface water within the swale. Odors on the rod were identified as being distinctly petroleum-related rather than coal tar-like. These odors were consistently observed in nearly all 15 of the probing locations and varied in depth, sometimes being detected at multiple locations on the rod per probe location.

December 1999

Site Investigations
No Site investigations occurred during this mobilization

Off-Site Study Area Investigation
Open Swale Area
A sample within the open swale was collected on December 14, 1999 as part of the RI investigation (SWALE-SED1). The soil appeared visually to be impacted (sheen on water), and the sample was analyzed for source fingerprinting.

January/February 2001

Mobilization for this portion of the subsurface soil investigation commenced on January 2, 2001, at which time the drilling subcontractor, Lyon Drilling, mobilized their equipment and supplies to the site.

Site Investigation

Three locations, SB-21 through SB-23, were advanced on the former MGP property in the vicinity of the 200,000 cu. ft. former gasholder, encountered refusal (possibly the concrete foundation of the gasholder and/or debris), and were abandoned. A fourth boring, SB-24, was completed on January 3, 2001. Two soil samples were collected from this location and analyzed for BTEX and PAHs.

Off-Site Study Area Investigation

In order to evaluate further the extent of potential impacts in the off-site study area, additional boring locations were advanced. Nineteen horizontal transect lines (FW-02 through FW-20), encompassing a total of 72 boring locations (Figure 2-1), were completed between January 2 and February 28, 2001. The end depths of the soil borings were typically at 12 feet bgs but ranged from 7 feet bgs (FW-20G) to 20 feet bgs (FW-2). The boring advanced at location FW-01 encountered refusal at 6.2 feet bgs and was abandoned. A total of 69 soil samples collected from the borings were shipped for laboratory analysis of BTEX and PAHs (55 samples); VOCs and SVOCs (11 samples); or PCBs, metals, total cyanide, bromate, total petroleum hydrocarbons (TPH), heat quantity (BTUs), percent solids, and sulfur (3 samples). In addition, 24 samples from various borings were analyzed for source fingerprinting. Completed boreholes were properly abandoned through tremie-grouting with cement/bentonite grout.

Open Swale Area

A total of 21 borings were completed over 11 transects (transects SED-01 through SED-11) to evaluate the subsurface soils in the open swale that leads to the Mohawk River. The borings were advanced to between 8 ft bgs and 20 ft bgs utilizing direct push soil probing from January 3 through February 22, 2001. The 41 samples collected were submitted for BTEX and PAHs (34 samples); VOCs and SVOCs (5 samples); source fingerprinting (9 samples); or PCBs, metals, total cyanide, bromate, total petroleum hydrocarbons (TPH), heat quantity (BTUs), percent solids, and sulfur (3 samples).

January 2002

Mobilization for the subsurface soil investigation commenced on January 7, 2002. At this time, the drilling subcontractor, Lyon Drilling, mobilized their equipment and supplies to the Site. All field work conducted during this phase of the RI was performed in the off-site study area.

Prior to this phase of field work, it had been determined that vertical and horizontal profiling conducted during previous RI investigation activities had not sufficiently delineated constituents in the locations northeast of the Site. Therefore, in order to better assess the off-site study area, supplemental direct push subsurface soil sampling was performed from January 7 through 11, 2002. Eighteen locations (FW4A, FW4B, FW6A, FW7E, FW9E, FW9F, FW9G, FW9H, FW10H, FW10I, FW11H, FW12H, FW13C, FW20C, FW20D, FW20E, FW20F, and FW20G) were added to the previously performed sample grid lines. A total of 36 samples, along with two duplicate samples, were collected from the soil cores, for BTEX and PAH analysis. Completed boreholes were properly abandoned through tremie-grouting with cement/bentonite grout.

October 2004

Mobilization for this portion of the subsurface soil investigation started on October 11, 2004. At this time, the drilling subcontractor, Nothnagle Drilling, mobilized their equipment and supplies to the Site.

Site Investigation

Two soil borings were installed on the Site using 4.25-inch inner diameter hollow stem augers with continuous split-spoon sampling. Soil boring TtSB-01 was installed within the footprint of the northern gasholder in an attempt to ascertain the depth to the bottom of the gasholder. Soil boring TtSB-02 was installed near the eastern boundary of the Site, east of MW-02. The purpose of soil boring TtSB-02 was to delineate elevated PAH concentrations (i.e., above the screening value of 500 ppm) previously measured in soils sampled from the 4 and 6 foot bgs interval in soil boring SB-02/MW-02. Soil boring TtSB-02 was also advanced to collect geotechnical parameters necessary for the evaluation of monitored natural attenuation as a possible remedial alternative at the Site. Upon completion of sampling activities, the borings were abandoned with a cement/bentonite grout in accordance with NYSDEC TAGM HWR-88-4008.

Soil boring TtSB-01 was advanced to 26 feet bgs, and two soil samples were collected. A sample was collected from 10 to 12 feet bgs for BTEX analysis, and a sample was collected from 8 to 12 feet bgs for PAH and cyanide analysis.

Soil boring TtSB-02 was advanced to 12 feet bgs, and three soil samples were collected. Soil samples collected from 4 to 5 feet bgs and 6 to 8 feet bgs were analyzed for PAH. The third sample was collected from 8 to 12 feet bgs and analyzed for grain size distribution, specific gravity, total porosity, reconstituted bulk density, total organic carbon, and Atterberg limits. Geotechnical analytical results are presented in Appendix B.

Soil samples were collected with disposable plastic scoops from decontaminated carbon steel split-spoons. Samples were homogenized in disposable aluminum food storage/cooking trays prior to transfer to laboratory supplied sample jars.

Off-Site Study Area Investigation

Four soil borings (TtDP-01 through TtDP-04) were advanced in the off-site study area to complete the delineation of the vertical and lateral extent of elevated PAH concentrations (concentrations above 500 ppm) previously detected in this area. Soil borings TtDP-01 and TtDP-02 were located adjacent to the ends of transect lines performed in January 2001 and January 2002 to delineate previously observed impacts. Soil borings TtDP-03 and TtDP-04 were performed for general soil characterization and to supplement the vertical delineation in the off-site study area.

The soil borings were advanced to 20 feet bgs with direct push technology using a Geoprobe® 6610 DT and nominal 4-foot long macrocore samplers. A subsurface soil sample was collected from each 4-foot sampler, recovery permitting (recovery below approximately 8 feet bgs was limited). A total of 11 subsurface soil samples were collected and submitted for PAH analysis. Samples were collected from the macrocore samplers as described under *Site Investigation* above. Completed boreholes were properly abandoned through tremie-grouting with cement/bentonite grout.

Open Swale Area
Five borings (TtSED-01 through TtSED-05) were advanced and sampled to evaluate the extent and concentration of PAHs in the shallow (0 to 2 feet bgs) zone and to evaluate the potential for contamination, if present, to be mobilized by peak flows through the open swale. The borings were advanced by manually pushing direct push sampler liners into the subsurface soils. One sample was collected from each boring for PAH analysis. Three geotechnical samples were collected for grain size distribution, specific gravity, organic content, water content, and Atterberg limits (if silt or clay). The geotechnical samples were collected from sediment borings TtSED-01, TtSED-03, and TtSED-05 and geotechnical analytical results are presented in Appendix B.

August 2006

Mobilization for the Site soil investigation began on August 8, 2006. At this time, the drilling subcontractor, Parratt Wolff Drilling, Inc., mobilized equipment and supplies to the Site.

Site Investigation

Three soil borings (TTSB-03 through TTSB-05) were installed within/adjacent to the former 200,000 cubic foot (cu. ft.) gasholder to further delineate the impacted soil in this area (Figure 1). Soil borings were installed via hollow stem auger methods and were continuously logged. Soil borings TTSB-03 and TTSB-04 were advanced to 16 feet bgs and soil boring TTSB-05 was advanced to 20 feet bgs. Two soil samples were collected from the interval between 8 feet and the bottom of each boring (based on field screening results and visual observations) and submitted for BTEX, PAH, and cyanide analysis. As stated in the work plan, if evidence of impacts was observed at proposed maximum depths, soil borings would be advanced deeper, additional samples may be collected, and contingency borings would be installed. Contingency borings would be advanced to depths sufficient to delineate impacts observed in adjacent borings and would be sampled based on field screening results and visual observations. Two contingency borings were installed (CB-01 and CB-03) based on visual and olfactory impacts and elevated PID readings observed in TTSB-03 and TTSB-05, respectively. A third contingency boring (CB-03a) was installed to split the difference in spacing between borings TTSB-05 and CB-03. The soil boring locations are displayed on Figure 2-1.

Off-Site Study Area Investigation
Open Swale Area
Eight subsurface soil borings (TtSED-05 through TtSED-12) were advanced and sampled to evaluate the extent of shallow (0 to 2 feet bgs) soils in the open swale impacted by PAHs and BTEX compounds and to evaluate if the impacts are related to the former MGP or other local sources. The identification of location TtSED-05 was also used to identify a sample location from the October 2004 mobilization. Where these locations are discussed in the text, the date of the mobilization is also provided for clarification. Three locations (TtSED-05, TtSED-07, and TtSED-09) were advanced to 4 feet bgs to increase deeper sample coverage and one location, TtSED-08, was advanced to 8 feet bgs. Deeper locations were submitted to the laboratory for PAH analysis only. All samples were submitted to the laboratory for fingerprint analysis. The borings were advanced by driving Geoprobe ® macrocore samplers with liners with a manually-

operated slide hammer into the subsurface soil. The locations were accessed either by boat or by wading in the water. PAH and BTEX analysis was performed by Severn Trent Laboratories (STL) in Edison, NJ. Fingerprint analysis (modified ASTM method D-3328) was performed by Worldwide Geosciences of Houston, Texas.

February 2008

Mobilization for the Off-Site study area investigation began on February 7, 2008. TtEC located the proposed intrusive field activity locations to allow utility clearance activities to be performed prior to advancing soil borings or test pits.

Off-Site Study Area Investigation

Five soil borings were advanced and subsurface soil samples were collected to evaluate the extent of MGP-related impacts near test pits where (Non-Aqueous Phase Liquid) NAPL was previously identified. Four of the soil borings were advanced at the off-site area south of the spoil piles near where the MGP impacts were identified, and the boreholes were converted to monitoring wells (MW-14 through MW-17) upon completion of the boring advancement. These borings were advanced and located primarily for the installation of the shallow monitoring wells.

The final soil boring (SB-16) was performed to adequately address soil delineation requirements at the area located between test soil borings FW-09C and FW-08A, which was identified by the NYSDEC in their June 27, 2007 comment letter. Previous attempts to address data gaps at this area were unsuccessful as several large, densely vegetated, undulating spoil piles prohibit access to this area from any direction. Generally, access into this spoil pile area cannot be achieved to advance soil borings and/or additional test pits, but in 2004, a direct-push soil boring (TTDP04) was advanced at a low area between the spoil piles. Sample recovery at this soil boring was low. As part of this field mobilization, TtEC attempted to advance one or more soil borings at this low area with a hollow-stem auger (HSA) rig.

During the mobilization to the Off-Site study area on February 7, 2008, TtEC observed additional spoil piles at the proposed location of soil boring SB-16 preventing access. Because of the location of these spoil piles, SB-16 was re-located approximately 20’-25’ feet south of its original proposed location.

The borings were advanced below ground surface by HSA drilling methods and subsurface soils were sampled by driving 2” OD carbon steel split spoon samplers using a 140 lb hammer falling 30 inches to drive the sampler into the subsurface soil. Each boring extended to 16.0 feet bgs.

Soil samples were collected from the boreholes advanced for the installation of MW-14 through MW-17. The samples were submitted to Test America of Edison, NJ for BTEX and PAH analysis. Each soil sample was collected at an organic peat/silt layer exhibiting organic odors during advancement of borehole. NAPL was not observed during the advancement of any of the five soil borings described above.

2.6 TEST PIT EXCAVATIONS

Test pitting activities were performed both at the Site and in the off-site study area to determine the location of subsurface structures and to better view subsurface stratigraphy, composition of soil and fill materials, and potential contamination. The locations of the test pits are presented on Figures 2-1 and 2-2. Test pit logs including soil descriptions, field instrumentation readings, observations of impacts, and locations of analytical samples were completed for each test pit and are presented in Appendix C. Information obtained from the excavation of the test pits was utilized in determining the Site and near-site area geologic conditions, as discussed in Section 3.4. Analytical results are discussed in Sections 4.2.2 and 4.3.2.

2.6.1 Preliminary Site Assessment

Three test pits (TP-01, TP-02 and TP-03) were excavated on the Site property during the PSA (Parsons, 1998). TP-01 and TP-02 were completed to determine the existence, location, integrity, and contents (if applicable) of the former site structures. TP-03 was excavated in an area where there was a suspected underground storage tank (UST). The trenches ranged up to 9.5 feet in depth and 38 feet in length. Three soil samples, two from TP-01 and one from TP-02, were collected on July 7, 1997 for analysis of BTEX, PAHs, total cyanide, and TOC.

2.6.2 Remedial Investigation

August 1999

Three test pits (TP-01A, TP-02A, and TP-03A) were excavated on the Site to obtain information on the construction of the former octagonal gasholder. Samples for laboratory analysis were not collected from the test pits.

December 1999

A total of five test pits (OFTP-01 through OFTP-05) were excavated in the off-site study area in December 1999. These test pits were excavated to locate and characterize the hypothetical former storm water swale (see Section 2.4.2), and to characterize soils in the area of the existing storm sewer. The excavations were performed on December 14 and 15, 1999, with four of the five trenches being perpendicular to the existing stormwater piping. Excavated soils were geologically classified and field screened for organics with a PID. One soil sample was collected from each of the five excavations and shipped to the laboratory for analysis of TCL VOCs, TCL SVOCs and fingerprinting (OFTP-01); BTEX, PAHs and fingerprinting (OFTP-02, OFTP-03, OFTP-05); or BTEX and PAHs only (OFTP-04). No conclusive evidence indicating the location of the former open swale was revealed during the excavations.

October 2004

Site Investigation

Two test pits (TtTP-01 and TtTP-02) were excavated on October 14 in the northern portion of the Site, in order to confirm the location of the former 80,000 cu. ft. gasholder and obtain necessary information regarding gasholder construction and nature of fill materials contained within the former gasholder. Test pit TtTP-01 and TtTP-02 were excavated to approximately 8 feet bgs and 9 feet bgs, respectively. One soil sample was collected from the bottom of each of the two test pits and submitted for BTEX, PAH, and cyanide analysis. Samples were collected from the bucket of the excavator/backhoe using disposable plastic scoops. Samples for BTEX analysis were transferred directly into the glassware. Samples for PAH and cyanide analysis were homogenized in disposable aluminum food storage/cooking trays prior to transfer into laboratory-supplied glassware.

Off-Site Study Area Investigation

Fifteen test pits were excavated in the off-site study area. Three of the 15 test pits (TtTP-03, TtTP-04, and TtTP-05) were excavated to attempt to complete the delineation of total PAH concentrations exceeding the 500 ppm screening value observed during previous investigation activities at locations FW-11H (6 to 7 feet below ground surface and FW-13C (5 to 6 feet below ground surface). The lateral extent of elevated PAH concentrations to the north and west of these locations had been adequately defined, previously. Twelve of the 15 test pits (TtTP-06 through TtTP-17) were excavated to delineate a lens of soil containing tarry material encountered in test pit TtTP-04.

Test pit TtTP-03 was excavated south of FW-11H, test pit TtTP-04 was excavated east of FW-11H, and Test Pit TtTP-05 was excavated southeast of soil boring FW-13C. These test pits were excavated to a depth of approximately 12 to 13 feet bgs. Two soil samples were collected from each of the three test pits and submitted for PAH analysis. Using disposable plastic scoops, samples were taken from the bucket of the excavator/backhoe, homogenized in disposable, aluminum food storage/cooking trays, and transferred to laboratory-supplied glassware. One additional soil sample was collected of the soil containing the tarry material encountered in test pit TtTP-04 for fingerprint analysis. The samples from test pits TtTP-03 through TtTP-05 were collected based on visual observation of contamination and/or field screening (e.g., elevated PID or FID reading). Where no indications of contamination were observed, samples were collected from the depth interval corresponding to the depth at which total PAH concentrations measured in the adjacent boring were above 500 ppm and from the 10 to 12 foot depth interval.

The 12 test pits excavated to delineate the lens of soil containing tarry material observed in test pit TtTP-04 were excavated roughly to the north, south, east and west of test pit TtTP-04. Test pits TtTP-06 through TtTP-09 and TtTP-13 through TtTP-17 were excavated to the north, test pit TtTP-10 was excavated to the west, test pit TtTP-11 was excavated to the east, and test pit TtTP-12 was excavated to the south. These test pits were excavated to depths of approximately 7 to 9 feet bgs, until peat was encountered. Six soil samples were collected for PAH analysis from the 12 test pits. The samples were collected from visually clean soil intervals immediately above the peat in test pits that appeared to delineate the extent of the tarry material (test pits TtTP-10, TtTP-11, TtTP-12, and TtTP-17.

February 2008

Off-Site Study Area Investigation

Two test pits (2007TP01 and 2007TP02) were advanced at the Off-Site area east of previously completed test pits TTTP06 and TTT13, as described in the December 2007 SRIWP. Advancement of the test pits was performed to adequately address soil delineation requirements at the area east of test pit TTTP06 to TTTP13, which was identified by the NYSDEC in their June 27, 2007 comment letter.

Test pit 2007TP01 extended 9.0’ deep by 9.0’ long by 2.5’ wide. Test pit 2007TP02 extended 10.0’ deep by 9.0’ long by 2.5’ wide. Each test pit was oriented in an east-west direction and located east of the gravel road immediately adjacent to TTTP06 and TTT13. No soil samples were collected from the soils encountered during advancement of the test pits.

2.7 MONITORING WELL INSTALLATION AND DEVELOPMENT

During the PSA and RI, 17 monitoring wells and two piezometers were installed at the Site, near Site area, and Off-Site Study Area. Locations of the monitoring wells and piezometers are shown on Figure 2-2. Boring logs and well construction diagrams are presented in Appendix A.

2.7.1 Preliminary Site Assessment

In order to provide site-specific hydrogeologic data (*i.e.*, depth to groundwater, groundwater flow direction, etc.), evaluate groundwater quality, and assess the potential for contaminant migration, six groundwater monitoring wells were installed between July 8 and 15, 1997 as part of the PSA field program performed by Parsons as follows:

- Boring SB-02 to well MW-02;
- Boring SB-03 to well MW-03;
- Boring SB-04 to well MW-04;
- Boring SB-05 to well MW-05;
- Boring SB-06 to well MW-06; and
- Boring SB-07 to well MW-01.

The wells were installed with 10-foot PVC screens (except MW-05, which was installed with a 5-foot screen), and developed by purging (except MW-02 which was hand bailed) until the water quality meter indicated turbidity was less than 50 NTUs and other parameters were stable.

2.7.2 Remedial Investigation

August/September 1999

To further characterize the hydrogeology and groundwater quality, two additional groundwater monitoring wells (MW-07 and MW-08) were installed at the Site between August 30 and September 8, 1999. MW-07 was placed northwest of monitoring well MW-02, between the 200,000 cu. ft. gasholder and the northwestern fence line. MW-08 was installed to the north of MW-02, between the well and the gas regulator building. Development of these two monitoring wells occurred on September 9 and 10, by pumping and surging.

January 2002

Monitoring well MW-09 was installed on January 3, 2002 to the north of the Site, to evaluate potential near Site area and off-site migration of constituents. Well development was performed for MW-09 on January 9, 2002. Development was performed using pumping and surging techniques and continued for approximately seven hours until the turbidity level was observed to be less than 50 NTUs. Approximately 180 gallons of water were evacuated from the well during development.

On January 9, 2002, monitoring well MW-08 was redeveloped as the screen had become full of silt below the groundwater surface. Development continued for about 1.5 hours and approximately 40 gallons of water were evacuated using pumping and surging techniques.

Two piezometers were installed in the off-site study area on January 11, 2002. PZ-01 was located near FW-07E, and PZ-02 was located near FW-11H. The piezometers were constructed of 1-inch diameter PVC with 5-foot screened intervals.

October 2004

Two monitoring wells (MW-10 and MW-11) were installed northeast of the Site on October 18, 2004 to complete the delineation of cyanide-impacted groundwater observed in existing Site wells and to provide additional information for assessing groundwater flow patterns. Soil borings for the monitoring wells were advanced with 4.25-inch ID hollow-stem augers and continuous split-spoon sampling using 2-inch OD carbon steel split spoons. The wells were constructed of 2-inch ID PVC with 10-foot screens straddling the groundwater surface.

Development of the wells occurred on October 19, 2004 and was accomplished via pumping and surging the wells with the drill rig Moyno pump and hose. The wells were developed until the turbidity was less than 50 NTUs. Approximately 19 gallons (19 volumes) and 31 gallons (25 volumes) were evacuated from MW-10 and MW-11, respectively.

August 2006

To further evaluate the northern edge of the cyanide plume in groundwater, monitoring well MW-12 was installed along the northwestern edge of the Site adjacent to the property at 214 Clark Street. This well was installed on August 08, 2006 using a hollow stem auger and continuous split-spoon sampling OD carbon steel split spoons.

To improve the understanding of groundwater flow and groundwater quality in the sand and gravel (kame) unit, and the lateral limits of the cyanide plume, monitoring well MW-13 was installed adjacent to monitoring well MW-11 and screened within the kame unit, from approximately 14 to 24 feet bgs. This well was installed on August 08, 2006 using a hollow stem auger and continuous split-spoon sampling 2-inch OD carbon steel split spoons.

Development of the monitoring wells occurred on August 10, 2006 and was accomplished via with a submersible pump (double whale pump ®). The wells were developed until the turbidity was less than 50 NTUs. Approximately 36 gallons (36 volumes) and 35 gallons (35 volumes) were evacuated from MW-12 and MW-13, respectively.

February 2008

Off-Site Study Area Investigation

Four groundwater monitoring wells (MW-14 through MW-17) were installed and four soil samples were collected from the soils encountered during the advancement of the boreholes drilled to install the monitoring wells. The monitoring wells were installed to evaluate the extent of MGP-related impacts near test pits south of the spoil piles where NAPL was previously identified. Groundwater is anticipated to flow to the north at this location and the monitoring wells were located at positions to best address potential impacts to groundwater. Three of the wells (MW-14, 15, and 16) are located at the areas believed to be downgradient and/or sidegradient of where NAPL was previously identified at test pits TtTP-04, TtTP-06, TtTP-07, TtTP-08, TtTP-09, TtTP-13, and TtTP-15. MW-17 is located at an area believed to be upgradient of the MGP impacts.

2.8 HYDRAULIC CONDUCTIVITY TESTING

Hydraulic conductivity testing was conducted via slug tests during the PSA on July 29, 1997 in five of the six newly installed wells on the Site. MW-05 did not undergo testing as it was completed within the footprint of a former gasholder. Slug testing was performed and the data analyzed by the Bouwer and Rice method. Both rising head and falling head tests were performed. Results are presented in Appendix E.

2.9 GROUNDWATER LEVEL MEASUREMENTS

Eight complete synoptic rounds of groundwater level measurements were collected during the PSA and RI. Two rounds were collected during the PSA and six rounds were collected during the RI. Groundwater monitoring elevation data are presented in Appendix K.

2.9.1 Preliminary Site Assessment

Two complete rounds of groundwater level measurements were collected from the six PSA monitoring wells (MW-01 through MW-06) on July 28, 1997 and October 29, 1997.

2.9.2 Remedial Investigation

October 1999

One round of groundwater level measurements was collected on October 7, 1999 from monitoring wells MW-01 through MW-08.

February 2000

Groundwater elevations were collected from monitoring wells MW-02 through MW-08 on February 15, 2000. Data was not collected at monitoring well MW-01, as this well had been buried by soil stockpiled on the Site.

September/October 2004

Groundwater level measurements were collected on September 22, 2004 from monitoring wells MW-02 through MW-09 (MW-01 was buried and not accessible). A complete round of groundwater elevation measurements (MW-01 through MW-11) was collected on October 19, 2005. A second complete round of groundwater elevation measurements (MW-01 through MW-11) was collected on October 27, 2004.

August 2006

A round of synoptic groundwater elevation measurements was collected on August 08, 2006 from monitoring wells MW-01 through MW-13. The groundwater level was not measured in MW-05. MW-05 is hydraulically disconnected from other monitoring wells because of its location within the footprint of a former gasholder. Groundwater elevations at MW-05 are approximately 10’-13’ higher than at the other Site wells, indicating the well is likely monitoring a different water-bearing zone inside the existing structure and footprint of the former gasholder.

February 2008

A round of synoptic groundwater elevation measurements was collected on February 25 and 26, 2008 from Site and off-site monitoring wells MW-01 through MW-17.

2.10 GROUNDWATER SAMPLING

Nine rounds of groundwater sampling were conducted during the PSA and RI. Two rounds were collected during the PSA and seven during the RI. Monitoring Well purge data sheets are presented in Appendix D. Analytical results for the groundwater sampling rounds are discussed in Sections 4.2.2.3 and 4.3.2.4.

2.10.1 Preliminary Site Assessment

Two rounds of groundwater samples were collected from each of the six monitoring wells that were installed during the PSA (MW-01 through MW-06). The first round was performed on July 28, 1997, and the second round was completed on October 29, 1997. A minimum of three well volumes were evacuated from each well using dedicated, disposable polyethylene bailers, with the exception of MW-05, which was not purged because it is located within the gasholder. Field parameters were recorded during purging. Groundwater samples (from both rounds) were submitted to the laboratory for analysis of TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, total cyanide, and certain water quality parameters. Monitoring well MW-05, which is located within a former gasholder, was sampled for TCL VOCs, TCL SVOCs, and total cyanide in the July round and for TCL VOCs, TCL SVOCs, metals, and total cyanide in the October event.

2.10.2 Remedial Investigation

October 1999

One round of groundwater samples was collected at the Site between October 7 and 8, 1999, after installation of wells MW-07 and MW-08. A minimum of three to five well volumes were evacuated from each well using a polyethylene bailer, with temperature, pH, turbidity, and conductivity measurements recorded after each purged volume. Groundwater samples were submitted for analysis of BTEX, PAHs (unfiltered and filtered), metals (unfiltered and filtered), and total cyanide. Filtered and unfiltered PAH and cyanide samples were collected due to high turbidity, as the concentrations for both contaminants can be biased high by adsorption of the contaminants to particulate matter in the sample.

February 2000

Monitoring wells MW-02, MW-05, MW-07, and MW-08 were sampled in February 2000. Groundwater samples were collected from these wells to confirm results for the October 1999 sampling round. These were the wells for which cyanide was detected above criteria in the samples collected during October 1999. A minimum of three to five well volumes were evacuated from each well using a polyethylene bailer, with temperature, pH, turbidity, and conductivity measurements recorded after each purged volume. Groundwater samples were submitted for analysis of total cyanide.

December 2000

Further groundwater sampling occurred at wells MW-02, MW-05, and MW-07 on December 13 and 14, 2000 to confirm cyanide analytical results from previous rounds of groundwater monitoring. Groundwater samples were submitted for analysis of total cyanide during this round of sampling.

January 2002

One round of groundwater samples was collected from monitoring wells MW-02, MW-05, MW-07, MW-08, and MW-09 on January 8 and 10, 2002 to confirm analytical results from previous rounds of groundwater monitoring. Each well was screened with a PID immediately upon opening to measure the concentration of accumulated organic vapors, if any, present within each well column and the results documented in a field logbook. The wells were purged in accordance with the United States Environmental Protection Agency Region II Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling. A submersible pump was utilized for purging and sampling, with temperature, dissolved oxygen, pH, Eh, turbidity, flow rate, and conductivity measurements recorded approximately every five minutes until stabilization. Groundwater samples from MW-02, MW-05, MW-07, and MW-08 were submitted for total cyanide, while the sample from MW-09 was analyzed for TCL VOCs, TCL SVOCs, and total cyanide.

September/October 2004

The primary focus of the groundwater sampling conducted in September/October 2004 was to complete the delineation of cyanide impacted groundwater. One round of groundwater samples was collected from monitoring wells MW-01 through MW-09 on September 22 through 24, 2004. Following installation and development, MW-10 and MW-11 were sampled on October 27, 2004. Each well was screened with a PID immediately upon opening the well cap to measure the concentration of accumulated organic vapors, if any, present at each well head and the results documented in a field logbook. The wells were purged in accordance with the United States Environmental Protection Agency Region II Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling. A peristaltic pump, submersible pump, and/or dedicated bailer were utilized, with temperature, dissolved oxygen, pH, Eh, turbidity, flow rate, and conductivity measurements recorded approximately every five minutes until stabilization. Groundwater samples from all eleven wells were submitted for BTEX, PAHs, and total cyanide analyses. Due to high turbidity in the sample, additional field filtered aliquots were collected from monitoring wells MW-06 and MW-08 for PAHs and total cyanide. Samples from MW-03, MW-06 and MW-08 were also collected for monitored natural attenuation (MNA) field and laboratory parameters. MNA laboratory analysis consisted of:

- Water quality parameters
  - biological oxygen demand (BOD)
  - chemical oxygen demand (COD)
  - total suspended solids (TSS)
  - total dissolved solids (TDS)
  - total organic carbon (TOC)
  - chloride
  - alkalinity
- Dissolved gases
  - carbon dioxide
  - hydrogen sulfide
  - methane
- General attenuation parameters
  - heterotrophic plate count
  - micro-toxicity
  - ferrous and total iron
  - manganese
  - potassium
  - nitrate-nitrogen

- nitrite-nitrogen
- orthophosphate
- total phosphorus
- sulfate
- total sulfide

August 2006

One round of groundwater samples was collected from monitoring wells MW-01 through MW-13, with the exception of MW-05, on August 28 through 30, 2006. MW-05 was not sampled because it is hydraulically isolated from the remainder of the Site wells haven been installed within a former gasholder. Each well was screened with a PID immediately upon opening the well cap to measure the concentration of accumulated organic vapors, if any, present at each well head and the results documented in a field logbook. The wells were purged utilizing a submersible pump, with temperature, dissolved oxygen, pH, Eh, turbidity, flow rate, and conductivity measurements recorded approximately every three to five minutes until stabilization. Purge data including parameter measurements are presented in Appendix B.

Monitoring wells MW-01, MW-02, MW-03, MW-04, MW-06, MW-07, MW-08, MW-09, MW-10, MW-11, MW-12, and MW-13 were sampled for total cyanide. In addition, monitoring wells MW-07, MW-09, and MW-12 were sampled for BTEX and PAHs.

NAPL was not observed in the monitoring wells during this round of groundwater sampling.

February 2008

One round of groundwater samples was collected from monitoring wells MW-01 through MW-17 on February 26 to 28, 2008. The headspace of each well was field-screened with a PID immediately upon opening the well cap to measure the concentration of accumulated organic vapors, if any, present at each well head. The wells were purged utilizing a bladder pump and temperature, dissolved oxygen, pH, Eh, turbidity, flow rate, and conductivity measurements were recorded approximately every three to five minutes until the parameters stabilized. Monitoring well purge data including water quality indicator parameter measurements are presented in Appendix B.

Groundwater samples collected from Site study area monitoring wells MW-01, MW-02, MW-03, MW-04, MW-06, MW-07, MW-08, MW-09, MW-10, MW-11, MW-12, and MW-13 were analyzed for BTEX and total cyanide. In addition, the groundwater sample collected from monitoring well MW-05 was analyzed for VOCs and PAHs. Groundwater samples collected from Off-Site Study Area monitoring wells MW-14 through MW-17 were analyzed for BTEX, PAHs, and cyanide.

2.11 VAPOR INTRUSION INVESTIGATION

Previous RI reports (March 2007) submitted to the NYSDEC by NG indicated the potential exposure of occupants of nearby buildings to Site-related constituents via the vapor intrusion (VI) pathway is unlikely based on the following information:

- VOCs were not detected in the groundwater at monitoring well locations between the Site and near Site area buildings.
- Concentrations of constituents in soil proximal to near Site area buildings are either low or non-detect.
- The area of the Site between where higher concentrations are present in the soil and the near Site area buildings are either lawn or otherwise unpaved areas, and thus the soil vapor between the Site and these buildings is readily exchanged with the ambient outdoor air.

NG, in the March 2007 RIR, did not recommend further evaluation of the VI pathway or media at the Site based on this information.

In the June 27, 2007 NYSDEC letter providing comments in response to the March 2007 RIR, the NYSDEC and NYSDOH stated they disagree with NG's recommendation stating no further evaluation of the VI pathway is necessary. The NYSDEC states the presence of VOCs in soil and groundwater and the close proximity to residential areas indicate soil vapor should be evaluated as an environmental medium. In response to the NYSDEC's comment, NG submitted a Revised SRIWP in December 2007, which included a plan to evaluate potential VI impacts. This plan formed the basis for the VI investigation performed in February 2008 as part of the RI. NG collected seven soil vapor samples and one ambient air sample during the February 2008 VI investigation.

In their August 4, 2008 letter, the NYSDEC and NYSDOH stated they disagreed with NG's recommendations regarding VI presented in the June 2008 Revised RIR. The June 2008 Revised RIR indicated that "no further remedial investigation activities at the Site area with respect to vapor intrusion are recommended". The NYSDOH and NYSDEC did not concur with this statement and recommended that additional soil vapor samples be collected off-site east of SV-07 and west of East Street to evaluate elevated concentrations of chlorinated and BTEX VOCs contained in the soil vapor sample collected at SV-07.

NG submitted an Additional Soil Vapor Sampling Work Plan to the NYSDEC in October 2008 to describe the proposed methods to evaluate these elevated concentrations. NG proposed to collect two additional soil vapor samples to further assess the potential presence and concentrations of MGP-related constituents in soil vapor potentially migrating off-site. The Work Plan was approved by NYSDEC and NYSDOH in their October 31, 2008 letter. NG collected two additional soil vapor samples and one ambient air sample during the December 2008 vapor intrusion investigation. Details regarding the VI investigation activities are presented in the following sections. Analytical results from the VI investigation are presented in Section 4.2.2.4.

February 2008

Site Investigation

To assess the potential presence and concentrations of MGP-related constituents in soil vapor potentially migrating off-site, TtEC installed seven soil vapor points at the northern and eastern perimeter boundaries of the site. The soil vapor points were located at areas between the identified on-site impacts (i.e., NAPL in subsurface soil in/near the area of the former 200,000 ft^3 holder and the former octagonal holder) and potential off-site receptors (e.g., residences). In their November 26, 2007 letter, the NYSDEC approved the soil vapor sampling outlined in the SRIWP. The soil vapor sampling was conducted in accordance with NG's Draft SOP for Soil Vapor Intrusion Evaluation (updated September 2007), of which Appendices A and B were approved by the NYSDEC and NYSDOH on March 15, 2007.

The temporary soil vapor probes (SV-01 through SV-07) were planned to be installed using direct-push methods to a target sample depth of 8 feet bgs. Due to the depth of groundwater at individual soil vapor point locations preventing advancement to 8 feet bgs, the soil vapor points extended to a depth of 4 feet bgs at each location for consistency. The soil vapor probe screens were surrounded with glass beads to a height of one foot above the depth to bottom of the boring. A three foot bentonite slurry seal was placed in the annular space of the boring, surrounding the ¼" O.D. teflon-lined polyethylene tubing connected to the soil vapor probe.

Prior to implementing soil vapor sampling, a tracer gas evaluation using helium as the tracer gas was performed at each soil vapor point to evaluate the integrity of the soil vapor probe and assess the potential for introduction of ambient air into the soil vapor sample. No tracer gas was detected in readings using a helium-gas monitor connected to the soil vapor probe, indicating the integrity of the probe and the effectiveness of the bentonite seal was adequate for sampling.

One day after installation of the soil vapor probes and tracer tests, on February 15, 2008, soil vapor samples were collected at a maximum flow rate of less than 0.2 liters per minute in certified clean, evacuated Summa® canisters and analyzed for the compounds identified on USEPA method TO-15.

In addition, an ambient (outdoor) air sample was also collected during the soil vapor sampling event to identify and evaluate potential impacts during the sample collection. The air sample was collected over an approximate 4-hour period at a location upwind of the soil vapor sample locations and analyzed by USEPA method TO-15.

December 2008

TtEC installed two soil vapor points at soil vapor sample locations SV-08 and SV-09 (see Figure 2-1). The soil vapor points were located within the East Street Right-of-Way at locations between the identified on-site impacts (i.e., NAPL in subsurface soil in/near the area of the former 200,000 ft^3 holder and the former octagonal holder), SV-07, and potential off-site receptors (e.g., residences). The soil vapor sampling was conducted in accordance with the

October 2008 Additional Soil Vapor Sampling Work Plan, and the NYSDEC and NYSDOH approved Appendices A and B of NG's Draft SOP for Soil Vapor Intrusion Evaluation (updated September 2007).

The soil vapor points (SV-08 and SV-09) were installed using direct-push methods to a depth of 8 feet bgs on December 5, 2008. The soil vapor probes were constructed and checked for leaks using methods similar to those used during the February 2008 soil vapor sampling event. The soil vapor samples were collected at a maximum flow rate of less than 0.2 liters per minute in certified clean, evacuated Summa® canisters and analyzed for the compounds identified on USEPA method TO-15. An ambient (outdoor) air sample was also collected using similar methods to those used during the February 2008 soil vapor sampling event and analyzed for the compounds identified on USEPA method TO-15.

2.12 SURVEY

TtEC retained the services of C.T. Male Associates, P.C., a New York State licensed land surveyor, to survey the Site and surrounding properties. The survey included the previously investigated off-site study area and residential properties adjacent to the Site. A boundary survey of the surrounding properties, identification of easements and rights-of-way, and vertical and horizontal surveying of new and existing monitoring wells, soil borings, and test pits was also included. The elevation of reference points on each monitoring well (the top of the inner well casing) was also surveyed to allow the determination of groundwater elevations and flow direction. Corners of the Site and of properties adjacent to the National Grid property, as well as nearby properties within and near the off-site study area and open swale, were staked in the field with iron markers so that the boundaries may be delineated in the future. In addition, a topographic survey was completed for the Site and for the off-site study area, with particular focus on the open swale, drainage features (e.g. outfall pipes, culverts) associated with the swale and debris piles that were placed in the Off-site Study Area by the current property owner. The survey information associated with the swale and debris pile was not updated during the 2008 survey activities.

2.13 ANALYTICAL PROGRAM

Analytical testing for the RI was performed by Galson Laboratories (Galson), Syracuse, New York; Severn Trent Laboratories, Monroe, Connecticut; Severn Trent Laboratories, Newburgh, New York; Chemtech, Mountainside, NJ; and Test America, Edison, New Jersey and South Burlington, Vermont. The laboratories are New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratories and participating members of the NYSDEC Analytical Services Protocol (ASP) program. Fingerprint analyses were performed by Worldwide Geosciences of Houston, Texas.

The analytical program included the following analyses:

- NYSDEC ASP Target Compound List (TCL) Volatile Organic Compounds (VOCs)
- NYSDEC ASP TCL Semi-Volatile Organic Compounds (SVOCs)
- NYSDEC ASP TCL Pesticides and Polychlorinated Biphenyls (PCBs)

- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- NYSDEC ASP Target Analyte List (TAL) metals
- NYSDEC ASP total cyanide
- Total organic carbon (TOC)
- Source fingerprinting (modified ASTM method D-3328)
- Total petroleum hydrocarbons (TPH)
- Heat quantity (BTUs)
- Percent solids
- Sulfur
- Geotechnical parameters
- Toxicity Characteristics Leaching Procedure (TCLP) testing
- USEPA Method TO-15

2.13.1 QA/QC Program

Field quality control samples consisting of field duplicates, field blanks, trip blanks, and potable water blanks were collected and analyzed to assess field sampling accuracy and precision. A total of 22 field duplicates, 16 field blanks, 14 trip blanks, and one potable water blank were part of the QA/QC Program during the RI field activities. The field duplicate samples were analyzed to evaluate the reproducibility of the sampling procedures. Duplicate samples were collected at a rate of approximately five percent of the total samples for each specific matrix for each type of analysis (i.e., one duplicate for up to every 20 samples).

One field blank was collected for up to every 20 samples, to verify the appropriateness of field decontamination techniques for sampling equipment. A trip blank accompanied each shipment of groundwater samples to be analyzed for volatile organic compounds (e.g., BTEX) from the Site to the analytical laboratory. Trip blanks served to detect possible cross-contamination of samples resulting from handling, storage, and shipment procedures. In addition, a sample of potable water used for decontamination of the drilling rig and split-spoons was collected from the water tank on the drilling rig on September 3, 1999, to confirm that the source of contamination in the field blank samples, if any, was not from the supplied water.

2.13.2 Data Validation

Data generated during the PSA and RI were validated as part of each study. Data Validation Services of North Creek, New York performed a QA/QC validation review of the analytical data generated during the RI, with the exception of the fingerprinting. This included a review of pertinent QA/QC data, such as sample extraction and analysis holding times, calibration, a review of laboratory blanks and QA/QC sample results, and a review of the analytical case narrative. Non-conforming QA/QC results were evaluated with respect to their implications for data reliability and usability. Data Usability Summary Reports (DUSRs) were prepared, and are provided in Appendix G. Upon completion of the data validation task, the analytical results and appropriate qualifiers were entered into the project database, and summary tables were prepared (Appendix F).

2.14 GEOPHYSICAL SURVEY

As part of the RI, TtEC performed a geophysical survey at East Street, Clark Street, East North Street/East North Street Extension, and the field north of the East North Street Extension. The survey was performed from December 11 through 15, 2000 using two geophysical methods: frequency domain electromagnetic induction (EMI) and electrical resistivity profiling. The focus of the survey was to determine if there were indications of a former buried swale near or adjacent to the storm water sewer and in the field north of the East North Street Extension (south of the existing swale). Methods, study area, procedures, results, and conclusions of the geophysical survey are described in Appendix J.

2.15 OPEN SWALE RECONNAISSANCE AND REVIEW

August 2006

Prior to the collection of samples in the open swale, a detailed field reconnaissance on August 9, 2006 was performed to document:

- The nature and composition of the banks and bottom of the open swale;
- Location and character of visible impacts, such as sheens and seeps, if any;
- Points of discharge into the swale;
- Conditions of surrounding land contributing to stormwater runoff; and
- Other observations pertinent to assessing the source of impacts in the open swale.

The physical description of the open swale area is presented in section 4.3.1.1. Representative photographs taken of the open swale are included in Appendix L.

On August 9, 2006, physical conditions of the open-swale area were observed and photo-documented. At the time of the site visit, the swale was only observed from the topside of its bank at areas that were accessible on foot. The banks of the swale consisted of a sand and silt mix with heavy vegetative cover. The surrounding topography was relatively flat with a gentle slope towards the swale. Standing water was observed throughout the length of the swale ranging in depth from a few inches to what appeared to be one to two feet. No sheen or other visible contamination was observed on the water surface in the swale. However, several items were observed to have been discarded into the swale and surrounding area. These items consisted of a rusted through 55-gallon drum, empty chemical containers and general refuse. Several drainage pipes and culverts were noted to be capable of discharging contents into the swale, although none were actively discharging anything at the time of the observation. One drain was constructed of 4-inch PVC material that was traced back to its point of origin inside the maintenance garage adjacent to the swale on the DPW property. A photograph of this drainage feature is presented in Appendix L.

Also, local references including libraries and municipal offices were visited to research any available information describing the storm drain networks that discharge into the swale, Village of Ilion's swale maintenance practices, and history of the operations at the property to note if any environmental issues were documented related to the swale. The following lists the locations visited and information researched related to the swale.

Ilion Town Library
The following report titles with respective publication dates were reviewed at the Ilion Town Library:

- NM-Initial Submittal, NYSDEC # D0-0001-9210, January 15,1997;
- NM-PSA/IRM Study, February 1998;
- NYSDOH-Health Hazards Map, Herkimer County;
- NM-QAPP & SAP, June 1996;
- German Flats Landfill Closure Plan;
- NM-Final Work Plan, May 1997; and
- Foster Wheeler-RI/FS, May 1999.

The NIMO submittal from 1997 stated the former landfill was approximately 500 feet north of the swale and the area is listed in the Inactive Hazardous Waste Sites in New York, Vol. G, April 1990. The report also gave mention to three underground storage tanks (USTs) on the DPW property (leaded/unleaded/diesel). Two reported spills have been reported to NYSDEC (Spill #'s 890641 and 9200678) relating to these USTs. The properties south and west of the DPW property were an auto repair shop and a junkyard. The junkyard was on the corner of East Clark and Cottage Streets and was operated by Star Metal and Waste Company.

The remaining documents reviewed were not pertinent to the DPW property or open swale area or have been discussed in previous sections of this report.

Brown's Directory of American Gas Companies
A search was performed of Brown's Directory of American Gas Companies for information on any gas plants in Ilion, NY. Dates of the directory from 1887 through 1912, excluding 1888, 1895-1898 (no publications of the directory in these years) were reviewed. No relevant information was discovered about the open swale in any year for Brown's Directory or further mention of the specific processes used at the former MGP. The directory did not list any specific processes occurring at the MGP during operation.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 INTRODUCTION

This section presents information relative to the physical surface and subsurface characteristics of the Site, near Site area and the off-site study area. The information discussed in this section is based on data generated from the PSA (as applicable), from the RI field activities, and from review of various published reference materials.

3.2 SITE TOPOGRAPHY

The Ilion (East Street) Former MGP Site, comprising approximately 1.3 acres of property in the Village of Ilion, is sloped to the north toward the boundary with East Clark Street. The Site is covered primarily with vegetation, with the exceptions of the regulator building, a gravel driveway/parking area in the central portion of the Site, and former building foundation walls (concrete) located in the southern portion of the Site. Based on the survey generated during the RI field program, the Site surface elevation ranges from approximately 392 to 402 feet above mean sea level (msl).

The off-site study area is also primarily vegetated, although there are gravel driveways, spoil piles, and a highway (New York State Route 5S) in the vicinity (Figure 1-2). A drainage swale (open swale), which receives drainage from a storm water sewer and conveys it to the Mohawk River, runs through the central portion of this area. Surface elevations range from approximately 379 feet above msl within the open swale to approximately 397 feet above msl at New York State Route 5S.

3.3 SURFACE WATER HYDROLOGY

The nearest surface water body is the Mohawk River, located approximately 2,200 feet northeast of the Site. The Mohawk River flows east approximately 80 miles before joining the Hudson River. The Mohawk River is classified by the NYSDEC as a Class B surface water body. Other surface water bodies within one mile of the Site include Fulmer Creek located approximately 4,000 feet east of the Site and Steele Creek located approximately 3,500 feet west of the Site. Both streams flow north and are tributaries of the Mohawk River. Fulmer Creek and Steele Creek are classified by the NYSDEC as Class C surface water bodies. Class B surface water bodies are suitable for primary contact recreation and any other uses except as a source of water for drinking, culinary, or food processing purposes. Class C waters are suitable for fishing and fish propagation. The water quality is suitable for primary and secondary contact recreation even though other factors may limit the use for that purpose (Parsons, 1998).

No surface water bodies are present on the Site. As described in Section 3.2, an open swale draining to the Mohawk River is present in the off-site study area.

3.4 GEOLOGY

3.4.1 Regional Geology

The Site is located in the Mohawk lowlands. Much of the unconsolidated deposits in the Mohawk lowlands were formed as a result of Pleistocene glaciation. The soil adjacent to and beneath the Site surficial fill deposits is comprised of alluvium derived from glacial deposits. Soil located south, southwest, and southeast of the Site is composed of glacial lacustrine sand, glacial outwash sand and gravel, and kame deposits (Casey and Reynolds, 1989). Kame sediments are deposited adjacent to glacial ice sheets.

The soil immediately below the Site is described by the Soil Conservation Service as Herkimer gravelly silt loam. Herkimer gravelly silt loams (HhA) form on the base of old alluvial fans and contain red and green Utica Shale chips. The Herkimer soils are well drained to moderately well drained, and have moderate permeability in the shallow zone and rapid permeability in the substratum. Rough broken land (RO) is present south of the Site. Rough broken land is steep land composed of glacial till, glacial outwash, and lacustrine deposits dissected by numerous, intermittent drainage channels. Cut and fill soil (Cu) is present north of the Site. The cut and fill soils are defined as soils recently disturbed by man and may represent borrow or disposal areas. The cut and fill land near the Site may have been used as a borrow area during the construction of the New York State Thruway. Areas of Cohoctah mucky very fine sandy loam (Co) are also present north of the Site. The Cohoctah soils are deep, poorly drained, medium textured near the surface and moderately coarse textured in the subsoil. Permeabilities are moderately rapid. The Cohoctah soils developed in low spots on flood plains in recent alluvium (Parsons, 1998).

The area glacial deposits are underlain by Late Ordovician-age Utica Shale bedrock. The depth to bedrock is approximately 250 ft. bgs or greater, and the general dip of the bedding planes is to the south-southwest. The surface of the bedrock is likely lowest near the center of the Mohawk River Valley (Casey and Reynolds, 1989). The dip of the bedrock results in the exposure of progressively older formations from south to north. Younger Frankfort Formation shales and siltstones are present above the Utica Shale in the hills south and north (across the Mohawk River) of the Site. The Utica Shale is underlain by the Trenton Group limestones and Black River Group limestones, cherts, and dolomites (Parsons, 1998).

3.4.2 Site Geology

Site geology is characterized by disturbed soils (primarily fill) overlying glacial deposits. The glacial deposits consist of lacustrine deposits and a sand and gravel unit. A layer of peat, possibly part of the glaciolacustrine sequence, is present above the glacial deposits in the northern portion of the Site. Based on Casey and Reynolds (1989), the sand and gravel unit could be part of the nearby kame or outwash deposits. The relationship of the units on site is displayed in Cross Section A-A’ (Figure 3-1). The transect of cross section A-A’ is presented on Figure 2-1.

Disturbed soils range in thickness from 2.5 ft. bgs (SB-07/MW-01) to 13 ft. bgs (SB-13). They are typically composed of sand, gravel, silt, clay, wood, coal and anthropogenic materials including ash, cinders, clinkers, brick fragments, wire, and wood chips. Wood chips were identified in three borings (SB-09, SB-12, and MW-08).

A thin layer of peat underlies the disturbed soils in the northern portion of the Site, ranging in thickness from 0.5 ft. (MW-07) to 3 ft. (SB-03/MW-03), and appears to thicken to the north. Peat was observed in borings SB-03/MW-03, SB-04/MW-04, TtSB-03, MW-07, MW-08, and MW-12. The depth of the peat ranged from 7.5 ft. bgs (SB-03/MW-03) to 11.5 feet bgs (TtSB-03). The elevation of the upper surface of the peat ranges from approximately 384 ft. msl (SB-03/MW-03 and MW-07) to 386 ft. msl (SB-04/MW-04 and MW-08), dipping to the north. Except where it is locally covered by sedimentary deposits such as silts, sands, and clays, the peat, where present, appears to have been the historical ground cover prior to development of the Site.

Underlying the peat, where present, and the disturbed soils are lacustrine deposits composed of silts, sands, and clays. Grain size analyses of this interval conducted during the PSA and RI indicated sandy silt, ML (SB-06/MW-06 24 to 26 ft bgs) (Parsons, 1998); sandy silt, ML (SB-12A); and silty sand, SM (TtSB-02 8-12 ft bgs). The depth to the top of the lacustrine deposits ranges from approximately 2.5 ft bgs (SB-07/MW-01) to 12.5 ft (SB-04/MW-04). The thickness of this unit ranged from approximately 2 ft (SB-03/MW-03) to 26 to 27 ft bgs (SB-06/MW-06 and SB-12, respectively). The elevation of the top of the lacustrine deposits ranges from approximately 396 ft msl to approximately 381 ft (SB-03/MW-03). Therefore, the surface of the lacustrine deposits appears to dip to the north. The deposits appear to become thinner to the north as well.

The sand and gravel unit (possible kame or outwash deposit) underlies the lacustrine deposits across the Site area. This unit contains varying amounts of silt and clay. Grain size analysis of these deposits indicated silty, clayey sand with gravel, SC-SM (SB-03/MW-03 16 to 18 ft. bgs) and silty, clayey gravel with sand, GC-GM (SB-04/MW-04 12-14 ft bgs) (Parsons, 1998). The actual percentage of gravel in this unit may be more than that indicated in the grain size analyses, as 2-inch outside diameter split spoons tend to under sample gravel due to the size of the sampler opening. The depth to the top of this unit varies from approximately 12 ft. bgs (SB-03/MW-03 and TtSB-01) to 34 ft. bgs (SB-12). Sand and gravel were encountered to a depth of approximately 62 ft. bgs at the deepest Site boring (SB-12).

3.4.3 Off-Site Study Area Geology

Off-site study area geology tends to be similar to the Site geology. Typically, there is a layer of disturbed soil (generally fill, but including topsoil) overlying sand, silt, clay, or peat. In the vicinity of the site, the peat overlies lacustrine deposits which, in turn, overlie sand and gravel. North of the site, particularly north of the East North Street Extension, locally present sand, silt, or clay overlie peat. The peat overlies silt, sand, and/or clay alluvial or lacustrine deposits, frequently containing shells of small aquatic animals. Cross section B-B’ (Figure 3-2) displays relationships between off-site units. The transect of cross section B-B’ is shown in Figure 2-2.

Disturbed soils typically range in depth from 4 to 8 ft. bgs but may range from approximately 3 ft. bgs (FW-04) to 12 ft. bgs (FW-19B). They typically consist of sand, silt, gravel, clay, pebbles, and anthropogenic material including coal, ash, brick, glass, bottles, newspaper, paint-like material, and various debris. Two newspapers found in the upper three feet of the fill (in the field north of the East North Street Extension) were dated June 1960. The vast majority of anthropogenic material observed in the disturbed soils does not appear to be site related. For materials such as coal and ash observed in the disturbed soils, though similar materials may have been used or generated by MGPs, there is no indication that the materials observed are Site related. It is important to note that the Village of Ilion did not use the former Ilion landfill until 1933, over 20 years after the Ilion MGP ceased manufacturing gas (EA, 1988). However, it is unknown when the field north of the East North Street Extension was first used as a refuse disposal area.

The locally present sand, silt, and clay deposits overlying the peat generally range in thickness from 2 to 4 feet. Sometimes this unit contains root materials or small shells. The top of the peat is encountered at depths typically ranging from 8 ft bgs to 11 ft bgs, but was observed as high as 4 ft bgs in soil borings FW-09C and GP-16. The bottom of the peat generally extended to the bottom of borings (usually 12 ft bgs), although the bottom of the peat was encountered as shallow as 8 ft bgs in boring FW-09C. Soil boring logs from monitoring wells MW-14 through MW-17 and SB-16, prepared during the most recent phase of RI activities, indicate the bottom of the peat material extends to a maximum of 15 feet bgs. The elevation of the surface of the peat drops from approximately 386 ft msl (MW-09)/385 ft msl (MW-11) at the vicinity of the Site to approximately 378 ft msl at the Off-Site study area north of the East North Street Extension.

3.5 GROUNDWATER HYDROLOGY

3.5.1 Regional Groundwater Hydrology

Regionally, groundwater flow is expected to be toward the Mohawk River, which serves as the regional discharge feature. Typically, in the vicinity of regional discharges, upward hydraulic gradients are present between bedrock aquifers and overlying overburden aquifers.

In the shallow unconsolidated deposits in the vicinity of the Site, fine-grained, low permeability deposits are common. However, moderate quantities of groundwater can be obtained from localized sand and gravel beds and lenses. The Village of Mohawk has municipal supply wells south of the Mohawk River approximately 1 mile downstream (east) of the Site. The wells are screened in glacial deposits at depths ranging from 21 to 53 feet bgs. Reported well yields range from 350 to 1100 gallons per minute (gpm). The Village of Frankfort has supply wells approximately two miles west and upstream of the Site along the Mohawk River. The wells are completed in glacial deposits at depths ranging from 86 to 112 feet bgs. Reported well yields range from 345 to 370 gpm (Parsons, 1998).

3.5.2 Site Groundwater Hydrology

Thirteen monitoring wells were installed on and near the Site during the PSA and RI to characterize groundwater quality, groundwater flow direction, and aquifer characteristics. Synoptic groundwater level measurements for the Site and Off-site study areas are presented in Appendix K. Eight rounds of groundwater level measurements were completed for all wells existing at the time of monitoring. These eight rounds were conducted on July 28, 1997; October 29, 1997; October 7, 1999; February 15, 2000; October 19, 2004; October 27, 2004; August 8, 2006; and on February 25 and 26, 2008. Piezometric surface maps have been created for six of these eight rounds (Figures 3-3 through 3-8A). The groundwater elevations collected on July 28, 1997 were excluded from mapping based on an apparently anomalous measurement at MW-01. The groundwater elevations collected on October 7, 1999 were excluded from mapping because of an apparently anomalous measurement at MW-02. Data for monitoring well MW-05 was not included in the piezometric surface maps, as it is located within the former octagonal gasholder. The groundwater within the former octagonal gasholder appears to be hydraulically isolated relative to groundwater across the Site (Figure 3-1). Groundwater contours on Figures 3-3, 3-4, 3-5, 3-6 3-7, and 3-8A represent modified versions of contours generated in GIS\Key™ version 4.2.1 using Quicksurf 5.1.

In Figures 3-3 through 3-8A, groundwater elevations for monitoring wells MW-09 and MW-11 were excluded. The groundwater elevations for these wells are relatively high with respect to other site wells. A review of boring logs indicated that these monitoring wells are screened above the peat layer and primarily above the sand and gravel, while MW-01 through MW-08, and MW-10 are screened in the sand and gravel and/or lacustrine deposits. MW-07 is also screened partially above the peat layer; however, a large portion of the MW-07 screen is within the sand and gravel unit. Groundwater elevations in monitoring wells MW-09 and MW-11 may reflect the elevation of water perched on top of the peat unit and/or these wells may not be hydraulically connected to the sand and gravel water-bearing unit; therefore, the data from these monitoring wells were not used. In addition, the groundwater elevation collected at MW-12 was not included in the preparation of the piezometric surface map for the February 2008 monitoring event. The February 2008 groundwater elevation at MW-12 was inconsistent with previous groundwater sampling events and the identified direction of groundwater flow.

The piezometric surface for the six mapped monitoring events is relatively flat (*i.e.*, it has a relatively low hydraulic gradient). There is less than a 1-foot difference between the highest and lowest elevations for the October 29, 1997 monitoring event. There is approximately a 2-foot difference between the highest and lowest elevations for the two 2004 monitoring events. Over these three mapped monitoring events, the depth to water ranged from approximately 4 ft bgs (MW-09) to 18 ft bgs (MW-06). Groundwater elevations (excluding MW-05) for the six mapped monitoring events ranged from 383.40 ft msl (MW-04) to 388.69 ft msl (MW-06). The water elevation at MW-05, screened within the former octagonal gasholder, over the three mapped monitoring events, ranged from 393.21 ft msl to 393.67 ft msl.

In general, the following observations were noted upon review of the piezometric surface maps:

- The figures show relatively higher groundwater in the southeast corner of the Site from which groundwater flows in a northwest direction;
- For the six mapped monitoring events, the hydraulic gradient for flow to the northwest from MW-06 ranges from approximately 3.76×10^{-3} feet/foot (October 29, 1997) to 9.41×10^{-3} feet/foot (October 19, 2004);
- For the October 29, 1997 monitoring event (Figure 3-3), groundwater flows northwest out of the southeast corner of the site;

- For the remaining monitoring events (Figures 3-2 through 3-8A), groundwater flows from the high in the southeast corner of the Site; and
- The groundwater flow pattern is generally consistent with the regional expectation (toward the Mohawk River).

Hydraulic conductivity at the Site was relatively high, ranging from 2.48 x 10^{-3} cm/sec to 2.44 x 10^{-2} cm/sec. The geometric mean hydraulic conductivity was 1.08 x 10^{-2} cm/sec. Measured vertical permeability from a Shelby Tube sample collected from MW-01 from a depth of 12 to 13.7 feet was 2.19 x 10^{-5} cm/sec. This sample interval corresponds to the glacial lacustrine sediments (Parsons, 1998). Slug test results and geotechnical sample results for the PSA conducted by Parsons Engineering Science, Inc. are presented in Appendix D.

Groundwater velocities for the Site were calculated using the equation $V = (KI)/n$, where

V is groundwater velocity;
K is hydraulic conductivity;
I is hydraulic gradient; and
n is porosity.

A groundwater velocity was calculated using the maximum and minimum I calculated for the six contoured monitoring events for groundwater flowing northwest from MW-06 (see above). For K, the mean hydraulic conductivity of 1.08 x 10^{-2} cm/sec (30.6 ft/day) was used; and for n, a commonly published value of 25% for sands was used. Resulting groundwater velocities ranged from 0.46 ft/day to 1.15 ft/day.

3.5.3 Groundwater Usage in Site Vicinity

Groundwater is used for municipal supply east of the Site by the Village of Mohawk and west of the Site by the Village of Frankfort. The Village of Ilion obtains its municipal water supply from surface water sources (Parsons, 1998). For additional information, see the discussion in Section 3.5.1.

3.5.4 Off-Site Study Area Groundwater Hydrology

Four monitoring wells were installed at and near the Off-site study area during the February 2008 RI activities to evaluate groundwater quality and flow direction. Synoptic groundwater level measurements for the Site and Off-Site Study areas are presented in Appendix K. One round of groundwater level measurements was completed for the Off-site study area monitoring wells existing at the time of monitoring. The round of groundwater monitoring was conducted on February 25 and 26, 2008. A piezometric surface map has been created for this first round of monitoring (Figures 3-8B). Groundwater contours presented on Figure 3-8B represent modified versions of contours generated in GIS\Key™ version 4.2.1 using Quicksurf 5.1.

The piezometric surface observed during the February 2008 monitoring event is relatively flat (*i.e.*, it has a relatively low hydraulic gradient). There is less than a 0.3-foot difference between the highest and lowest groundwater elevations observed at MW-14 and MW-16, which are approximately 150’ feet apart.

In general, the following observations were noted upon review of the piezometric surface maps:

- The figures show relatively higher groundwater elevations at the western portion of the Off-Site Study Area and a general direction of groundwater flow to the northwest, generally consistent with the Site study area groundwater flow direction;
- For the February 2008 monitoring event, the hydraulic gradient for flow to the northwest of MW-16 is approximately 2.00×10^{-3} feet/foot; and
- The groundwater flow pattern is generally consistent with the regional expectation (toward the Mohawk River).

The soil type observed at the Off-Site study area is comparable to the soil type observed at the Site study area, indicating hydraulic conductivity values are likely consistent with the values obtained from slug test data and analyses performed at the Site Study Area.

4.0 NATURE AND EXTENT OF IMPACTS

4.1 INTRODUCTION

As discussed in Section 2.0, over the course of the PSA and RI, field and analytical data were collected to assess the nature and extent of MGP-related impacts at the Site, near Site area, and at the off-site study area. Field observations of impacts are summarized in the text below. The tabulated analytical results of the RI sampling investigation conducted through December 2006 are summarized by environmental medium in Appendix F. The results from the PSA are not presented in these tables; however, copies of the summary tables from the Parsons, 1998 report are provided in the appendix.

Site surface and subsurface soil concentrations were compared to the recommended soil clean-up objectives from the NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046, *Determination of Soil Clean-up Objectives and Clean-up Levels* (April 1995 and December 2000) [hereafter referred to as NYSDEC TAGM 4046 levels]. Total BTEX and Total PAH concentrations were compared to the objectives for total volatile organics (10 ppm) and total semi-volatile organics (500 ppm), respectively. These values were used as screening criteria until December 2006 to evaluate if additional delineation sampling was required for subsurface soils during the course of the RI.

In December 2006, New York State adopted new criteria under 6 NYCRR Subpart 375-6: Remedial Program Soil Cleanup Objectives (SCOs). Since the multiple phases of the RI were developed and implemented based on the TAGM 4046 levels described above and the March 2007 version of the RI Report was already in preparation, the main body and text of the March 2007 version of the RI Report and any subsequent RI Reports, including this report, presents soil sample analytical data collected prior to December 2006 in comparison to the TAGM 4046 levels. The main body and text of this RI Report, and any subsequent RI Reports, summarizing the results of soil sample analytical data collected after December 2006 are only compared against the new SCO values.

NG has prepared three separate appendices to address the change in soil criteria. Appendix F provides a data summary of the soil and groundwater RI results conducted prior to December 2006. Appendix F contains the soil results compared to the TAGM 4046 levels and groundwater results compared to the applicable NYSDEC WQ Value. Appendix M provides a comparison of the soil RI analytical data collected from the beginning of the RI through the February 2008 RI activities to the new SCOs issued by the NYSDEC. Appendix O presents the soil, groundwater, and soil vapor results obtained during the February 2008 RI activities to their current and applicable NYSDEC criteria.

Soil samples collected during RI activities conducted after December 2006 from the Site, near Site area and Off-Site Study Area were compared to the following NYSDEC SCOs: Protection of Groundwater criteria, Protection of Ecological Resources criteria, and Protection of Public Health criteria. As indicated, Appendix M also presents the comparison of the soil RI data collected prior to December 2006 to these SCOs.

The Site is zoned as commercial; therefore, the Protection of Public Health, Commercial SCO was applied. The Protection of Public Health, Residential SCO was used for comparison of the near Site area as the zoning is residential (see Table M-1 and Figure M-1 of Appendix M). The Off-Site Study Area is zoned residential in the southwest portion and manufacturing in the undeveloped east/northeast portion; therefore, Protection of Public Health, Residential SCO, was applied to the samples collected in the southwest and Protection of Public Health, Industrial SCO, was applied to the samples collected in the undeveloped east/northeast portion including the swale (see Table M-1 and Figure M-1 of Appendix M).

Groundwater analytical results were compared with levels specified in NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1, *Ambient WQ Values and Guidance Values* (June 1998, January 1999, and April 2000) [hereafter referred to as NYSDEC WQ Values]. For groundwater, Class GA values were applied. Class GA waters are defined as fresh groundwater, found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock, which are used as a source of potable water supply (NYSDEC, 1986).

The NYSDOH recommends evaluating the soil vapor results "as a whole" in conjunction with results from other site environmental media and the site conceptual model. Since the October 2006 Final NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York indicates the State does not present any standards, criteria, or other guidance values for concentrations of volatile chemicals in subsurface vapors (either soil vapor or sub-slab vapor) (NYSDOH, October 2006), NYSDOH suggests comparison to background outdoor air levels, site-related outdoor air sampling results, or the NYSDOH guidelines for volatile chemicals in air. NG utilized multiple lines of evidence to evaluate the potential for vapor intrusion at nearby occupied structures. The soil vapor concentrations detected in soil vapor samples collected during the RI were compared to ambient outdoor air concentrations collected at the same time as the soil vapor samples. Other lines of evidence included a review of the groundwater contaminant concentrations, consideration of the distance from affected groundwater or soil to the nearest occupied structures, and comparison of soil vapor concentrations to screening levels presented in the USEPA's OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils.

NG reviewed the USEPA's OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (USEPA Guidance) to provide additional analysis and evaluation regarding the potential for soil vapor to migrate off-site. The USEPA Guidance provides target indoor air concentrations, shallow and deep soil gas concentrations, and groundwater concentrations for MGP-related constituents and other volatile organic compounds for comparison of site-specific analytical results (USEPA, 2002). Three levels of health risk for potential carcinogenic compounds are identified, representing 10^{-4}, 10^{-5}, and 10^{-6} cancer risks, but the USEPA Guidance does not recommend which level to use for a specific exposure setting. In accordance with recommendations presented in Section IV of the USEPA Guidance, NG elected to utilize the 10^{-5} health risk level and the shallow soil gas screening values identified for this health risk level for evaluation of the site-specific soil vapor analytical data collected during the RI (USEPA, 2002).

After an initial screening of the data without regard to an attenuation factor, NG has elected to conservatively use the 0.1 attenuation factor to further screen soil vapor data in accordance with the USEPA's Guidance. USEPA recommends an attenuation factor (equal to the indoor air concentration divided by the soil vapor concentration) of 0.1 be used to conservatively screen shallow soil vapor concentrations (USEPA, 2002). The soil vapor data presented in Appendix O provide the raw soil vapor data without regard to an attenuation factor.

In the following discussion, Site and near Site area field observations and analytical results are presented in Section 4.2 and off-site study area field observations and analytical results are presented in Section 4.3. Figures illustrating the sampling locations and constituent concentrations are referenced in the various matrix subsections where applicable. Figures 4-1 through 4-5C present analytical data for the Site and near Site area. Figures 4-6 through 4-8 present analytical data and sample locations at the Off-Site Study Area. Figure 4-9 presents the estimated horizontal and vertical extent of NAPL at the Site, near site, and Off-Site Study Area.

4.2 SITE AND NEAR SITE AREA

4.2.1 Physical Investigation Results

Detailed site geology is described in Section 3.4.2. This section will address MGP-related impacts physically observed during investigation activities at the Site and near Site area.

4.2.1.1 Soil and Groundwater

NAPL was observed within the soil in six Site soil borings (SB-05/MW-05, SB-08, SB-10, SB-11, SB-14, and SB-15). Two of the six soil borings (SB-08 and SB-15) were associated with the former 200,000 cu. ft. gasholder with the remaining four borings being associated with the former octagonal gasholder. NAPL was observed in the shallower deposits at a depth of approximately 10 feet bgs and was not observed in the deeper sand and gravel deposits.

Figure 4-9 (Cross-Section C-C' and D-D') depicts the estimated horizontal and vertical extent of NAPL at the Site Study Area associated with the former 200,000 cu. ft. gasholder and the octagonal gasholder (Cross-Section C-C' and D-D' and Plan View). The NAPL at the former gasholders appears to be primarily located at the depths of the slabs of the former gasholders or at the base of the surface fill materials. Visual observation and description of subsurface soils encountered during advancement of soil borings and test pits at the former 200,000 cu. ft. gasholder indicates horizontal migration outside the former gasholder is limited to the NAPL observed within the subsurface soils encountered at SB-15, performed just outside the footprint of the former 200,000 cu.ft. gasholder. Soil boring TtSB05 and test pit TP-02 delineate the horizontal extent of NAPL at the former 200,000 cu. ft. gasholder.

Soil boring SB-12 and SB-13 delineate the horizontal extent of NAPL at the former octagonal gasholder. Visual observations and descriptions of subsurface soils encountered during advancement of soil borings and test pits at the former octagonal gasholder indicates horizontal and vertical migration of NAPL is likely limited to the former gasholder footprint. Although there are limited borings located at the northern extent of the octagonal gasholder, the slabs and portions of the sidewalls were detected at test pits TP-01A, TP-02A, and TP-03A and at monitoring wells MW-05, SB-10, SB-11, and SB-14). In addition, the groundwater elevation at MW-05 (screened within the gasholder) is approximately 8 feet higher than the groundwater surface elevation beneath and around the gasholder (Figure 3-1). The perched water within the gasholder indicates that the remaining gasholder foundation is competent and groundwater as well as NAPL is hydraulically isolated from groundwater and media outside the gasholder. The NAPL is present within the soils located immediately above the slab of the former gasholder, which remains in place.

NAPL was not observed at the site groundwater monitoring wells during well development, collection of groundwater level measurements, or groundwater purging and sampling.

Wood chips were observed in three soil borings (SB-09, SB-12, and MW-08). The wood chips were found in the disturbed soils above the groundwater surface at the following depths: SB-09, 7.3 to 7.7 feet bgs; SB-12, 4 to 6 feet bgs; and MW-08: 6.5 to 6.9 feet bgs.

4.2.1.2 Historic Subsurface Structures and Associated NAPL

Seven test pits (TP-01, TP-01A, TP-02, TP-02A, TP-03A, TtTP-01, and TtTP-02) and 15 soil borings (MW-05, SB-08, SB-10 through SB-13, SB-12A, SB-13A, SB-14, SB-15, SB-21 through SB-24, and TtSB-01) were excavated to determine the existence, location, integrity, and contents of former Site gasholder construction and nature of fill materials contained therein. A summary of the test pits and soil borings performed to evaluate each gasholder is presented below.

- Test pits TP-01, TtTP-01, and TtTP-02 were performed to investigate the former 80,000 cu. ft. gasholder;
- Soil boring TtSB-01 was advanced to investigate the former 80,000 cu. ft. gasholder;
- Test pits TP-01A, TP-02A, and TP-03A were performed to investigate the former octagonal gasholder;
- Soil borings SB-10 through SB-13, SB-12A, SB-13A, and SB-14 were advanced for the investigation of the former octagonal gasholder.
- Test pit TP-02 was performed to investigate the former 200,000 cu. ft. gasholder.
- Soil borings SB-08, SB-15, and SB-21 through 24 were advanced to investigate the former 200,000 cu. ft. gasholder; and
- Six additional soil borings (TtSB-03, TtSB-04, TtSB-05, CB-01, TtCB-03, and CB-03a) were installed in August 2006 to further delineate the horizontal and vertical extent of MGP-related impacts associated with the former 200,000 cu. ft. gasholder.

Figure 4-3 shows the geometry of the remaining former gasholder structures in the Site subsurface and the location of soil borings and test pits.

Based on the results of test pits, the slab and portions of the side walls of the former octagonal gasholder appear to be present. A brick wall was encountered in test pits TP-01A, TP-02A, and TP-03A at depths of 4 feet bgs, 6 feet bgs, and 6 feet bgs, respectively. Brick was encountered at approximately 11 feet bgs in the 4 soil borings advanced within the circumference of the gasholder (MW-05, SB-10, SB-11, and SB-14). The water elevation in MW-05 (screened within the gasholder) is approximately 8 feet higher than the groundwater surface elevation beneath the gasholder (Figure 3-1). The perched water within the gasholder indicates that the remaining gasholder foundation is competent (and that MW-05 is hydraulically isolated from the groundwater at the Site).

NAPL was observed in soil borings SB-05/MW-05, SB-10, SB-11, and SB-14, within the footprint of the former octagonal gasholder. The NAPL was encountered just above the gasholder bottom from approximately 10 to 11 feet bgs. The nature of the NAPL ranged from blebs to full NAPL saturation of the soil.

The slab for the former 200,000 cu. ft. gasholder appears to be intact based on the results of test pits and soil borings. In test pit TP-02, a 6-inch concrete slab was encountered at approximately 2.5 feet bgs. The slab was encountered over the majority of the 38-foot length of the test pit. Soil borings SB-08, SB-22, SB-23, and SB-24 encountered concrete from 1 to 3 feet bgs. Soil boring SB-21 encountered concrete from 6 to 8 feet bgs. Based on data collected from TP-02 and SB-24, the slab was set on approximately 6 feet of fill materials above a native lacustrine deposit. A wall was not observed at the edge of the gasholder slab encountered in test pit TP-02. Beneath the slab, NAPL was observed in soil borings SB-08 and SB-15. In borings SB-08 and SB-15, the NAPL was encountered from approximately 8 to 10 feet bgs, at the bottom of the fill material and above the lacustrine deposits. In SB-08, only blebs were observed. In SB-15, the NAPL was described as thick and “taffy-like.” Blebs of NAPL were also observed in a sandy seam at approximately 13 feet bgs in boring SB-15. Of the six additional soil borings installed in August 2006, three (TtSB-03, TtSB-04, TtSB-05) were installed within/adjacent to the 200,000 cu. ft. gasholder. Concrete fragments were encountered within the top five feet beneath grade in borings TtSB-03, TtSB-04, TtSB-05. NAPL was not observed in any of these soil borings. Soil borings (CB-01, TtCB-03) were installed as step-out boring locations because of high PID readings and odors in TtSB-03 and TtSB-05. PID screening levels at TtSB-03 was 111 ppm at 10-12 feet bgs and TtSB-05 was 74.5 ppm at 10-12 feet bgs. TtSB-03 had a tar-like odor at 10-12 feet bgs and TtSB-05 had a naphthalene-like odor at 10-12 feet bgs. Soil boring CB-03a was installed to evaluate the area between soil borings TTSB-05 and CB-03. Soil conditions from CB-01, TtCB-03, and CB-03a did not exhibit high PID readings and did not have tar-like or naphthalene-like odors.

Based on the results of test pits and soil borings, the former 80,000 cu. ft. gasholder appears to have been removed except for a circular footing constructed of stone and concrete. The three test pits encountered the top of a wall, from 0 to 2 feet below grade. In TP-01, the wall was 4 feet thick and constructed of concrete. In TtTP-01, the wall was stone and 7 feet thick with a 6-inch steel pipe crossing through it. At the inner edge of the wall, the pipe turned up, increased to 12 inches in diameter and rose to the ground surface. The wall in test pit TtTP-02 was stone and 4 foot thick. The wall was observed to extend to at least the bottom of each test pit (6.5 feet in TP-01, 8 feet in TtTP-01, and 9 feet in TtTP-02). A slab was not observed in the three test pits; therefore, soil boring TtSB-01 was advanced within the circumference of the wall. The soil boring was advanced to a depth of 26 feet bgs without encountering a layer of stone or concrete. Based on the absence of a slab, the wall appears to be a footing. The slab apparently rested on the wall/footing and was apparently removed with the gasholder superstructure. Based on Site geology, it appears that the footing for this structure was necessitated by the peat present in this portion of the Site, and the footing appears to have been set on the lacustrine unit or sand and gravel unit beneath the peat. The area inside the footing wall appears to have been filled with loose sand and gravel. No NAPL was observed in the test pits and soil borings associated with the investigation of this gasholder.

Test Pit TP-03 was excavated to investigate a suspected underground storage tank (UST) in the area west of the former building. Presence of a UST was confirmed, and it was subsequently removed. Photographs and field observations indicate that the UST was competent when removed (Parsons, 1998).

4.2.2 Analytical Results

4.2.2.1 Surface Soil Analytical Results

Thirty-two (32) surface soil samples (i.e., soils less than 6 inches bgs) were collected on Site or at the near Site area to evaluate potential surficial impacts. Four of these locations were sampled as part of the PSA (1997); the remaining surface soil samples were collected by TtEC during the RI. In addition, 14 samples were collected from 0 to 2 inches bgs at locations considered to be "background," (i.e., not impacted by site activities, to establish baseline soil conditions). Results for the surface soil analyses are provided in Tables F-2 through F-7 of Appendix F. Total PAH and Total carcinogenic PAH (cPAH) concentrations for the surface soils are presented on Figure 4-1 (site and vicinity) and Figure 4-2 (background locations).

BTEX constituents were not detected during the surface soil sampling (see Appendix F, Tables F-2 and F-4).

Total PAH and Total cPAH concentrations for the surface soils are presented in Table F-4 and plotted on Figure 4-1. Minimum and maximum concentrations for Total PAH and Total cPAH were noted in the same locations, SS-29 (minima of approximately 4.2 ppm and 2.1 ppm, respectively) and SS-08 (maxima of about 180 ppm and 101 ppm, respectively). For the background locations, the samples contained concentrations of Total PAH from approximately 1 ppm to 44.7 ppm and Total cPAH from almost 0.5 ppm to 21.2 ppm, as presented on Figure 4-2. There was no exceedance of the 500 ppm TAGM 4046 screening level in the surface soils. The following Site and near Site area locations had Total PAH and/or Total cPAH concentrations greater than the maximum value detected in the background locations: SS-02, SS-06 and SS-08 in the southern portion of the Site; SS-11 through SS-13, SS-22 and SS-27 along the boundary with East Street; and SS-16 and SS-17 along the northwestern boundary of the Site (see Figure 4-1). Individual PAH concentrations detected in the surficial soils are compared to NYSDEC TAGM 4046 levels in Table F-3 of Appendix F.

Based on the distribution of PAHs on Site, at the near Site area, and at the background locations, it appears that former MGP operations may have locally contributed a portion of these constituents to the surficial soils. However, other sources (such as vehicle exhaust, asphalt pavement, etc.) may also be a factor, especially for locations along roadways.

Eleven metals were detected in the RI samples from background surface soil locations BKGSS10 through BKGSS13 (see Table F-5), while 21 metal constituents were present in the PSA surface soil samples. Arsenic, beryllium, copper, lead, mercury, nickel, and zinc occurred in at least one of the samples at a concentration above NYSDEC TAGM 4046 levels. The Site concentrations for the metals appear to be generally equivalent in magnitude to those detected in the background samples, and thus do not indicate that the Site contributed metals to the surface soils.

During the RI, surficial soil samples from ten locations near the perimeter of the Site were analyzed for cyanide. Previously during the PSA, cyanide analyses were performed on four Site and three background location samples. Cyanide was detected in three surface soil samples as follows: SS-28 at 0.96 ppm, SS-30 at 12.4 ppm, and SS-31 at 1.2 ppm (see Table F-6). For cyanide, a NYSDEC TAGM 4046 level has not been developed. However, for comparison purposes, the USEPA Region 3 Risk Based Concentrations (RBCs) for cyanide in soils at industrial and residential properties are 20,000 ppm and 1,600 ppm, respectively.

4.2.2.2 Subsurface Soil Analytical Results

A total of 76 soil samples and three duplicate samples were collected from locations across the Site at depths of 2 feet bgs or more. Tabulated results of the analyses are presented in Appendix F, Tables F-11 through F-17. Total BTEX, Total PAH, Total cPAH, and cyanide concentrations for the subsurface soil samples are presented on Figure 4-3.

Total BTEX concentrations greater than the 10 ppm TAGM 4046 screening level for total volatiles were noted for three samples, SB-08 at 9.2 to 10 feet bgs (approximately 119 ppm); SB-11 at 10.3 to 10.7 feet bgs (76.6 ppm); and SB-15 at 9.6 to 10 feet bgs (1,128 ppm) (see Table F-13). As shown in Figure 4-3, these three locations (i.e., SB-08, SB-11 and SB-15) appeared to contain residual NAPL during sampling (see Section 4.2.1). Based on the soil boring logs, SB-11 is located within the footprint of the former octagonal gasholder, and SB-15 is located outside the footprint of the former 200,000 cu. ft. gasholder (see Appendix A). Individual BTEX constituents were detected sporadically across the Site, generally at concentrations less than NYSDEC TAGM 4046 levels (see Appendix F, Table F-11).

As shown on Table F-13 and Figure 4-3, elevated Total PAH concentrations (i.e., greater than 500 ppm) were measured at the following locations: SB-11 at 10.3 to 10.7 feet bgs, MW-05 at 8 to 10 feet bgs (within the octagonal gasholder, near bottom), MW-02 at 4 to 6 feet bgs (between the octagonal gasholder and the 200,000 cu. ft. gasholder), SB-08 at 9.2 to 10 feet bgs, SB-15 at 9.6 to 10 feet bgs (outside the 200,000 cu. ft. gasholder), and TtSB-05 at 10 to 10.5 feet bgs (adjacent to the 200,000 cu. ft. gasholder). With the exception of MW-02 and TtSB-05, residual NAPL was noted in these borings during drilling (see Section 4.2.1). Fingerprint analysis of the sample from SB-08 indicated the PAHs have a “coal tar” origin (see Appendix F, Table F-27). Comparison of individual PAHs to TAGM levels is presented in Table F-12.

During the RI investigation, 37 samples and one duplicate were collected from around the Site and analyzed for metals (see Appendix F, Table F-14). This is in addition to the seven PSA soil samples. Generally, the concentrations for the metal constituents from the Site samples were approximately equivalent in magnitude to those in the background locations (see Section 4.2.1) and, therefore, are not considered to be related to former MGP operations.

As shown in Table F-15 and Figure 4-3, cyanide was detected in 19 subsurface soil locations. It was present at concentrations ranging from 0.5 ppm (TtTP01 at 7 to 8 feet bgs) to 266 ppm (SB-15 at 9.6 to 10 feet bgs). Cyanide occurred at its most elevated concentrations in SB-08 (256 ppm) and SB-15 (266 ppm), drilled by the former 200,000 cu. ft. gasholder, near the center of the Site. As stated previously, no NYSDEC TAGM 4046 level exists for cyanide; however, the USEPA Region 3 RBCs for cyanide in soils at industrial and residential properties are 20,000 ppm and 1,600 ppm, respectively. As stated in Section 4.2.1, wood chips were observed during the drilling of soil borings SB-09, SB-12, and MW-08, which are located to the south of SB-08 and SB-15 (see Figure 4-3).

One subsurface soil sample, SB-14 at 10.2 to 10.7 feet bgs, was analyzed for volatile organic, semi-volatile organic, pesticide, herbicide, and metal constituents by TCLP testing procedures and RCRA characteristic parameters (see Table F-17 of Appendix F). Benzene, chloroform, and tetrachloroethene were detected in the VOC fraction, at concentrations of 8 ppb, 0.5 ppb, and 0.4 ppb, respectively. These concentrations are below TCLP regulatory levels. No semi-volatile, pesticide, or herbicide constituents were detected. The sample contained barium (1,440 ppb), cadmium (1.8 ppb), lead (40.3 ppb), and mercury (2.1 ppb), and these concentrations are also below TCLP regulatory levels. Reactive cyanides and reactive sulfides were not present, and the sample was classified as not corrosive, ignitable or reactive.

4.2.2.3 Groundwater Analytical Results

Monitoring wells on the Site have been sampled periodically from July 1997 through February 2008. Depending on the sampling event, the groundwater samples were analyzed for NYSDEC ASP TCL VOCs, TCL SVOCs, BTEX, PAH, TAL metals, cyanide, and/or water quality parameters. Analytical data from the Site wells are presented in Appendix F, Tables F-28 through F-36 (1997 through 2006) and Appendix O, Tables O-5 through O-7 (2008). Figure 4-4 displays the concentrations of Total BTEX, Total PAH and cyanide for the various sampling events.

BTEX constituents were detected in groundwater samples collected from monitoring wells MW-02 and MW-08 in at least one of the sampling rounds, as shown in Figure 4-4. Both of these wells are located to the north and, in general, hydraulically side-gradient of the former octagonal gasholder. Concentrations of the individual BTEX compounds in wells MW-02 and MW-08 have historically ranged up to 240 ppb (benzene in MW-02 in July 1997), which is above its NYSDEC WQ Value. The most recent round of groundwater sampling conducted at MW-02 and MW08 at the Site (during which samples from these wells were analyzed for BTEX [September 2004]) indicated that exceedances are still present in MW-02 (benzene at 12 ppb, ethylbenzene at 5.3 ppb, and xylenes at 8.2 ppb). However, no BTEX constituents were detected in the September 2004 sample from MW-08 (see Table F-28 in Appendix F). Samples from MW-02 and MW-08 were not analyzed for BTEX constituents during the August 2006 sampling event. Total BTEX concentrations for MW-02 have decreased from 444 ppb in July 1997 to 26.3 ppb in September 2004, while in MW-08, Total BTEX has decreased from 13 ppb (October 1999) to non-detect (September 2004), indicating natural attenuation processes are likely occurring (see Figure 4-4).

Groundwater samples were collected from the thirteen site monitoring wells in February 2008 and the samples were analyzed for BTEX. Groundwater samples collected from monitoring wells MW-02, MW-05, MW-07, and MW-08 exhibit concentrations of BTEX constituents at levels above the NYSDEC WQ value (see Table O-5). The highest concentrations are observed in the groundwater sample collected at MW-02, which contained concentrations of benzene at 43 ppb, ethylbenzene at 15 ppb, and total xylenes at 17 ppb. Groundwater samples collected at MW-05, MW-07, and MW-08 contain concentrations of benzene at levels of 1.5, 2.7, and 1.1

ppb, respectively, slightly exceeding the NYSDEC WQ value of 1 ppb. The observed concentrations are slightly higher than those detected during previous sampling events; however, a general decreasing trend is noted in the analytical results from the initial sampling rounds conducted in August 1997.

As shown in Table F-29, concentrations of 1,1,1-trichloroethane and 1,1-dichloroethane were detected in groundwater samples collected from monitoring well MW-05 during the two 1997 sampling events. As described in Sections 3.5.2 and 4.2.2 and as shown in Figure 3-1, MW-05 is positioned within the former octagonal gasholder and is hydraulically isolated from the groundwater at the Site. 1,1,1-Trichloroethane was present at concentrations of 4 ppb and 5 ppb, which is equal to its NYSDEC WQ Value of 5 ppb. The occurrences of 1,1-dichloroethane (7 ppb and 11 ppb) exceeded its NYSDEC WQ value (5 ppb). MW-05 had not been sampled for full TCL VOCs since 1997. However, in February 2008, groundwater samples collected from MW-05 were analyzed for full TCL VOCs. The analytical results from these groundwater samples indicate 1,1,1-trichloroethane and 1,1-dichloroethane are not present in groundwater at levels exceeding the NYSDEC criteria (see Table O-5).

Thirteen PAHs were identified in the Site groundwater; see Tables F-30 and F-31. At least one individual PAH compound was present in samples collected from MW-02, MW-05, MW-07, MW-08, and MW-11 during the various events, and concentrations ranged from 0.4 ppb (anthracene) to 100 ppb (acenaphthylene). Concentrations exceeding NYSDEC WQ values were present for the following nine PAHs: acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluorene, naphthalene, and phenanthrene (see Table F-30). Total PAH concentrations summed from non-detect to 212 ppb in MW-02; non-detect to 238 ppb in MW-05; non-detect to 138 ppb in MW-07; non-detect to 62.2 ppb in MW-08; and 0.3 ppb in MW-11. As shown in Figure 4-4, MW-05 was installed within the former octagonal gasholder. MW-02 and MW-08 are located to the north and, in general, hydraulically sidegradient of this gasholder (and, as discussed above, also contained elevated BTEX concentrations). Across East Street and slightly north of these wells is MW-11 (see Figure 4-4) where PAHs are below NYSDEC WQ values. Monitoring well MW-07 is located to the west of the former 200,000 cu. ft. gasholder in the northwestern portion of the Site. Total PAH concentrations have decreased in the seven years of groundwater sampling, up to two orders of magnitude (see Table F-33).

In addition to the PAH compounds, phenolic compounds were detected during the PSA sampling of monitoring well MW-02. Phenol concentrations of 52 ppb (July 1997) and 2 ppb (October 1997) were noted, and both of these occurrences are greater than its NYSDEC WQ value of 1 ppb. In addition, 2,4-dimethylphenol, 2-methylphenol, and 4-methylphenol were also detected above 1 ppb during the July event. This well has not been sampled for phenolic compounds or the full list of TCL SVOC constituents since 1997, and phenolic compounds were not present in the other wells sampled during the PSA (MW-01, MW-03 through MW-06) or in MW-09, which was analyzed for the full list of TCL SVOCs in 2002.

Groundwater samples collected in 1999 from monitoring wells MW-01 through MW-08 were analyzed for metals. Both unfiltered and filtered samples were analyzed, with the filtered portion being considered representative of the dissolved fraction of metals in the groundwater. The concentration of the metals in the filtered samples were either non-detect or below

NYSDEC WQ Values, with the exceptions of chromium and nickel in MW-01 (see Table F-35). MW-01 is located cross-gradient from former MGP operation areas, and neither chromium nor nickel is considered a Site-related contaminant. As shown in Table F-34, concentrations in the unfiltered samples were above NYSDEC WQ Values for specific analytes in several wells, and these levels are suspected to be associated with the turbidity developed during groundwater sampling (i.e., the 1999 round contained elevated amounts of particulates based on the turbidity values).

Concentrations of cyanide in groundwater are presented in Table F-36, Table O-6, and Figure 4-4. Groundwater samples from MW-02, MW-05, MW-07, MW-08, and MW-10 contained cyanide above its NYSDEC WQ value of 0.2 ppm (see Table F-36 and Figure 4-4). Occurrences in MW-02, MW-07 and MW-08 may be a result of the more elevated cyanide concentrations in the soil adjacent to the former gasholder (i.e., SB-08/SB-15). The concentrations of this constituent have fluctuated in the sampled wells, and no consistent trend has been noted. Fluctuations in concentration levels may have been the result of changes in the sampling methodology (e.g., earlier sampling events were performed by bailer versus low flow pump in more current rounds), the level of turbidity of the sample (i.e., the 1999 round contained elevated amounts of particulates based on the turbidity values), or other factors.

Groundwater samples were collected from the thirteen site monitoring wells in February 2008 and the samples were analyzed for cyanide (see Table O-6 and Figure 4-4). Groundwater samples collected from monitoring wells MW-02, MW-07, and MW-08 exhibited concentrations of cyanide at levels above the NYSDEC WQ value. The monitoring well samples exhibiting concentrations above the NYSDEC WQ value during the February 2008 sampling match the monitoring wells previously identified as exhibiting cyanide exceedences, with the exception of MW-05 and MW-10.

Isoconcentration contour plots, which show the principal areas of cyanide contamination in groundwater, are presented on Figure 4-5A ,Figure 4-5B, and Figure 4-5C for historic (pre-2004),recent (2004 through 2006), and February 2008 results, respectively. The historic cyanide contours are based on the maximum concentration value detected in a well prior to 2004, regardless of the date of the sampling event. The figures indicate that the highest levels of contamination, both historically and recently, are located in the eastern portion of the Site, specifically MW-02 and to a lesser extent MW-08. As noted previously, wood chips (often associated with purifier waste and therefore a potential source of cyanide contamination) were observed in the disturbed soils above the groundwater surface in three soil borings (SB-09, SB-12, and MW-08). These three borings are located around the edge of the most elevated concentrations present within the cyanide groundwater plume (see Figures 4-5A 4-5B, and 4-5C).

Groundwater samples in 2004 from MW-03, MW-06 and MW-08 were analyzed for natural attenuation/water quality parameters (see Table F-37 in Appendix F). All of the groundwater samples collected from monitoring wells during the August 2006 and February 2008 events were also characterized in the field for natural attenuation/water quality field parameters. These field parameters are recorded on the purge data sheets presented in Appendix D. Evaluation of the natural attenuation capacity of the aquifer will be performed during the Feasibility Study.

4.2.2.4 Soil Vapor Analytical Results

TtEC collected nine soil vapor samples from nine temporary soil vapor probes (SV-01 through SV-09) installed at the northern and eastern perimeter boundaries of the Site during the February and December 2008 soil vapor sampling events. The samples obtained from the soil vapor probes were collected at a maximum flow rate of less than 0.2 liters per minute in certified clean, evacuated Summa® canisters and analyzed for the compounds identified in USEPA method TO-15.

In addition, ambient (outdoor) air sample were collected during the February and December 2008 soil vapor sampling events, to identify and evaluate potential impacts during the sample collection. The ambient air samples were collected over an approximate 4-hour period at a location upwind of the site and analyzed for TO-15. The analytical data for the soil vapor samples and ambient air samples collected in February 2008 are presented in Appendix O, Tables O-12 and O-13, respectively. The analytical data for the soil vapor samples and ambient air sample collected in December 2008 are presented in Appendix P, Tables P-2 and P-3, respectively. The data presented in these tables is not compensated for the 0.1 attenuation factor referenced in Section 4.1.

The February 2008 soil vapor sample results indicated low levels of BTEX and BTEX isomers (e.g., 1,2,4-Trimethylbenzene) are the primary VOCs detected in the shallow soil gas and ambient air at the Site. In addition, low levels of chlorinated solvents (e.g., 1,1,1-Trichloroethane, Tetrachloroethene) were also detected in the shallow soil gas and ambient air samples. The soil vapor concentrations were generally detected at concentrations either within the same order of magnitude as the ambient air concentration or at concentrations just slightly exceeding an order of magnitude (e.g., 22 versus 0.9). Generally, the highest concentrations were detected in the samples collected at SV-07 and at SV-05, both located along the eastern site perimeter.

Based on the results observed at SV-07, additional soil vapor samples were collected at SV-09 and SV-09. The December 2008 analytical results for these samples indicate very low concentrations of non-chlorinated contaminants were detected in the soil vapor samples collected at sample locations SV-08 and SV-09. Non-chlorinated contaminants are typically found in common petroleum sources such as gasoline and motor oil, but can also be found in MGP wastes.

The shallow soil gas concentrations were reviewed with consideration of the shallow soil gas attenuation factor of 0.1 (ratio indoor air concentration to soil vapor concentration measured adjacent to or underlying the residence), which takes into account soil conditions, depth and characteristics of subsurface source, and foundation slab thickness. Taking this attenuation factor into account, indoor air concentrations are likely significantly lower than the concentrations observed in soil vapor due to the characteristics which make up the site-specific attenuation factor, in addition to the horizontal distance from the shallow soil gas sample locations to the neighboring residences. The identified indoor air concentrations would then likely be at the same order of magnitude as the concentrations detected in the ambient air samples and the potential for vapor intrusion to be affecting neighboring residences is unlikely.

The analytical sample results indicate the shallow soil vapor exhibit concentrations of volatile organic compounds at levels below the USEPA Target Shallow Soil Gas Concentrations identified in Table 2b of the 2002 USEPA Vapor Intrusion Guidance. The observed concentrations are detected at levels below the USEPA guidance without consideration of the 0.1 attenuation factor, and thus would also be detected at levels below the USEPA guidance with consideration of the attenuation factor. No further remedial investigation activities to assess off-site soil vapor are recommended at this time based on the following lines of evidence:

- Relatively low levels of groundwater contamination,
- Relatively low levels of soil vapor contamination detected in the soil vapor samples.
- The comparison of detected soil vapor concentrations to the USEPA screening levels and the ambient air sample results, and
- The distance from affected groundwater and soil to the nearest occupied structures.

In a letter dated February 2, 2009, NYSDEC and NYSDOH concurred with National Grid's recommendation for no further investigation of off-site soil vapor based on the low levels of contamination found in the soil vapor samples.

4.3 OFF-SITE STUDY AREA

4.3.1 Physical Investigation Results

Detailed off-site geology is described in Section 3.4.3. This section addresses potential MGP- related impacts physically observed during investigation activities in the off-site study area.

4.3.1.1 Description of Open Swale Area

The open swale is an approximately 1,100 foot long, heavily vegetated linear feature located within the off-site study area (Figure 1-2). The open swale begins approximately 1,500 feet north-northeast of the Site, at the outfall of a 24-inch culvert for a storm sewer extending from the Site vicinity. This storm sewer line collects drainage from streets (including Main Street) and commercial, industrial and residential properties along these streets, located south of the open swale. The open swale in turn discharges to the Mohawk River. The open swale is comprised of four segments separated by culverts. The first and second segments are positioned south of New York State Route 5S. The open swale passes underneath Route 5S, which is located along a former railroad line. The third and fourth segments are located north of Route 5S, with the end of the fourth segment terminating at the confluence of the swale with the Mohawk River. North of Route 5S, another 24-inch pipe enters the third segment of the open swale from the west. This pipe drains a ditch running parallel to the north side of Route 5S. A ditch draining the DPW debris disposal area to the east enters the swale at the southern end of the second segment.

The open swale is positioned within a relatively low-lying area that includes portions of the former Ilion landfill, an open parcel of land, approximately 25 acres in size, to the northeast of the Site (EA, 1988). The limits of the former Ilion landfill are shown in Figure 1-1. The former landfill site was used by the Village of Ilion between 1933 and 1971 as a dump to dispose of municipal waste, including wastes from Remington Arms and other local industries. Additionally, an incinerator was operated at the landfill property to burn waste liquids such as oils and lacquers (EA Science and Technology, April 1988). The area currently occupied by the Village of Ilion Department of Public Works (DPW) is situated within the former Ilion landfill, and both sides of the open swale abut the former disposal area. South of Route 5S, the swale is positioned adjacent to the garages and debris disposal area for the DPW. The area west of the swale and north of Route 5S was also formerly a sewage disposal plant (Figure 1-1). The field on the north side of East North Street Extension, just south of the beginning of the open swale, is an area in which refuse was formerly deposited and in which construction debris is currently being disposed.

Based on the urban setting of the swale, the storm sewer that discharges into it, and the landfill abutting the banks of the swale, there are many potential sources of petroleum type impacts to the sediments within the swale. The sources include the Ilion DPW, as evidenced by a waste oil/used oil spill that was reported by NYSDEC in June 2000 and three other spills (gasoline, diesel fuels, and waste oils) that were reported between 1989 and 1992 (see Spill Records in Appendix N). In addition, petroleum-type impacts may originate from Route 5S, and the former railroad bed on which Route 5S is located may provide petroleum and pyrogenic-type impacts to the swale. Pyrogenic-type impacts may originate from wooden ties treated with creosote, a coal tar derivative. Backup from the Mohawk River, particularly during flood events, could cause contaminants entering the swale in the vicinity of Route 5S to migrate south toward the head of the swale.

4.3.1.2 Soil and Groundwater

The shallow swale soils typically consist of silt, clay, and silty sand with abundant organic matter (e.g., leaves) and occasionally peat. The soils overlie peat/organic material layer(s) and alluvial or lacustrine deposits comprised of silt, sand, and/or clays, frequently containing shells of small aquatic animals. On the banks of the swale, fill materials typically overlie the peat/organic layer. The fill materials range up to approximately 12 feet in thickness and are composed of sand, silt, clay, gravel, reworked peat, and anthropogenic material such as ash and brick. Logs for the borings are provided in Appendix B. Table 4-1 summarizes visual and olfactory descriptions that were noted in boring logs and log book notes.

September 1999 sample probing resulted in the generation of several sheens on the standing water in the swale upon rod removal. Odors noted during the sample probing were petroleum-like NAPL observed in several off-site study area test pits (see Figure 4-6). Blebs of tarry-like NAPL were observed at the bottom of the disturbed soils, at the bottom of the silt and clay overlying the peat layer, or in the top of the peat layer. NAPL was not observed beneath the peat layer in the test pits. The test pits in which residual NAPL was observed (i.e., TtTP-04, TtTP-06, TtTP-07, TtTP-08, TtTP-09, TtTP-13, and TtTP-15) lie generally along a north-south trending line that abuts to the northern leg of the sewer line transecting the field north of the East North Street Extension (Figure 1-2). Figure 3-2 presents cross-section B-B’, showing the relationship of the test pits, the estimated horizontal and vertical extent of tarry-like NAPL impacts observed within the test pits, and the sewer line. The line described by these test pits, if extended north, runs generally adjacent and parallel to the storm sewer.

As noted in the borings during the 1999 mobilization, a petroleum-like sheen on the surface water was observed when the sample probe was retracted. Petroleum odors were observed in four of the eight boring locations (TtSED-05, TtSED-06, TtSED-09, and TtSED-10) and a petroleum sheen was noted in the shallow sample (0-2 ft) from TtSED-05. NAPL was not observed in any of the soils in the sampling sleeves. A naphthalene-like odor was noted in TtSED-05 and TtSED-09 from 2-4 feet bgs in each location.

Two test pits, 2007TP01 and 2007TP02, were advanced to a depth of 9.0 and 10.0’ bgs, respectively, during the February 2008 RI activities, to investigate soil conditions and assess if NAPL is present in the subsurface soils at the area east of test pits TtTP-06, TtTP-07, TtTP-08, TtTP-09, and TtTP-13. The test pits were advanced east of the gravel access road to delineate the eastern lateral limit of NAPL observed at test pit TtTP-13.

In addition, one soil boring (SB-16) was advanced to delineate the area located between test soil borings FW-09C and FW-08A, which was identified by the NYSDEC in their June 27, 2007 comment letter. As part of the February 2008 RI activities, TtEC advanced one soil boring (SB-16) with a hollow-stem auger (HSA) drill rig at the low area present between FW-09C and FW-08A. In addition, subsurface soils were observed and logged during advancement of the boreholes performed to allow installation of MW-14 through MW-17. NAPL was not observed during well development, collection of groundwater level measurements, or groundwater sampling performed at the Off-Site Study Area.

No NAPL or other MGP-related visual or olfactory impacts (staining, petroleum or MGP-like odors) were observed within the soil encountered during advancement of the test pit. Organic odors from the organic peat layer were noted but were not indicative of NAPL or MGP impacts. Subsurface soils encountered during advancement of the test pits generally consisted of soils similar to those described earlier in this section. Test pits 2007 TP01 and 2007TP02 define the eastern limits of NAPL observed at test pits TTTP06 through TTTP13.

Groundwater was observed seeping into the test pit excavations at approximately 3.5’ bgs at each test pit. Each excavation was left open for a period of 45 minutes to allow NAPL or visually-impacted groundwater, if present, to seep into the excavation. No NAPL, sheen, or visual impacts were noted on the groundwater. The static groundwater levels were approximately 3.0’ bgs.

Subsurface soils encountered during advancement of SB-16, located between FW-09C and FW-08A, did not contain MGP-related visual or olfactory evidence of contamination. Organic odors from the organic peat layer were noted but were not indicative of NAPL or MGP impacts. Groundwater was encountered at 4.5’ bgs during advancement of the soil boring. Figure 2-2 shows the locations of the test pits and soil borings. Figures 4-6 and 4-7 present the results from the off-site study area test pit excavations and soil borings. In addition, Figure 4-9, Cross Section and Plan View B-B’, depicts the estimated horizontal and vertical extent of NAPL at the off-site study area. The NAPL at this location is primarily located along the line of test pits TTTP06 through TTTP13. Visual observations and descriptions of subsurface soils encountered during advancement of these test pits indicate horizontal migration of NAPL outside of the immediate vicinity of these test pits is limited and defined by test pits 2007TP01 and 2007TP02. Vertical migration of NAPL is defined by the peat layer encountered at approximately eight to nine feet bgs at these locations.

4.3.2 Off-Site Study Area Analytical Results

4.3.2.1 Catch Basin Material Analytical Results

Four catch basin material samples (SWR-01 through SWR-04) were collected and analyzed for BTEX and PAH compounds. The sampled catch basins feed the storm drain that drains to the swale. Results for these analyses are provided in Tables F-8 through F-10 of Appendix F. These samples were collected to evaluate the potential contribution of constituents to the open swale from road drainage and other sources that are not related to the Site.

Individual BTEX constituents were present in the catch basin material samples at concentrations ranging from 0.0009 ppm to 0.27 ppm, with Total BTEX summing between approximately 0.001 ppm and 0.275 ppm (see Tables F-8 and F-10).

As presented in Appendix F, Table F-9, the catch basin material samples contained 16 PAHs (range of concentrations: 0.015 to 16 ppm). Six individual PAH compounds were detected at concentrations exceeding NYSDEC TAGM 4046 levels in all four of the locations. The maximum Total PAH and Total cPAH concentrations were present in SWR-01 (approximately 74.6 ppm and 32.3 ppm, respectively), which is located near the eastern corner of the Site (see Table F-10). Concentrations decrease along the drainage system pathway. The source of the catch basin material and associated constituents is likely related to non-MGP sources, such as road run-off.

4.3.2.2 Surface Soil Analytical Results

Four direct push boring surface (0 to 2 inches bgs) soil samples were collected in the off-site study area at locations TtDP-01 through TtDP-04 and analyzed for PAHs. Results for these analyses are provided in Tables F-9 and F-10 of Appendix F. As noted in Table F-10, concentrations for Total PAH and Total cPAH were approximately 3.39 ppm and 1.75 ppm (TtDP-01), 0.38 ppm and 0.22 ppm (TtDP-02), 2.59 ppm and 1.67 ppm (TtDP-03), and 1.31 ppm and 0.64 ppm (TtDP-04), respectively. These concentrations are below the maximum background concentrations of Total PAH and Total cPAH discussed in Section 4.3.1. A comparison of concentrations to NYSDEC TAGM 4046 levels for individual PAH is provided in Table F-9.

4.3.2.3 Subsurface Soil Analytical Results

Over 200 subsurface soil samples were collected from soil borings and test pits advanced in the off-site study area. A majority of these 200 samples were analyzed for either BTEX and PAH constituents or just PAH. Other subsurface soil samples underwent analysis for NYSDEC ASP TCL VOC and SVOC, and for metals, cyanide, PCB, and physical/geotechnical parameters to determine composition and disposal parameters. Tabulated results are presented in Appendix F, Tables F-18 through F-26.

Elevated (i.e., greater than 10 ppm) Total BTEX concentrations occurred at three locations, FW-08A at 11 feet bgs (362 ppm); FW-20A at 8 feet bgs (10.1 ppm); and FW-20A2 at 8 feet bgs (147 ppm); see Table F-22. Comparison to TAGM 4046 levels for individual BTEX compounds is provided in Table F-18.

Exceedance of NYSDEC TAGM 4046 levels for individual PAHs was present throughout the sampled off-site study area (see Table F-20). In general, the maximum concentrations for the individual PAHs were noted in the 8-foot bgs sample from TtTP-04.

Figures 4-6 and 4-7 present visual representations of elevated concentrations (i.e., above 500 ppm) of Total PAH for the samples collected above the peat layer and within/below the peat layer, respectively. The peat layer appears to be a horizon between where indications of coal tar-type impacts were typically noted and the lack of such observances (see Section 4.3.1.2). A location shown in red on the figures indicates a Total PAH concentration greater than 500 ppm, while one in purple contained Total PAH above 500 ppm and had coal tar identified as the primary constituent in a fingerprint sample (e.g., FW-20A2, FW-09C, FW-08A). Two locations (OFTP-02 and TtTP-04) are denoted in orange, indicating that their samples contained Total PAH above 500 ppm, had coal tar identified as the primary constituent in a fingerprint sample, and had residual NAPL observed during the field investigation. Although not shown on these figures, several other sample locations had coal tar identified as a subordinate or possible component of the PAH concentrations, with petroleum being the primary component. (see Table F-27 of Appendix F). Locations where NAPL was observed but no analytical sample was collected during the field investigation are also noted on the figures in blue.

As shown in Figure 4-6, the following areas contained elevated PAH concentrations above the peat layer:

- The intersection of East Street and North Clark Street (FW-20A/FW-20A2, up to almost 9,200 ppm);
- Along/near the East North Street Extension (FW-13C/FW-11F/FW-11H/TtTP04, up to 52,160 ppm);
- The field north of the East North Street Extension (FW-09A/FW-09B/FW-09C/FW-10A/FW-10B/FW-10C/FW-12A2, up to 13,316 ppm); and
- Along the southern property boundary for the DPW property, east of East Street (FW-08A/FW-08A3/FW-08B/OFTP-02, up to 30,805 ppm).

The higher concentrations of PAHs within or beneath the peat layer are generally in these same areas. However, the levels are considerably lower, and only two locations – FW-09C and GP-16 – contained Total PAH above 500 ppm (see Table F-22 and Figure 4-7). Concentrations for these boring samples were approximately 720 ppm and 705 ppm, respectively, which indicate a decrease of two orders of magnitude from the corresponding upper interval soil.

Based on the distribution and identification of constituents in the off-site study area, it appears that MGP-related material may have contributed a portion of the noted impacts. Assorted municipal waste and debris were present in the sampled area, and likely also contributed to the contamination. Fingerprint samples from numerous locations indicated the presence of "biodegraded residual fuel oil," while analysis of the sample from OFTP-05 was characterized as "lubricant product."

Other organic constituents present in the off-site study area samples included 11 VOCs, 10 SVOCs, and two PCBs (see Tables F-19, F-21, and F-23). These detections may be related to the disposal of waste materials in the off-site study area as noted during the field investigation. Exceedance of NYSDEC TAGM 4046 levels was noted for acetone (exceedance range: 0.24 to 2 ppm); dimethylphthalate (4 ppm); chloroaniline (0.29 ppm); phenol (exceedance range: 0.042 to 1 ppm); 2-methylphenol (0.25 ppm); and 4-methylphenol (0.95 ppm).

Five samples were analyzed for metals (see Appendix F, Table F-24). Concentration of the metal constituents in the sampled locations was approximately equivalent in magnitude to the concentration present in the background locations. The concentration of metals in these soils is not considered to be related to the former MGP operation.

Cyanide was not detected in the five off-site study area soil samples for which it was analyzed.

The results of the physical/geotechnical testing for the five off-site study area soil samples are presented in Table F-26. Sulfur concentrations were 126 ppm and 210 ppm in the swale samples, and less than 0.1 ppm in the other three soil samples. This trend was reversed for BTU, which was elevated (range: 43 to 61 ppm) in FW-11B, FW-12A, and FW-12D, in comparison to SED-03B and SED-08 (range: 0.175 to 0.399 ppm). TPH values were detected between 45.1 ppm (FW-12D at 8 feet bgs) and 18,700 ppm (SED-03B at 5 feet bgs).

Four subsurface soil samples and one duplicate sample were collected during the advancement of the soil borings performed prior to the installation of monitoring wells MW-14 through MW-17. The analytical data summary table presenting the results of the soil samples is presented in Appendix O, Tables O-2 through O-4. The soil samples were submitted for laboratory analysis and analyzed for BTEX and PAHs. BTEX and PAHs was not detected in the soil samples at levels above the NYSDEC SCOs for Protection of Groundwater, Protection of Ecological Resources, and Protection of Public Health-Residential.

4.3.2.4 Groundwater Analytical Results

Four groundwater samples and two duplicate samples were collected from Off-Site Study Area monitoring wells MW-14 through MW-17 in February 2008. The monitoring wells were sampled two weeks following monitoring well installation and development and the groundwater samples were submitted to the laboratory for BTEX, PAH, and cyanide analysis. The analytical data summary tables presenting the results of the groundwater samples are presented in Appendix O, Tables O-7 through O-10. Figure 4-4B presents the results of the groundwater sampling.

The analytical results of the groundwater samples indicate groundwater at the Off-Site Study Area has not been affected by BTEX or cyanide at levels exceeding the NYSDEC WQ values [Class GA]. Naphthalene was detected in the groundwater sample collected at MW-15 at a concentration of 13 ppb, slightly exceeding the NYSDEC WQ value of 10 ppb. No other PAHs were detected at levels above the method detection limit.

4.3.2.5 Summary of Findings from Open Swale Area

This section summarizes the data from the investigations performed at the open swale, located within the Off-Site Study Area of the East Street (Ilion) Site. Fifty soil boring locations were installed within the open swale. A majority of these samples were analyzed for either BTEX and PAH constituents or just PAH. Other samples underwent analysis for NYSDEC ASP TCL VOCs and SVOCs, and for metals, cyanide, and PCB. Fingerprint analysis was performed on 51 samples and is presented on Table F-27.

Of the samples collected in the open swale during the 2004 activities, TTSED-01 through -05, focused on the shallow zone in the open swale. These samples were collected from 0 to 2 feet below the soil/water interface along the length of the swale, and were analyzed for PAHs. The only other analytical sample from this interval was from SWALE-SED01, which was collected in the first swale segment and was subjected to fingerprint analysis. However, at each of the boring locations in the swale, descriptions of the samples from the shallow interval were made, including visual or olfactory indicators of contamination, even if no samples were submitted for analysis.

During the August 2006 activities, sampling of the shallow soils (0 to 2 foot depth below the soil/water interface) were collected at an additional 8 locations in the first and second segment of the open swale. These samples were analyzed for BTEX and PAH constituents.

In the first and second segments of the swale, south of Route 5S, the total PAH concentrations in the shallow soils range from 8.6 to 208 mg/kg. The fingerprint analysis from SWALE-SED01 collected in 1999 indicates that the PAHs are related to degraded fuel oil (see Table 11). This is supported by the petroleum-like odors noted during sample collection and sample probing in these two segments (see Table 4-1) are consistent with the findings of the fingerprint analysis.

North of Route 5S, in the downstream segments of the open swale closer to the Mohawk River, the PAH concentrations in the shallow subsurface soils are much less than to the south, ranging from not detected to 2.5 mg/kg. Where odors were noted in the shallow samples, they were described as petroleum and/or organic. Locally, sheens were observed on the water surface near the sampling locations. No fingerprint analysis was conducted on the shallow (0- to 2-foot) samples, but data from deeper samples (between 3 and 5 feet) indicated the detected PAHs are related to degraded fuel oil.

Tabulated results are presented in Appendix F, Tables F-18 through F-26. A summary of the analytical results is presented below.

- In the southern two segments of the open swale, located south of Route 5S, the total PAH concentrations in the shallow sediments (0- to 2-foot depth) range from 8.6 to 208 mg/kg. At a depth interval of about 2 to 4 feet in soil and sediment below and adjacent to the swale, the PAH concentrations are similar in magnitude to those in the shallower sediments, but with a broader range (2.39 to 9,390 mg/kg). Below the 4 foot depth interval, the total PAH concentrations generally decrease (range: not detected to 123 mg/kg).
- In the downstream segments of the open swale, located north of Route 5S, the range of PAH concentrations in the soils beneath and/or adjacent to the swale are one to two orders of magnitude less than those in equivalent depth intervals south of Route 5S. As shown on Figure 4.6, soils contained elevated PAH concentrations above the peat layer in the first segment and in the southern portion of the second segment of the open swale (SED-05/FW-02/SED-02/ TtSED-09, up to about 1,015 ppm).
- BTEX compounds were not detected, or are present at low concentrations in the samples from soils beneath and adjacent to the open swale. Total BTEX concentrations south of Route 5S (range: not detected to 6.5 mg/kg) are greater than those to the north (range: not detected to 0.34 mg/kg).
- The peat layer appears to be a restriction for the migration of contaminants.
- The metals detected in the open swale area are not considered to be related to former MGP operations and may be related to the former or current local operations and conditions.
- Cyanide was not detected in soil samples collected from the open swale.
- Fingerprint analysis and sample descriptions (e.g., odors) indicate the PAH and BTEX in the soil beneath and adjacent to the swale are associated with degraded fuel oil locally in the first

segment of the swale and the southern portion of the second segment, in addition to fuel oil, a component of the PAH concentration may also be attributable to coal tar.

- Fingerprint analysis for the 11 samples collected in the soils beneath the swale during the 2006 mobilization indicate the presence of coal tar in nine of the 11 sediment samples. The description on the amount/type of coal tar was "little, if any coal tar" (TtSED09-0-2, TtSED10-0-2, and TtSED11-0-2); "subordinate coal tar" (TTSED06-0-2, TTSED07-0-2, and TTSED07-2-4); and "significant coal tar" (TTSED05-0-2, TTSED05-2-4, and TTSED09-2-4) in the sediment samples. The "significant coal tar" showed primarily fluoranthene / pyrene and higher PAH peaks and the subordinate coal tar showed the full range of PAH peaks from naphthalene on. Source fingerprinting also showed evidence of residual fuel oils in ten of the 11 sediment samples.
- The usage of land in the Off-Site Study Area (former railroad bed, storm sewer, landfills, etc.) by its nature, has the potential to contribute contaminants, particularly PAHs, into the environment. In addition, flooding of the Mohawk River can deposit contaminants from up-stream sources within the open swale.
- Most of the impacts identified in the swale are not related to former MGP operations, but are likely related to former and current local operations and conditions. This is supported by the following:
    - The open swale receives stormwater flow from: roads and commercial, industrial and residential properties in a large area south of the swale via flow to storm sewer catch basins; the area of the Ilion DPW garages; and the DPW debris disposal area. These areas contribute, or potentially contribute, petroleum-related substances to the swale.
    - A pipe draining a ditch along the north side of Route 5S discharges to the swale.
    - Several pipes of unknown origin have been identified that discharge to the swale.
    - The swale lies within the area of the former Ilion Landfill, and is positioned adjacent to the DPW garages and debris disposal area. The banks of the swale contain fill related to these current and former operations.
    - A railroad formerly operated along the current position of what is now Route 5S. Railroad operations may have contributed petroleum-related constituents as well as other impacts (*e.g.*, creosote from railroad ties) to the study area.

Table 4-1
Summary of Visual and Olfactory Descriptions for Borings in Off-Site Study Area Open Swale
Ilion (East Street) Site

Boring ID	Date	Visual (feet below surface)	Olfactory (feet below surface)
FW-01	01/02/2001	4 - 5': some discoloration, visible oil sheen	No odor noted
FW-02	01/02/2001	4 - 8': visible oil sheen 8 -12': sheen 12 - 16': sheen	8 - 12': odor, asphalt-like 12 -16': odor, asphalt-like
SED-01	01/04/2001	No sheen noted	0 - 4': organic and petroleum odors 4 - 8': organic and petroleum odors 8 - 12': organic and petroleum odors
SED-1A	02/19/2001	0 - 4': some ash. No sheen noted 10 - 12': some ash. No sheen noted	No odor noted
SED-1B	02/19/2001	No sheen noted	No odor noted
SED-02	01/04/2001	No sheen noted	0 - 4': organic and petroleum odors 4 - 8': organic and petroleum odors 8 - 12': organic and petroleum odors
SED-02A	02/20/2001	No sheen noted	No odor noted
SED-02B	02/20/2004	No sheen noted	No odor noted
SED-03	01/04/2001	No sheen noted	No odor noted
SED-03A	02/20/2001	4 - 8': ash. No sheen noted	No odor noted
SED-03B	02/22/2001	No sheen noted	8' - slight odor (n.o.s) 10' - slight odor (n.o.s.)
SED-04	01/04/2001	No sheen noted	0 - 4': Petroleum odor 4 - 8': Organic and petroleum odors 8 - 12': organic and petroleum odors
SED-04A	02/22/2001	No sheen noted	No odor noted
SED-04B	02/22/2001	No sheen noted in boring oil visible in shallow sediments along swale	4 - 8': slight odor, petroleum
SED-05	02/19/2001	No sheen noted	0 - 4': petroleum odor
SED-05A	02/19/2001	No sheen noted	0 - 4': slight odor (n.o.s.)
SED-05B	02/19/2001	No sheen noted	No odor noted
SED-06	02/20/2001	No sheen noted	No odor noted
SED-07	02/20/2001	No sheen noted	No odor noted
SED-08	02/22/2001	No sheen noted	No odor noted
SED-09	02/22/2001	No sheen noted	4 - 8': slight odor (n.o.s.)
SED-10	02/22/2001	No sheen noted	4 - 8': slight odor (n.o.s.)
SED-11	02/22/2001	No sheen noted in boring oil visible in shallow sediments along swale	4 - 8': slight odor (n.o.s.)
TtSED-01	10/12/2004	No sheen noted	No odor noted
TtSED-02	10/12/2004	0 - 2': slight sheen	0 - 2': slight acrid petroleum odor
TtSED-03	10/12/2004	No sheen noted	0 - 2': acrid petroleum odor
TtSED-04	10/12/2004	No sheen noted	No odor noted
TtSED-05	10/12/2004	0 - 2': trace ash material. No sheen noted	No odor noted
TtSED-05*	08/01/2006	0 - 4': sheen noted	0 - 4': Naphthalene-like odor
TtSED-06	08/01/2006	No sheen noted	0 - 2': Petroleum-like odor
TtSED-07	08/01/2006	No sheen noted	No odor noted
TtSED-08	08/01/2006	No sheen noted	No odor noted
TtSED-09	08/01/2006	No sheen noted	0 - 4': Petroleum and naphthalene-like odor
TtSED-10	08/01/2006	No sheen noted	0 - 2': Petroleum-like odor
TtSED-11	08/01/2006	No sheen noted	No odor noted
TtSED-12	08/01/2006	No sheen noted	No odor noted
2007TP01	02/11/2008	No sheen noted	4-9': Organic odor
2007TP02	02/11/2008	No sheen noted	4-10': Organic odor

Table 4-1
Summary of Visual and Olfactory Descriptions for Borings in Off-Site Study Area Open Swale
Ilion (East Street) Site

Boring ID	Date	Visual (feet below surface)	Olfactory (feet below surface)
SB-16-OFFSITE	02/12/2008	No sheen noted	4 - 8': Organic odors 12-16': Organic odors
MW-14	02/13/2008	No sheen noted	4 - 8': Organic odors 8 - 12': Organic odors
MW-15	02/13/2008	No sheen noted	4 - 8': Organic odors 8 - 12': Organic odors
MW-16	02/12/2008	No sheen noted	4 - 8': Organic odors 12-16': Organic odors
MW-17	02/13/2008	No sheen noted	10-12': Organic odors

Notes:
TtSED-05 name used for two different locations during two different mobilizations.
n.o.s. - not otherwise specified

5.0 FATE AND TRANSPORT

5.1 INTRODUCTION

An understanding of the environmental fate and the potential transport mechanisms of the constituents present at the Ilion (East Street) Site is necessary to determine the potential for on-site and off-site migration, and to assess the potential for exposure.

Two major characteristics affecting the fate and transport of a chemical are the persistence of the chemical in environmental media, and the mobility.

Persistence is the tendency of a chemical to remain in the environment. Persistence is influenced by many of the factors affecting chemical mobility (including solubility, sorption, and volatility), but is also a function of oxidation rates, hydrolytic and photolytic reactions, and biochemical processes (such as biodegradation and bioaccumulation).

Mobility is the tendency of a chemical to migrate through the environment. Mobility is controlled by both the physicochemical environment at the Site and the behavioral characteristics of individual chemicals. Important factors controlling the physicochemical environment of the Site include the local climate, the configuration and nature of surface water bodies and groundwater, and the nature of underlying soils and bedrock. Factors that control the behavior of individual compounds include aqueous solubility, the susceptibility of a chemical to sorption, degradation and volatility.

This section focuses on the fate and transport processes that may affect constituents associated with the Site. Detected compounds/analytes at the Site have been grouped into four categories sharing similar physicochemical and behavioral characteristics: [1] BTEX; [2] PAHs; [3] metals; and [4] cyanide. Section 5.2 contains information about the environmental behavioral characteristics of the above four constituents/constituent categories related to persistence. In Section 5.3, potential transport and migration pathway routes that may affect the constituents are discussed relative to the data collected from the Site and relevant environmental characteristics of the contaminants. A summary of the fate and transport analysis findings, especially those routes that pose the greatest potential for migration (i.e., mobility) at the Site, is presented in Section 5.4.

5.2 PERSISTENCE

In this section, the chemical characteristics and available fate and transport data are summarized. Each constituent or generalized constituent class is discussed ([1] BTEX; [2] PAHs; [3] metals; and [4] cyanide) along with a summary of the anticipated environmental fate characteristics. A summary of the behavioral characteristics that affect environmental fate and transport for the above categories is presented in Table 5-1. The characteristics are provided in a qualitative manner, and the descriptions are relative (i.e., very high to very low).

5.2.1 BTEX

General physicochemical characteristics of BTEX compounds (benzene, toluene, ethylbenzene, and xylenes) are listed in Table 5-1. Compounds of this class are mobile and not very persistent in the environment due to their high volatility, low to moderate (ethylbenzene only) adsorptive affinity to soils, low bioaccumulation potential, and high water solubility. In addition, biodegradation/biotransformation processes may further contribute to a low persistence in the environment.

5.2.2 PAHs

As part of the former operations at the Site, MGP-related constituents such as PAHs were released to the environment. Several PAHs were detected in various matrices (e.g., soils, sediments, and groundwater) at the Site and in the off-site study area. As indicated by their physicochemical characteristics presented in Table 5-1, PAHs are persistent and generally immobile in soil matrices under normal environmental conditions. This is primarily due to their low aqueous solubility, their resistance to photolytic, oxidative and hydrolytic degradation, and their high affinity for adsorption to organic matter and soil particles. However, in the presence of highly mobile volatile organic compounds, such as BTEX, which can act as co-solvents, the mobility of PAHs in soils and/or aqueous matrices can be enhanced. PAHs can be degraded by microbial populations; however, this degradation is generally a slow process in the environment. Among the PAHs, the lower molecular weight compounds, such as naphthalene, are more mobile in the environment, due to lower adsorptive affinity and higher aqueous solubility. The carcinogenic PAHs tend to be higher molecular weight compounds, and are generally less mobile in the environment (i.e., more likely to sorb to soil particles). Some of the PAHs may exhibit substantial bioaccumulation (i.e., phenanthrene, fluoranthene); however, this effect is usually ephemeral, since most organisms have the ability to metabolize these compounds.

5.2.3 Metals

Metals were detected in the various matrices sampled at the Site. Many of these metals occur naturally in the soil and also are present in groundwater due to natural or regional conditions. However, a number of metals exhibited atypical environmental concentrations (i.e., greater than criteria or background). Although these elevated concentrations appear not to be related to MGP operations, relevant fate and transport data for the metals are presented in Table 5-1.

Many of the fate and transport mechanisms that may be important for organic compounds have little impact on the metals. In addition, the metals are difficult to discuss in terms of behaviorally similar groups, and it is sometimes difficult to distinguish between naturally-occurring and introduced metals, particularly in the case of geochemical analytes, both major (e.g., aluminum, calcium, iron, magnesium, potassium and sodium) and minor (e.g., barium and manganese). The characteristics of individual metals are generally better understood, and fate and transport profiles of the metals are presented in Appendix H.

The most important factors controlling metal fate and transport are solubility, redox behavior, aqueous speciation and complexes (e.g., metal sulfides versus metal sulfates), and sorption behavior, all of which are functions of the ambient geochemical environment. In general, metals are persistent and of limited mobility within environmental matrices under normal environmental conditions. This persistence is primarily related to recycling mechanisms and removal mechanisms (i.e., precipitation, cationic exchange, adsorption, etc.) which decrease mobility. Chemical speciation of metals in the environment results in metals in both solid and aqueous media.

5.2.4 Cyanide

The cyanide functional group (-CN) can exist in a diverse group of organic or inorganic compounds whose fate and transport in the environment can vary greatly. The cyanide ion typically forms complexes with a variety of metals, especially transition series metals, with ferricyanides and ferrocyanides being the most prominent form typically encountered in the environment. Cyanides adsorb to a variety of materials, including clays, biological solids and sediments; however, sorption is typically not a significant immobilizing process due to the relatively high volatility, solubility and/or reactivity of most cyanide containing compounds. Generally, cyanides typically occur in water as: [1] free hydrocyanic acid; [2] simple cyanides; [3] easily decomposable complex cyanides and [4] relatively stable complex cyanides.

Some cyanide compounds are mobile and not very persistent in the environment due to their high volatility (hydrogen cyanide, nitriles), high reactivity (principally hydrogen cyanide), high aqueous solubility (except for insoluble simple metal cyanides), low adsorption to soil, low bioaccumulation potential, and susceptibility to microbial, metabolic, photolytic (primarily iron cyanides) and hydrolytic degradation. However, since many of these compounds can be converted to other cyanide containing compounds during various degradation/decomposition reactions, various forms may exist for some time in the environment, particularly if insoluble and/or stable cyanide containing compounds are produced. Cyanides associated with MGP sites typically occur as ferric-ferrocyanide which is a low toxicity compound. Ferric-ferrocyanide, and other similar iron cyanide solids, typically dissociate into iron cyanide complexes when leached (Ghosh et al., 1999). The rate of dissociation of iron cyanide complexes to free cyanide/hydrogen cyanide is very slow in the subsurface, and thus little, if any, hydrogen cyanide is expected to be associated with MGP sites. A complete fate and transport profile for cyanide is located in Appendix H.

5.3 POTENTIAL ROUTES OF MIGRATION

The fate and transport of contaminants are affected by site-specific environmental characteristics, specifically the geology and soil type, geochemistry, hydrogeology, and climate. These environmental characteristics are described in detail in Section 3.0.

Contaminants may migrate from a source area through a variety of mechanisms. The importance of a given migration mechanism is controlled by the specific physical, geochemical, hydrogeologic and climatic conditions at a given Site location, as well as by the physicochemical characteristics of the contaminant and the contaminated media. The importance of each migration pathway to the Site and to the Off-Site Study Area and to the chemicals detected is discussed below relative to the Site conditions and features.

5.3.1 Shallow Soil Route

Contamination of shallow soil generally occurs at a site as a result of daily operations and/or disposal practices (e.g., surface spills). Transitory surface runoff and ponding of stormwater may occur in localized areas that are within or adjacent to areas of contaminated soil, and more water-soluble constituents may migrate within the surface runoff/ponded water and spread to surrounding shallow soils. Surface runoff may also transport fine particulates that have constituents adsorbed to them to other shallow soil areas, if the runoff flow is sufficient to entrain the particulates. In addition, dry, windy weather may result in the entrainment of contaminated particles from exposed shallow soil into the atmosphere, with subsequent deposition over adjacent shallow soils.

Migration of shallow soil contamination will occur to a limited degree at the Ilion (East Street) Site. The Site presently houses a gas regulating station and minimal operations occur. A majority of the Site area is either vegetated or covered with the regulator building, a gravel driveway/parking area and former building footprints (concrete), which will reduce the possibility of airborne entrainment. Based on the surface topography of the Site, surficial water will likely be drained through percolation (after potential ponding on-site) or directed northeastward towards East Clark Street.

The Off-Site Study Area is also primarily vegetated, reducing the likelihood of airborne entrainment of contaminated shallow soil particulates. Drainage of surface water is predominantly through percolation or run-off to the catch basin/swale drainage channel, which runs through the central portion of the Off-Site Study Area. Storm events may generate sufficient water runoff for migration of surficial contamination (either as dissolved components or fine particulates). The Off-Site Study Area, though, has relatively low concentrations of constituents in the surface soils (i.e., Total PAHs up to only 3.5 ppm). Based on the data collected during the RI, it is unlikely that the surficial soil in the off-site study area was impacted by MGP operations (i.e., concentrations of constituents are within the range of background samples).

5.3.2 Subsurface Soil Route

Contamination of subsurface soil at a site location occurs as a result of the historic disposal practices employed during past operations. As a consequence of these activities, chemical constituents may potentially migrate into and through the surrounding soils through percolation of rain, dissolution in groundwater, and/or gravity.

As indicated by the analytical data, subsurface soils at the Site have been impacted by the residual constituents of MGP processes, for example within and in the vicinity of the former gas holders (see Section 4.0). In addition, localized areas of the Off-Site Study Area appear to contain residual tar-like material that potentially may have originated from the Site. Further migration of these constituents into and through the vadose zone soils would likely occur until they come into contact with a more impermeable layer (e.g., the peat and/or lacustrine deposits), with migration of contaminants into/through deeper soils described below in Sections 5.3.3 and 5.3.4. Rainwater would percolate through the vadose zone soils, leaching the more soluble constituents, such as BTEX. PAHs are persistent and generally immobile in soil matrices under normal environmental conditions, primarily due to their low aqueous solubility and high affinity for adsorption. However, the migrating BTEX may facilitate transport of the PAHs to deeper surface soils. Metals are also persistent and of limited mobility within soil matrices under normal environmental conditions, lessening subsurface migration. Cyanide, with its generally high solubility and low adsorption to particulates, tends to migrate into and/or through the surrounding vadose zone subsurface soils; however, due to its high reactivity/degradation potential, it is generally short-lived.

5.3.3 Groundwater Route

In general, contaminants detected in subsurface soils at a site may migrate into groundwater by the percolation of rainwater through the soils and by the flow of groundwater into the contaminated area(s). Incorporation of contaminants into the groundwater may be through direct dissolution of contaminants from soil, by dissolution into more water soluble organic compounds already entrained within the percolating rainwater (i.e., co-solvent effects), or by adherence to colloidal particles contained in the groundwater.

Migration of contaminants in groundwater is controlled by two processes: advection and dispersion. Advection is the process by which dissolved contaminants are transported by the bulk motion of groundwater flow. Dispersion is the spreading of dissolved contaminants as they move within groundwater through two basic processes: molecular diffusion and mechanical mixing. Both advection and dispersion act on contaminants in solution. Constituents associated with large soil particles generally are not transported by groundwater. However, some transport of fine particles (e.g., very fine clay, colloids) with adsorbed constituents may occur.

Volatile organics, such as BTEX, are characterized by high aqueous solubility and low adsorptive affinity for soils. Due to the permeable nature of the Site soils (see Section 3.0), in conjunction with BTEX's characteristics, dissolution and transport in groundwater is expected to be an environmental fate mechanism for these compounds. This is substantiated by the analytical data, which indicated relatively elevated concentrations of BTEX constituents in groundwater (i.e., up to 444 ppb for Total BTEX historically). BTEX compounds are present in overlying and/or nearby on-site soils at elevated concentrations, and groundwater may be leaching these relatively soluble constituents from the subsurface soils. As shown by the groundwater data, migration of lower molecular weight PAHs (i.e., naphthalene, fluoranthene) and to a lesser extent, the higher molecular weight PAHs, in the groundwater is also of importance for the Site (i.e., concentrations of up to 238 ppb for Total PAHs historically).

The transport of metals in groundwater is a function of the solubility (and related leachability) of a given metal in a specific water mass under specific conditions. Transport of metals in groundwater may also occur, to some extent, with particulate phases (i.e., colloids) to which the metals are adsorbed. Metals detected in the groundwater are generally also present in the overlying and/or nearby subsurface soils, which implies that the metals are migrating from the soils to and through the groundwater. This does not, however, specify that the metals contamination is related (in whole or in part) to Site activities. The concentrations detected in the groundwater may be indicative of natural groundwater conditions in the area, as shown by the relatively equivalent concentrations found around the Site, including in MW-01, which is considered to be hydraulically upgradient of former Site activities.

The high aqueous solubility and low adsorptive affinity of cyanide indicates that this constituent would likely migrate into and within the groundwater, if present. This is substantiated by the groundwater data, which historically had cyanide detected in monitoring wells at concentrations up to 47.4 ppm. However, with the relative low gradient of the water table at the Site (see Section 3.5.2), cyanide migration will be limited.

5.3.4 Non-Aqueous Phase Liquid Route

Non-aqueous phase liquids (NAPL) are immiscible fluids whose migration is governed by gravity, buoyancy and capillary forces. NAPL is generally classified by specific gravity (density in relation to water) as “light,” i.e., specific gravities less than water (LNAPL) or “dense,” i.e., specific gravities greater than water (DNAPL). NAPL movement occurs at the pore level when enough pressure, which is dependent on the capillary forces acting on the fluids, is available to force the NAPL through a small pore space. NAPL will migrate preferentially, though, through larger aperture, secondary porosity features in the soil-aquifer matrix, such as large fractures, root holes, coarse-grained layers, etc. Upon migration through the vadose zone, further downward migration of LNAPL is impeded by the water table, while DNAPL sinks into the saturated zone, potentially pooling at lower-permeability stratigraphic units. NAPL constituents can undergo dissolution (by percolating water through the vadose zone and directly into the surrounding groundwater in the saturated zone), hydrolysis, biodegradation, and volatilization.

Occurrences of NAPL were noted on-site at two general locations, near the former octagonal holder in the southeastern portion of the Site (MW-05, SB-10, SB-11, and SB-14) and near the former 200,000 cu. ft. gasholder in the central portion (SB-08 and SB-15). A sample containing the residual NAPL from SB-08 was collected, and the fingerprint analysis indicated a “coal tar” origin. In the off-site study area, blebs of NAPL were observed in test pits TtTP-04, TtTP-06 through TtTP-09, TtTP-13, TtTP-15, and OFTP-02. Fingerprint analysis determined the observed residual NAPL in TtTP-04 and OFTP-02 to be “coal tar.” Migration of NAPL likely occurred preferentially downward through the more permeable disturbed soils (primarily fill), and appears to have collected on top of the less permeable underlying peat and/or lacustrine deposits. Dissolution of the constituents into groundwater has also occurred at the Site, as evidenced by the elevated concentrations of BTEX and PAHs (specifically the lower molecular weight compounds) in the wells within and downgradient from or sidegradient to (e.g., MW-02, MW-05, MW-07, and MW-08) the source areas (former gasholders) containing coal tar-type impacts.

5.3.5 Air Route

Contaminants migrate into air through two distinct emission mechanisms: volatilization and entrainment of contaminated particles by the wind (e.g., fugitive dust emissions). VOCs can migrate into the air directly from surficial and subsurface soils. Volatilization from shallow surface soils is governed by the physicochemical characteristics of a given compound under ambient conditions. Volatilization from subsurface materials is more complex, and factors such as soil moisture and permeability must be taken into account. The extent of particulate entrainment at a site is governed in large part by climatic conditions (i.e., dry, windy conditions are more conducive to entrainment than wet, calm conditions). Other factors that affect entrainment of particulates include the extent of vegetated areas, and the grain size distribution of the shallow soils.

BTEX compounds were not detected in the surficial soil at the Site and thus there are no volatile emissions. Volatilization of BTEX from the subsurface soils, where these compounds were detected, is possible; however, it is likely limited due to the depth in the soils where these elevated concentrations occur (i.e., approximately 10 feet bgs), and the surface cover (vegetation or buildings/former buildings/gravel) across the Site.

The airborne entrainment of contaminated soil particles is a potential transport mechanism, especially for those constituents with high adsorptive affinities such as PAHs. As the majority of the Site and Off-Site Study Area is covered with grassy vegetation and/or other surface cover, though, this mechanism would be limited. Airborne entrainment of particulates would only occur when dust is generated during intrusive activity in a contaminated area or develops during significant dry/drought periods.

5.3.6 Vapor Intrusion

Vapor Intrusion (VI) is the migration of volatile chemicals from the subsurface into overlying buildings. The presence of VOCs in soil or groundwater offers the potential for chemical vapors to migrate through the subsurface potentially impacting the indoor air quality of affected buildings. The vapor source is the presence of a chemical of sufficient volatility and toxicity in the subsurface with sufficient mass and/or concentration to pose a possible inhalation risk within current or future occupied overlying enclosures. VI mechanisms can include diffusion of vapors from sources in the unsaturated zone; diffusion of vapors from sources in groundwater; advective/convective transport of vapors; and vapor migration through preferential pathways.

VI from the subsurface soils and groundwater, where these compounds were detected, is unlikely due to the depth where elevated concentrations occur (i.e., approximately 10 feet bgs), proximity to receptors (i.e., greater than 100 feet) and the porous surface cover (grass cover) across the Site which encourages exchange between the ambient air and any vapors from the subsurface. VI from the shallow subsurface soils and groundwater migrating to indoor air does not appear likely based on the following lines of evidence:

- Relatively low levels of groundwater contamination,
- The comparison of detected soil vapor concentrations to the USEPA screening levels and the ambient air sample results,
- The distance from affected groundwater and soil to the nearest occupied structures, and
- The relatively low levels of soil vapor contamination detected in the soil vapor samples. .

5.4 MOBILITY

The migration of detected constituents to underlying soils and groundwater by percolation of rainwater and/or infiltration of groundwater through contaminated soils and/or NAPL is expected to be an important environmental fate and transport mechanism at the Ilion (East Street) Site. In addition, capillary movement of NAPL through the subsurface may be of some importance based on the numerous visual observations during the field investigation. However, the amount of NAPL generally noted (i.e., blebs) indicates the majority of NAPL observed at the Site is at the residual level and further migration is unlikely. The soil quality data indicate the presence of BTEX and PAHs at elevated concentrations, especially in locations where coal tar-type observances were noted, and the analytical data show that groundwater migration is of particular importance for the BTEX constituents, the low molecular weight PAH constituents (e.g., naphthalene), and cyanide. Upon entering the groundwater, constituents migrate with the local groundwater flow until dispersion and attenuation mechanisms result in the reduction of their concentration to non-detectable levels.

The surficial soil migration route may potentially be present at the Site, especially in the vicinity of surface soil samples SS-02/SS-08, SS-11/SS-13, and SS-16, which contained relatively elevated PAH concentrations (i.e., up to 183 ppm). Although the majority of the Site is vegetated and/or covered with buildings/former building footprints/gravel, surface ponding of water may occur based on the topography, followed by percolation.

The surface soil migration route would be of lesser importance to the Off-Site Study Area, as the concentrations of PAHs are lower (i.e., Total PAHs summed to less than 3.5 ppm). Based on the data collected during the RI, it is unlikely that the surficial soil in the Off-Site Study Area was impacted by MGP operations (i.e., concentrations of constituents are within the range measured in the background samples). Storm events may generate sufficient water runoff for migration of surficial contamination (either as dissolved components or fine particulates), although this would be limited by the vegetation present in the area. Surface flow is typically towards the drainage swale, and then within the swale.

The air migration and vapor intrusion route would not be a principal environmental transport mechanism for the Site or Off-Site Study Area, as the majority of the properties are vegetated or covered, and generally low concentrations of MGP-related constituents were present near the surface. However, intrusive activities that may occur in these areas would increase the importance of the air route of migration (by the generation of dust), as would significant drought/dry weather episodes. Vapor intrusion would also increase the importance of this route if structures that would be occupied were to be constructed on the Site, but results of vapor intrusion sampling performed in February and December 2008 indicate the soil vapor levels are below applicable standards. Structures constructed on the Site for permanent occupancy is unlikely due to restrictions that would be placed on the Site preventing this use of the Site.

TABLE 5-1
Summary of Behavioral Characteristics that Affect Environmental Fate and Transport

Constituent	Aqueous Solubility	Volatility	Adsorptive Affinity	Biodegradation/ Biotransformation	Photolysis Susceptibility	Hydrolysis Susceptibility	Oxidation	Bioconcentration in Fish
BTEX Constituents	High to Very High	High to Very High	Very Low to Medium	High to Very High	Very Low	Very Low	Very Low	Very Low
PAH Constituents	Low	Low	High	Medium to High	Low	Very Low	Low	Low to Medium

	Mobility under pH Conditions			Immobilization Factors		
	Acid (< 5.5)	Neutral (5.5 - 7.0)	Alkaline (> 7.0)	Fe/Mn Oxides	Organic Matter	Other
Arsenic	Medium	Medium	Medium	Yes	--	Sulfide; clay
Barium	Low	Low	Low	--	--	Sulfate; reducing conditions carbonate; clay
Beryllium	Low	Low	Low	Yes	Yes	Clays
Cadmium	Medium	Medium	Medium	--	--	Reducing conditions
Chromium	Very Low	Very Low	Very Low	--	--	
Cobalt	High	Medium	Very Low to Low	Yes	--	
Copper	High	Medium to Low	Very Low	Yes	Yes	Sulfide; adsorption
Manganese	High	High	High to Very Low	Yes	--	Clays
Mercury (aqueous)	Medium	Low	Low	Yes	--	Sulfide
Mercury (vapor)	High	High	High	--	--	
Nickel	High	Medium to Low	Very Low	--	--	Sulfide; adsorption; silicate minerals
Silver	High	Medium to Low	Very Low	Yes	Yes	Reducing conditions; sulfide
Vanadium	High	High	Very High	--	--	Silicate minerals; reducing conditions; adsorption
Zinc	High	High to Medium	Low to Very Low	Yes	Yes	Sulfide; carbonate; phosphate

6.0 QUALITATIVE EXPOSURE ASSESSMENT

6.1 INTRODUCTION

A human health exposure pathway describes a chemical's route of transport from its source to the current or projected future exposed individual. A complete exposure pathway is comprised of the following elements:

- A source and mechanism of chemical release to the environment;
- An environmental medium (e.g., surface soil) for the released chemical and/or mechanism of transfer of the chemical from one medium to another;
- A point of potential contact (e.g., exposure) by humans with the contaminated medium;
- A route of exposure (i.e., inhalation, ingestion, and/or dermal absorption); and
- A receptor population.

An identified pathway does not imply that exposures are actually occurring, only that the potential exists for the pathway to be complete. This section presents a qualitative exposure assessment for the Ilion (East Street) Site.

6.2 EXPOSURE SETTING

The 1.3-acre site is bounded by East Clark Street to the north, East Street to the east, East State Street to the south, and a commercial property and several residences to the west, north, and east of the Site. The property is surrounded by an eight-foot chain-link fence topped with barbed wire, and two locked gates, located along East Street and East Canal Street, control access. The Site currently houses a gas regulator station in a small building near the facility gate off East Street, former building footprints (concrete), and a gravel driveway/parking area. The building is not regularly manned. The remainder of the Site is vegetated with grass and coniferous trees. The Site slopes gently from south to north.

The Off-Site Study Area, approximately 4 acres in size, is generally an open, vacant parcel of land to the northeast of the Site. A majority of the property is vegetated, and an open swale lies in the northwestern portion of the area. The Off-Site Study Area is bounded generally on the south and west by the extension of East North Street, and residential properties and East Street, respectively. The Off-Site Study Area is bounded to the north by the Mohawk River and to the east by disposal areas/vacant land. Portions of the Off-Site Study Area are surrounded by chain-link fencing. The Village of Ilion Department of Public Works utilizes this area for storage (e.g., soil piles). Formerly, the Village of Ilion utilized this area as a dump to dispose of municipal waste, including wastes from Remington Arms and other local industries (EA, 1988). In addition, based on observations made during the RI, refuse appears to have been historically deposited in the field on the north side of East North Street Extension. Currently, this area is being used for disposal of construction debris.

Groundwater is used as a municipal supply for the Village of Mohawk (east of the Site) and the Village of Frankfort (west of the Site). The Village of Ilion obtains its municipal water supply from surface water sources (Parsons, 1998).

It is anticipated that future use of the Site and Off-Site Study Area properties will remain generally the same (i.e., non-residential).

6.3 SOURCE OF CONTAMINATION

As discussed in Section 4.0, the results of the RI's sampling and analyses indicate elevated concentrations of BTEX, PAH, and/or cyanide are present in soil and/or groundwater at the Site. These constituents, specifically PAHs, are also present in soil at the off-site study area, although their presence (or a portion thereof) may not be related to the Site. Contaminants have migrated from the original source area(s), likely through a variety of mechanisms, with migration of detected constituents to underlying soils and groundwater by percolation of rainwater and/or infiltration of groundwater through contaminated soils and/or NAPL being of principal importance (see Section 5.0). The source of the contamination in the Off-Site Study Area is not definitively known and has not been directly linked to migration from the Site.

6.4 RECEPTORS

Receptors identified for current/future land use for the Site include a worker at the facility and a trespasser. Although not projected at this time, if the Site property is redeveloped in the future, a construction worker and a utility worker may be exposed to contaminated media at the Site. The Site is bordered by residential properties to the northwest, and there is housing across East Street; however, residential use of the Site property is not anticipated.

For the Off-Site Study Area, current/future receptor populations include a worker (e.g., Village of Ilion Department of Public Works, Amvets Post 777) and a trespasser. Based on property features such as the location of the drainage swale system and the shallow depth to groundwater, redevelopment of the property, either as a commercial/industrial facility or for residential use, is not anticipated.

6.5 POTENTIAL EXPOSURE PATHWAYS

Possible exposure pathways for the potential receptor populations were evaluated, and the selection process is presented in Table 6-1. The location, scenario timeframe, medium, exposure medium, exposure point, receptor population, exposure route, and the rationale for selection or exclusion of the potential exposure pathway are provided. The selection of potential exposure pathways is summarized below by medium:

Surface Soil

Potential exposure to constituents in the surface soil of the Site may occur for the current and future worker and trespasser. For the Off-Site Study Area, potential exposure may also occur for the current and future worker and trespasser. These exposures may result from incidental ingestion, dermal absorption, or inhalation of released VOCs and/or re-suspended particulates from the surface soils. Incidental ingestion of soil is the consumption of soil particles adhering to the skin (generally on the hand) as a result of hand to mouth contact. The dermal absorption pathway involves the absorption of chemical constituents through the skin surface given direct contact.

All (Surface and Subsurface) Soil

For the Site, near-Site area, and Off-Site Study Area, the current/future worker and trespasser may be exposed to constituents throughout the soil column via inhalation of released VOCs from subsurface contamination in the vadose zone. Maintenance of utility lines on the Site and/or construction/re-development would result in the future worker's potential exposure to constituents in all soils from incidental ingestion, dermal absorption, or inhalation of released VOCs and/or re-suspended particulates from the soil.

Swale Subsurface Soils

Potential exposure to constituents in the open swale subsurface soils in the northern portion of the Off-Site Study Area may occur for a current and future worker during maintenance of the drainage system. These exposures may result from incidental ingestion, dermal absorption, or inhalation of released VOCs and/or re-suspended particulates (if sufficiently dry).

Groundwater

A future worker may be exposed to volatile organic constituents in the groundwater at the Site via off-gassing of VOCs to soil gas and/or migration through the overlying soil into the indoor air of a facility building. Maintenance of utility lines and/or construction/re-development would result in a future worker at the Site being potentially exposed to constituents in the groundwater (which infiltrated into excavations) via incidental ingestion, dermal absorption, or inhalation of released VOCs.

Vapor Intrusion

Potential exposure through vapor intrusion would apply to only those within enclosed structures on the Site, adjacent to the Site, or within the dimensions of an off-site groundwater plume emanating from the Site. During the 2008 groundwater monitoring, VOCs were not detected or were detected at levels just slightly exceeding the NYSDEC WQ value in groundwater samples collected at downgradient monitoring wells located at the Site perimeter and between the Site and overlying downgradient enclosed structures (e.g., residences). Groundwater containing elevated concentrations of VOCs is not migrating downgradient of the Site perimeter to downgradient enclosed structures (e.g., residences).

In addition, soil vapor samples collected at nine locations at the site perimeter in the downgradient direction contained very low concentrations of VOCs. The concentrations were below the criteria presented in Table 2b of the USEPA Draft Vapor Intrusion Guidance (USEPA, 2002).

Based on the groundwater and soil vapor data, and the distance to nearby receptors (i.e., residences), the potential exposure to any occupants of these structures is unlikely. The possible exposure through VI to a worker within a structure on the Site is also unlikely. There only exists one structure on the property that can only be accessed by a worker with a key. The time spent inside of this structure would be minimal and thus any potential exposure would also be minimal.

TABLE 6-1 (Sheet 1 of 3)
Selection of Potential Exposure Pathways

Location	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Exposure Route	Rationale for Selection or Exclusion of Potential Exposure Pathway
Site	Current/Future	Soil	Surface Soil	Surface Soil	Worker	Incidental Ingestion	Direct exposure through incidental ingestion of the site surface soils
						Dermal Absorption	Direct exposure through contact with the site surface soils
						Inhalation of Volatiles	Inhalation of VOCs released from the surface soil into the ambient air
						Inhalation of Particulates	Inhalation of site surface soil particulates entrained into the ambient air by wind
					Trespasser	Incidental Ingestion	Direct exposure through incidental ingestion of the site surface soils
						Dermal Absorption	Direct exposure through contact with the site surface soils
						Inhalation of Volatiles	Inhalation of VOCs released from the surface soil into the ambient air
						Inhalation of Particulates	Inhalation of site surface soil particulates entrained into the ambient air by wind
			All Soil	All Soil	Worker	Inhalation of Volatiles	Inhalation of VOCs released from the subsurface contamination in the vadose zone into the ambient air
					Trespasser	Inhalation of Volatiles	Inhalation of VOCs released from the subsurface contamination in the vadose zone into the ambient air
	Future	Soil	All Soil	All Soil	Worker	Incidental Ingestion	Direct exposure through incidental ingestion of the site all soils during maintenance/construction activities
						Dermal Absorption	Direct exposure through contact with the site all soils during maintenance/ construction activities
						Inhalation of Volatiles	Inhalation of VOCs released from the all soils into the ambient air during maintenance/construction activities

TABLE 6-1 (Sheet 2 of 3)
Selection of Potential Exposure Pathways

Location	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Exposure Route	Rationale for Selection or Exclusion of Potential Exposure Pathway
Site [cont'd]	Future [cont'd]	Soil [cont'd]	All Soil [cont'd]	All Soil [cont'd]	Worker [cont'd]	Inhalation of Particulates	Inhalation of all soil particulates entrained into the ambient air during maintenance/construction activities
		Groundwater	Groundwater	Indoor Air (Vapor Intrusion)	Worker	Inhalation of Volatiles	VOCs in groundwater migrating through overlying soil into the indoor air of a Site building
				Soil Gas	Worker	Inhalation of Volatiles	Off-gasing of VOCs in groundwater to soil gas
				Groundwater Infiltration	Worker	Incidental Ingestion	Direct exposure through incidental ingestion of the site groundwater during maintenance/construction activities
						Dermal Absorption	Direct exposure through contact with the site groundwater during maintenance/construction activities
						Inhalation of Volatiles	Inhalation of VOCs released from the groundwater into the ambient air during maintenance/construction activities
Off-Site Study Area	Current/Future	Soil	Surface Soil	Surface Soil	Worker	Incidental Ingestion	Direct exposure through incidental ingestion of the off-site study area surface soils
						Dermal Absorption	Direct exposure through contact with the off-site study area surface soils
						Inhalation of Volatiles	Inhalation of VOCs released from the surface soil into the ambient air
						Inhalation of Particulates	Inhalation of off-site study area surface soil particulates entrained into the ambient air by wind
					Trespasser	Incidental Ingestion	Direct exposure through incidental ingestion of the off-site study area surface soils

TABLE 6-1 (Sheet 3 of 3)
Selection of Potential Exposure Pathways

Location	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Exposure Route	Rationale for Selection or Exclusion of Potential Exposure Pathway
Off-Site Study Area [cont'd]	Current/Future [cont'd]	Soil [cont'd]	Surface Soil [cont'd]	Surface Soil [cont'd]	Trespasser [cont'd]	Dermal Absorption	Direct exposure through contact with the off-site study area surface soils
						Inhalation of Volatiles	Inhalation of VOCs released from the surface soil into the ambient air
						Inhalation of Particulates	Inhalation of off-site study area surface soil particulates entrained into the ambient air by wind
			All Soil	All Soil	Worker	Inhalation of Volatiles	Inhalation of VOCs released from the subsurface contamination in the vadose zone into the ambient air
					Trespasser	Inhalation of Volatiles	Inhalation of VOCs released from the subsurface contamination in the vadose zone into the ambient air
		Swale Sediments	Sediments	Sediments	Worker	Incidental Ingestion	Direct exposure through incidental ingestion of the off-site study area swale sediments during maintenance of the drainage system
						Dermal Absorption	Direct exposure through contact with the off-site study area swale sediments during maintenance of the drainage system
						Inhalation of Volatiles	Inhalation of VOCs released from the swale sediments into the ambient air
						Inhalation of Particulates	Inhalation of off-site study area swale sediments particulates entrained into the ambient air by wind (pathway complete only if sufficiently dry)

7.0 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the conclusions of the RI performed at the Ilion (East Street) Site and presents recommendations for the FS to be performed at the Site. Data generated during the PSA was included, as applicable, in the development of the conclusions.

7.1 CONCLUSIONS

Based on the data generated during the performance of the field investigations, the following conclusions are presented for the Ilion (East Street) Site.

7.1.1 Geological/Hydrogeological

- Four unconsolidated deposits are present beneath the Site. In descending order from the ground surface (with their range of measured thickness on the Site), they are: disturbed soils/fill consisting of sand, gravel, silt, clay, wood, coal, and anthropogenic materials (2.5 to 13 feet); peat (0 to 3 feet); lacustrine deposits composed of silts, sands, and clays (2 to 27 feet); and sand and gravel (greater than 30 feet).
- The Off-Site Study Area geology is similar to the Site geology, with a layer of disturbed soils (generally fill, but including topsoil; up to 12 feet in thickness), overlying sand, silt, and clay (up to 4 feet in thickness), and/or peat (4 feet or more). Municipal wastes, construction debris, metal and other materials are present in the fill layer. Underlying the peat are silt, sand and/or clay alluvial or lacustrine deposits (frequently containing shells of small aquatic animals).
- The potentiometric surface at the Site has a relatively low gradient (nearly flat), with only a one to two-foot difference between the highest and lowest groundwater elevations.
- The hydraulic gradient in the sand and gravel unit ranged from approximately 3.76 x 10^{-3} to 9.41 x 10^{-3} feet/foot for flow northwest from MW-06.
- The hydraulic conductivity in the sand and gravel unit at the Site study area ranged from 2.48 x 10^{-3} cm/sec to 2.44 x 10^{-2} cm/sec, with a mean of 1.08 x 10^{-2} cm/sec. Based on the soil type observed at the Off-Site Study Area, hydraulic conductivity values for the Off-Site Study area are likely consistent with the values obtained from slug test data and analyses performed at the Site study area.
- The vertical permeability of the glacial lacustrine unit overlying the sand and gravel unit is 2.19 x 10^{-5} cm/sec (measured at 12 to 13.7 feet bgs from MW-01).
- Groundwater velocities in the sand and gravel unit ranged from 0.46 feet/day to 1.15 feet/day.

7.1.2 Site/Near Site Area Nature and Extent of Contamination

Surface Soils

- No VOCs were detected in the surface soil at the Site where analyzed.
- Total PAHs and Total cPAHs were measured in background surface soils at concentrations up to 44.7 ppm and 21.2 ppm, respectively.
- Of the 32 surface soil samples collected on or nearby to the Site, the Total PAH and Total cPAH concentrations at ten and nine locations, respectively, were above maximum background concentrations.
- Based on the distribution of PAHs on Site, in the near-Site area, and in the background locations, it appears that former MGP operations may have locally contributed a portion of these constituents to the surficial soils. However, other sources may also be a factor, especially for locations along roadways (e.g., vehicle exhaust).
- Site concentrations for the metals in surficial soils appear to be generally equivalent in magnitude to those detected in the background samples, and thus do not indicate that the Site contributed metals to the surface soils.
- Where cyanide was detected in the surface soils, the concentrations are below the USEPA Region 3 RBCs for industrial and residential properties.

Subsurface Soils

- Visual/olfactory indications of coal tar (e.g., NAPL, staining, sheens, odors) occur at a depth of approximately 8-12 feet bgs, corresponding to the bottom of the fill materials and/or above the peat and lacustrine deposits, in or adjacent to the historical MGP structures (former 200,000 cubic foot gasholder) on the Site.
- Visual/olfactory observations of coal tar (e.g., NAPL, staining, sheens, odors) are observed at a depth of 10-11 feet bgs, corresponding to the bottom of the fill materials at the location of the former octagonal gasholder. The remaining slab and walls of the gasholder hydraulically isolate the NAPL and groundwater present within the gasholder from groundwater and soil outside the gasholder.
- Where encountered, the nature of the NAPL observed on the Site ranges from discontinuous blebs to locally saturating pore spaces in soils.
- Total BTEX concentrations above the 10 ppm NYSDEC TAGM 4046 screening level for total volatile organics were noted at depths of approximately 9 to 10 feet bgs in three locations near the 200,000 cu. ft. holder and the octagonal holder.
- Elevated (i.e., greater than 500 ppm) Total PAH concentrations were noted near or within the former octagonal gasholder (SB-11/MW-05/MW-02) and near or within the former 200,000 cu. ft gasholder (SB-08/SB-15).

- Concentrations for the metal constituents detected in subsurface soils were approximately equivalent in magnitude to the concentrations present in the background locations and are not considered to be related to former MGP operations.
- Cyanide occurred in ten subsurface soil samples, with the highest concentrations near or within the former 200,000 cu. ft gasholder (TtSB-04 at 10'-10.5' bgs). The detected concentrations for cyanide are below the USEPA Region 3 RBCs for industrial and residential properties.

Groundwater

- Analytical results from the most recent groundwater sampling event (February 2008) conducted at the Site indicate concentrations of volatile organic compounds above the NYSDEC WQ Values are limited to monitoring wells located within the Site boundary.
- The highest concentrations of BTEX constituents observed in the Site groundwater samples were detected in the groundwater sample collected at MW-02, which contained concentrations of benzene at 43 ppb, ethylbenzene at 15 ppb, and total xylenes at 17 ppb. In addition, groundwater samples collected from monitoring wells MW-05, MW-07, and MW-08 exhibit concentrations of benzene at levels slightly above the NYSDEC WQ values. The observed concentrations are slightly higher than the concentrations detected during prior sampling rounds, but continue to be below the maximum values detected previously.
- Evaluation of the nine rounds of groundwater analytical data indicate a general decrease in concentrations for BTEX, PAHs and cyanide has occurred since 1997, indicating natural attenuation processes are likely occurring, even though groundwater samples collected from select wells (MW-02, MW-07, MW-08, MW-10, and MW-11) exhibit fluctuating groundwater concentrations and a discernible decreasing or increasing trend is not demonstrated.
- Non-destructive forms of natural attenuation, such as dispersion, advection, and sorption, and volatilization occur naturally as part of the natural groundwater system and may be the cause of the general decrease in concentration. Evaluation of site-specific geochemical data, to be conducted during the Feasibility Study, is necessary to evaluate whether destructive forms of natural attenuation, such as biological or abiotic degradation, are occurring at the Site study area.
- Concentrations of cyanide in groundwater samples at MW-08 exhibit varied and fluctuating levels of cyanide and a discernible decreasing or increasing trend is not demonstrated.
- Concentrations of 1,1,1-trichloroethane and 1,1-dichloroethane were detected in MW-05 in 1997 above NYSDEC WQ Values. Groundwater samples collected from MW-05 during the February 2008 did not contain concentrations of 1,1,1-trichloroethane and 1,1-dichloroethane above the NYSDEC WQ Values. MW-05 is positioned within the former octagonal gasholder and is hydraulically isolated from the groundwater at the Site.

Soil Vapor

- Concentrations of soil vapor collected at nine locations along the site perimeter in the downgradient direction were detected at levels at the same order of magnitude, or just slightly above the order of magnitude observed in the ambient air sample. Since this comparison was performed without consideration of a generic attenuation factor of 0.1, the shallow soil gas concentrations are consistent with concentrations detected in the ambient air sample.

- Concentrations of soil vapor were detected at levels below the USEPA criteria provided in Table 2b of the 2002 USEPA Vapor Intrusion Guidance.

- No further remedial investigation activities to assess off-site soil vapor are recommended based on the following lines of evidence:

  - Relatively low levels of groundwater contamination,

  - Relatively low levels of soil vapor contamination detected in the soil vapor samples at the Site perimeter,

  - The comparison of detected soil vapor concentrations to the USEPA screening levels and the ambient air sample results, and

  - The distance from affected groundwater and soil to the nearest occupied structures.

- NYSDEC and NYSDOH concur with the recommendation for no further remedial investigation activities to assess off-site soil vapor.

7.1.3 Off-Site Study Area Nature and Extent of Contamination

Catch Basin Material

- The catch basins drain to the drainage swale, and thus material and/or contaminants entering the catch basins may contribute constituents to the swale from sources other than the Site (e.g., road run-off).
- BTEX compounds were detected in the catch basin materials, with Total BTEX concentrations ranging from approximately 0.001 ppm to 0.275 ppm.
- PAHs were detected in the catch basin materials, with Total PAH concentrations ranging from approximately 17.9 ppm to 74.6 ppm.

Surface Soils

- Concentrations of Total PAHs and Total cPAHs in the surficial soil in the Off-Site Study Area are below background concentrations.

Subsurface Soils

- Potential indications of MGP-related contamination were found locally within the Off-Site Study Area, although contamination unrelated to the Site was also encountered. The potential MGP-related contamination was observed at the bottom of the disturbed soils (fill), at the bottom of the silt and clay overlying the peat layer, or in the top of the peat. NAPL was not observed beneath the peat layer.

- Where encountered, the nature of the NAPL observed was typically blebs of tarry material.
- Concentrations of Total BTEX above 10 ppm were detected at three locations in the Off-Site Study Area: two beneath the road just northeast of the Site (FW-20A and FW-20A2 at approximately 8 feet bgs) and one near the southern property boundary for the DPW property, east of East Street (FW-08A at approximately 11 feet bgs).
- Elevated (i.e., greater than 500 ppm) Total PAH concentrations were noted near the intersection of East Street and North Clark Street (FW-20A/FW-20A2); along/near the East North Street Extension (FW-13C/FW-11F/FW-11H/TtTP04); in the field north of the East North Street Extension (FW-09A/FW-09B/FW-09C/FW-10A/FW-10B/FW-10C/FW-12A2); and along the southern property boundary for the DPW property, east of East Street (FW-08A/FW-08A3/FW-08B/OFTP-02).
- The concentrations for the metal constituents in the soil at the sampled locations were approximately equivalent to the concentrations present in the background locations (with localized exceptions at FW-12D and SED-03B). The metals in these soils are not considered to be related to former MGP operations.
- Cyanide was not detected in the Off-Site Study Area soil samples.
- Based on the distribution and identification of constituents in the off-site study area, it appears that MGP-related material may have contributed a portion of the noted impacts. Assorted municipal waste, construction materials, and debris were present in the sampled area, and likely also contributed to the detected contamination. Fingerprint samples from numerous locations indicated the presence of "biodegraded residual fuel oil," while analysis of the sample from OFTP-05 was characterized as "lubricant product."

Subsurface Soils - Open Swale Area

- Potential indications of MGP-related contamination were found locally within the open swale area, although contamination unrelated to the Site was also encountered. The peat layer appears to be a restriction for the migration of contaminants. NAPL observances and/or elevated PAHs were noted above the layer versus within/below.
- The usage of land in the off-site study area (former railroad bed, storm sewer, landfills, etc.), by its nature, has the potential to contribute contaminants, particularly PAHs, into the environment.
- Based on the distribution and identification of constituents in the open swale, it appears that MGP-related material may have contributed a portion of the noted impacts. Source fingerprinting indicates coal tar ranging from little, if any to significant quantities in nine of the 11 samples analyzed.
- Fingerprint samples from numerous locations also indicated the presence of biodegraded residual fuel oil. As gathered through research, assorted municipal

waste, construction materials, and debris present in the vicinity of the swale, are likely other contributors to the detected contamination.

- Elevated (i.e., greater than 500 ppm) Total PAH concentrations were noted in the soils beneath the southern half of the drainage swale (SED-05/FW-02/SED-02/ TtSED-05).
- Concentrations of PAHs in the soil beneath the drainage swale lessen in concentration north of location SED-02, towards the Mohawk River.

Groundwater

- Naphthalene, at a concentration of 13 ppb, slightly exceeded the NYSDEC WQ Value of 10 ppb at the groundwater sample collected from MW-15 during the February 2008 initial groundwater sampling round at the Off-Site Study Area. No other PAHs were detected at concentrations above the NYSDEC criteria.
- BTEX and cyanide were not detected above the NYSDEC WQ Values in the groundwater samples collected at MW-14, MW-15, MW-16, and MW-17.
- Due to the slight exceedence of the NYSDEC WQ value at MW-15 and the potential for the groundwater to be affected by contamination attributable to sources other than the Ilion East Street MGP facility, no further groundwater sampling is proposed at the Off-Site Study Area.

7.1.4 Exposure Assessment

- It is anticipated that the future use of the Site will remain non-residential.
- Potential exposure to constituents in the surface soil of the Site may occur for the current and future worker and trespasser. For the Off-Site Study Area, potential exposure may also occur for the current and future worker and trespasser.
- For both the Site and the off-site study area, the current/future worker and trespasser may be exposed to constituents throughout the soil column via inhalation of released VOCs from subsurface contamination in the vadose zone. Maintenance of utility lines on the Site and/or construction/re-development of the property would result in the future worker being potentially exposed to constituents in all soils.
- Potential exposure to constituents in the swale sediments in the northern portion of the Off-Site Study Area may occur for a current and future worker during maintenance of the drainage system.
- A Site future worker may be exposed to the constituents in the groundwater migrating through the overlying soil into the indoor air of a facility building and/or off-gasing to soil gas. Currently, the existing Site building houses a gas regulator and is not occupied on a frequent basis; therefore, a current worker was not assessed for this potential exposure pathway. Maintenance and/or construction activities would result in a future worker at the Site being potentially exposed to constituents in the groundwater that infiltrated into excavations.

7.2 EVALUATION OF DATA COMPARED TO NEW SOIL CLEANUP OBJECTIVES

As discussed previously, analytical results of soil samples from the RI activities conducted from the initial phases of investigation through the August 2006 field activities were compared to the NYSDEC TAGM 4046 RSCOs criteria. Total BTEX and Total PAH concentrations were compared to the TAGM 4046 RSCOs for total volatile organics (10 ppm) and total semi-volatile organics (500 ppm). These values were used as screening criteria to evaluate if additional delineation sampling was required for subsurface soils during the course of the RI. Subsequently, in December 2006, New York State adopted the 6 NYCRR Subpart 375-6 Soil Cleanup Objectives (SCOs). In a meeting between National Grid and NYSDEC on January 4, 2007, NYSDEC recommended that the soil analytical results from the RI be compared to the newly adopted SCOs and presented in a revised RI Report.

This section discusses the comparison of the RI analytical data collected from August 1999 through February 2008 to the new SCOs issued in December 2006. The new SCOs address only individual constituent levels. As indicated previously, Appendix M provides the comparison of the soil RI analytical data collected from the beginning of the RI through the February 2008 RI activities to the new SCOs issued by the NYSDEC.

Note that the exceedance of an SCO is not an indicator that a constituent in a sample is related to the former MGP operation. As discussed in Section 4.0 and in Section 7.1, there were constituents detected in the soil samples which are unrelated to the Site; further, some of the constituents considered associated with the MGP operations can, in some areas, be attributed to non-MGP sources. The following is a summary of the comparison to the new SCOs. Figures M-1 through M-3 and Tables M-1 through M-9, included in Appendix M, present a summary of the data evaluation detailed in this section.

7.2.1 Site/Near Site Area Nature and Extent of Contamination

- A larger number of soil samples collected at Site and near Site area locations exhibit exceedences of the new SCOs for VOCs, SVOCs (Figure M-2).
- The extent of impacts to the soil in the vicinity of the former 200,000 cubic foot gasholder presents an exceedence of the SCOs (Figure M-2).
- Based on the sample locations exhibiting exceedences of the SCOs, the extent of individual constituent exceedances has not been fully delineated (Figure M-2).

7.2.2 Off-Site Study Area Nature and Extent of Contamination

- A larger number of soil samples collected in the off-site study area locations exhibit exceedences of the SCOs for VOCs, SVOCs (Figure M-3).
- Based on the sample locations exhibiting exceedences of the SCOs, the extent of individual constituent exceedances has not been fully delineated (Figure M-3).

7.3 RECOMMENDATIONS

Based on the data generated during the performance of the PSA and the RI, and the conclusions outlined above, NG recommends the performance of a Feasibility Study (FS) for the Site, near Site area and Off-Site Study Area. Although comparison to the Subpart 375-6 Soil Cleanup Objectives indicates individual constituents have not been fully delineated, the nature and extent of MGP-related impacts has been evaluated to a degree sufficient to perform the FS. Exposure pathways are limited, and alternatives can be developed and evaluated in the FS to mitigate the identified exposure pathways.

8.0 REFERENCES

Casey, G. D., and Reynolds, R. J., 1989 Hydrogeology of the stratified-drift aquifers in the Utica Area, Oneida and Herkimer Counties, New York – part 2 (east): U.S. Geological Survey Report No. 88-4195, 8 sheets, scale 1:24,000.

EPA, 1997. Exposure Factors Handbook: Update to Exposure Factors Handbook, Volumes 1-3. EPA/600/P-95/002 F a-c. Office of Research and Development, National Center for Environmental Assessment, Washington, D.C. August 1997.

Erie Canal, 2005. The Erie Canal website. http://www.eriecanal.org. Information obtained on February 16, 2005.

FWENC, 1999. Offsite Storm Water Swale Investigation Summary Report, Ilion (East St.) Former MGP Site, Ilion, New York. Prepared for Niagara Mohawk Power Corporation, Syracuse, New York. Prepared by Foster Wheeler Environmental Corporation, Boston, Massachusetts. December 1999.

FWENC, 2000. Supplemental Off-Site Stormwater Swale Investigation Report for the Ilion (East Street) Site, Ilion, New York. Prepared for Niagara Mohawk Power Corporation. Prepared by Foster Wheeler Environmental Corporation. May 2000.

Ghosh, R.S., D.A. Dzombak, and R.G. Luthy, 1999. “Equilibrium Precipitation and Dissolution of Iron Cyanide Solids in Water.” *Environmental Engineering Science*, 16(4):293-313.

Herkimer, 2006. Herkimer county Clerk’s Office, Herkimer, New York. Information obtained on August 9, 2006.

Ilion, 2005. Village of Ilion website. http://www.ilionny.com. Information obtained on February 16, 2005.

Ilion, 2006. Village of Ilion Town Library, Ilion, New York. Information obtained on August 9, 2006.

National Grid, 2007. Draft Soil Vapor Intrusion Evaluation at National Grid MGP Sites in New York State. Prepared by O’Brien and Gere Engineers, Inc. September 2007. (Note: Appendices A and B referenced herein were approved by NYSDEC and NYSDOH on March 15, 2007, and included in the Original September 2006 submittal).

NYSDEC, 1994. Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels. HWR-94-4046. New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation. January 1994.

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. New York State Department of Environmental Conservation, Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1. June 1998.

NYSDEC, 1999. Errata Sheet for June 1998 Edition of the Division of Water Technical and Operational Guidance Series (TOGS) Number 1.1.1. New York State Department of Environmental Conservation. January 1999.

NYSDEC, 2000a. April 2000 Addendum to June 1998 Division of Water Technical and Operational Guidance Series (TOGS) No. 1.1.1. New York State Department of Environmental Conservation. April 2000.

NYSDEC, 2000b. Internal Memorandum: Determination of Soil Cleanup Levels. New York State Department of Environmental Conservation, Division of Environmental Remediation. 20 December 2000.

NYSDEC, 2002. Technical Guidance for Site Investigation and Remediation. DER-10. Draft. New York State Department of Environmental Conservation, Division of Environmental Remediation. December 2002.

NYSDEC, 2006. Remedial Program Soil Cleanup Objectives. New York State Department of Environmental Conservation, Division of Environmental Remediation. December 2006.

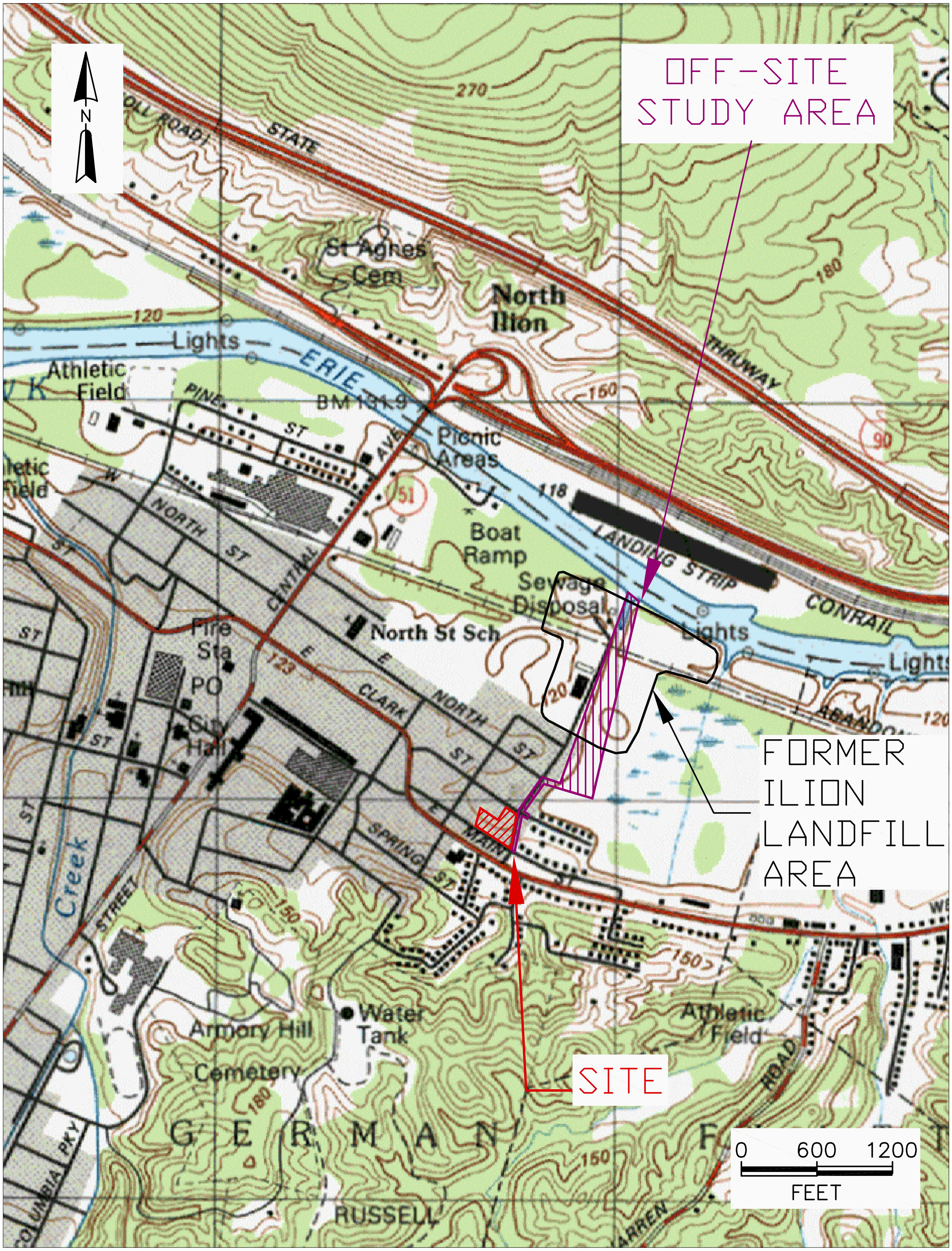
NYSDEC. 2006a. DER-13 / Strategy for Evaluating Soil Vapor Intrusion at Remedial Sites in New York. New York State Department of Environmental Conservation, Division of Environmental Remediation Program Policy. October 2006.

NYSDOH, 2006. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York. New York State Department of Health, Center of Environmental Health, Bureau of Environmental Exposure Investigation, October 2006.

Parsons, 1998. PSA/IRM Study, Ilion (East Street) Site. Prepared for Niagara Mohawk, Syracuse, New York. Prepared by Parsons Engineering Science, Inc., Syracuse, New York. February 1998.

USEPA, 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002.

WGI, 2000. Characterization of Samples, Ilion MGP/NIMO Site, Report 2. Prepared for Foster Wheeler Environmental Corporation. Prepared by Worldwide Geosciences, Inc. January 2000.



Source: Ilion, N.Y. USGS Topographic Quadrangle, 7.5–minute series, dated 1982.

nationalgrid

TETRA TECH EC, INC.

TITLE:

SITE LOCATION MAP

Remedial Investigation Report

Ilion (East Street) Site

DWN: LEA	DES.: LEA	PROJECT NO.: 2907.0003.0003
CHKD: PC	APPD: RC	
DATE: 10/12/04	REV.: 01	FIGURE NO.: 1–1

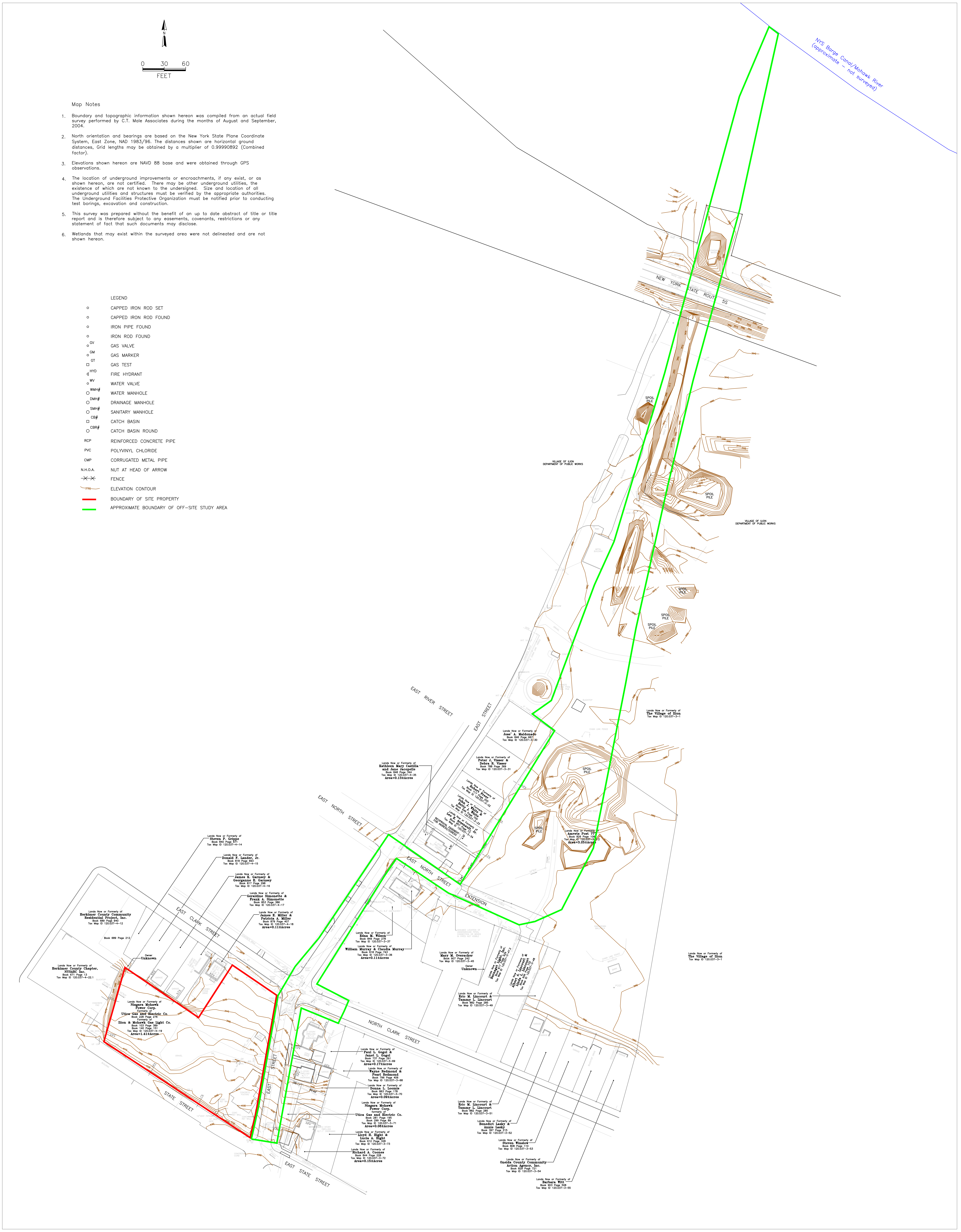
N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 1-1 SITE LOCATION.DWG

Map Notes

1. Boundary and topographic information shown hereon was compiled from an actual field survey performed by C.T. Male Associates during the months of August and September, 2004.
2. North orientation and bearings are based on the New York State Plane Coordinate System, East Zone, NAD 1983/96. The distances shown are horizontal ground distances, Grid lengths may be obtained by a multiplier of 0.99990892 (Combined factor).
3. Elevations shown hereon are NAVD 88 base and were obtained through GPS observations.
4. The location of underground improvements or encroachments, if any exist, or as shown hereon, are not certified. There may be other underground utilities, the existence of which are not known to the undersigned. Size and location of all underground utilities and structures must be verified by the appropriate authorities. The Underground Facilities Protective Organization must be notified prior to conducting test borings, excavation and construction.
5. This survey was prepared without the benefit of an up to date abstract of title or title report and is therefore subject to any easements, covenants, restrictions or any statement of fact that such documents may disclose.
6. Wetlands that may exist within the surveyed area were not delineated and are not shown hereon.

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH#	WATER MANHOLE
○ DMH#	DRAINAGE MANHOLE
○ SMH#	SANITARY MANHOLE
□ CB#	CATCH BASIN
○ CBR#	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
✕✕	FENCE
378	ELEVATION CONTOUR
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA



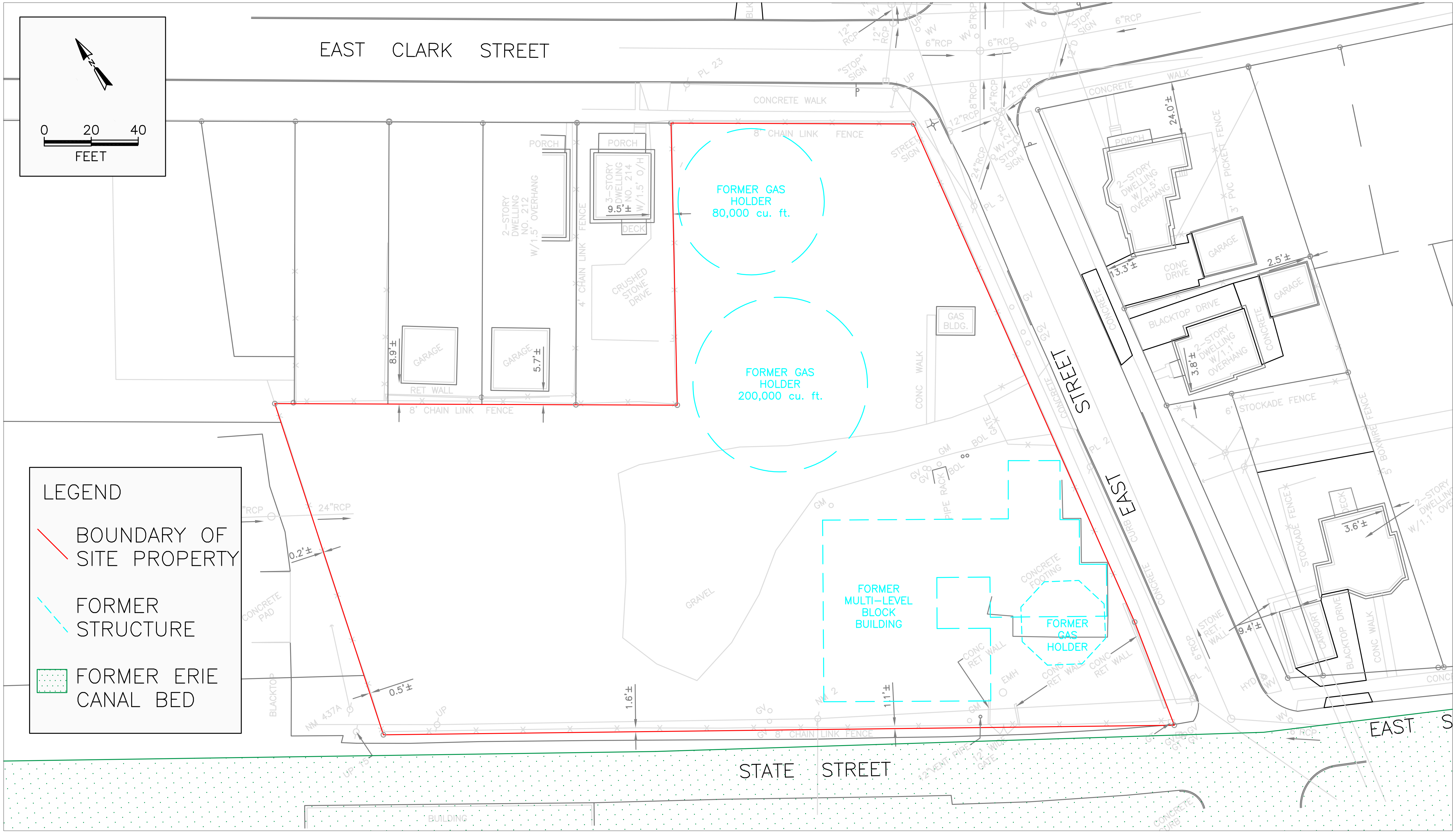
TETRA TECH EC, INC.

TITLE:
SITE PLAN AND SURROUNDING AREA
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN: LEA	DES.: LEA	PROJECT NO.: 2907.0003.0003
CHKD: PC	APPD: RC	FIGURE NO.: 1-2
DATE: 02/11/05	REV.: 0	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 1-2 SITE PLAN AND SURROUNDINGS.DWG



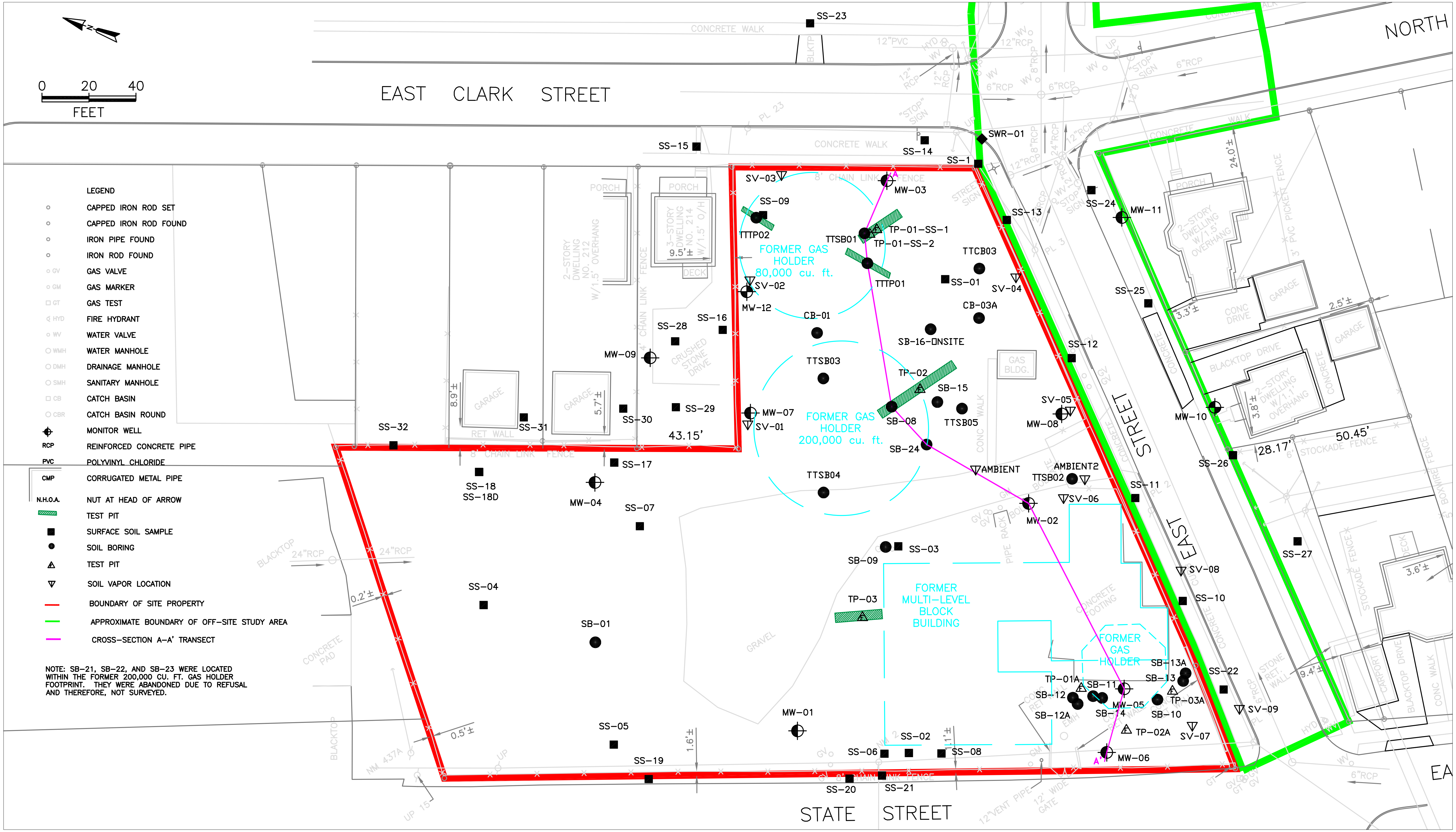
TETRA TECH EC, INC.

TITLE:
FORMER SITE FEATURES
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LEA	DATE: 02/11/05	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 1–3
DES.: LEA	APPD.:	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 1-3 FORMER STRUCTURES.DWG



NOTE: SB-21, SB-22, AND SB-23 WERE LOCATED WITHIN THE FORMER 200,000 CU. FT. GAS HOLDER FOOTPRINT. THEY WERE ABANDONED DUE TO REFUSAL AND THEREFORE, NOT SURVEYED.

TETRA TECH EC, INC.

TITLE:
SITE AND NEAR SITE AREA SAMPLING LOCATIONS
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 02/23/09	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 3	FIGURE NO.: 2-1
DES.: CTS	APPD.:	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-ISSUE FIGURES\RI FIGURE 2-1 SAMPLE LOCATIONS – SITE 022309.DWG

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH	WATER MANHOLE
○ DMH	DRAINAGE MANHOLE
○ SMH	SANITARY MANHOLE
□ CB	CATCH BASIN
○ CBR	CATCH BASIN ROUND
⊠	PIEZOMETER
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
▬	TEST PIT
■	SURFACE SOIL SAMPLE
●	SOIL BORING
⚠	TEST PIT
◆	SOIL SAMPLE COLLECTED IN THE OPEN SWALE AREA
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
—	CROSS SECTION B-B' TRANSECT
—	OUTLINE OF SWALE

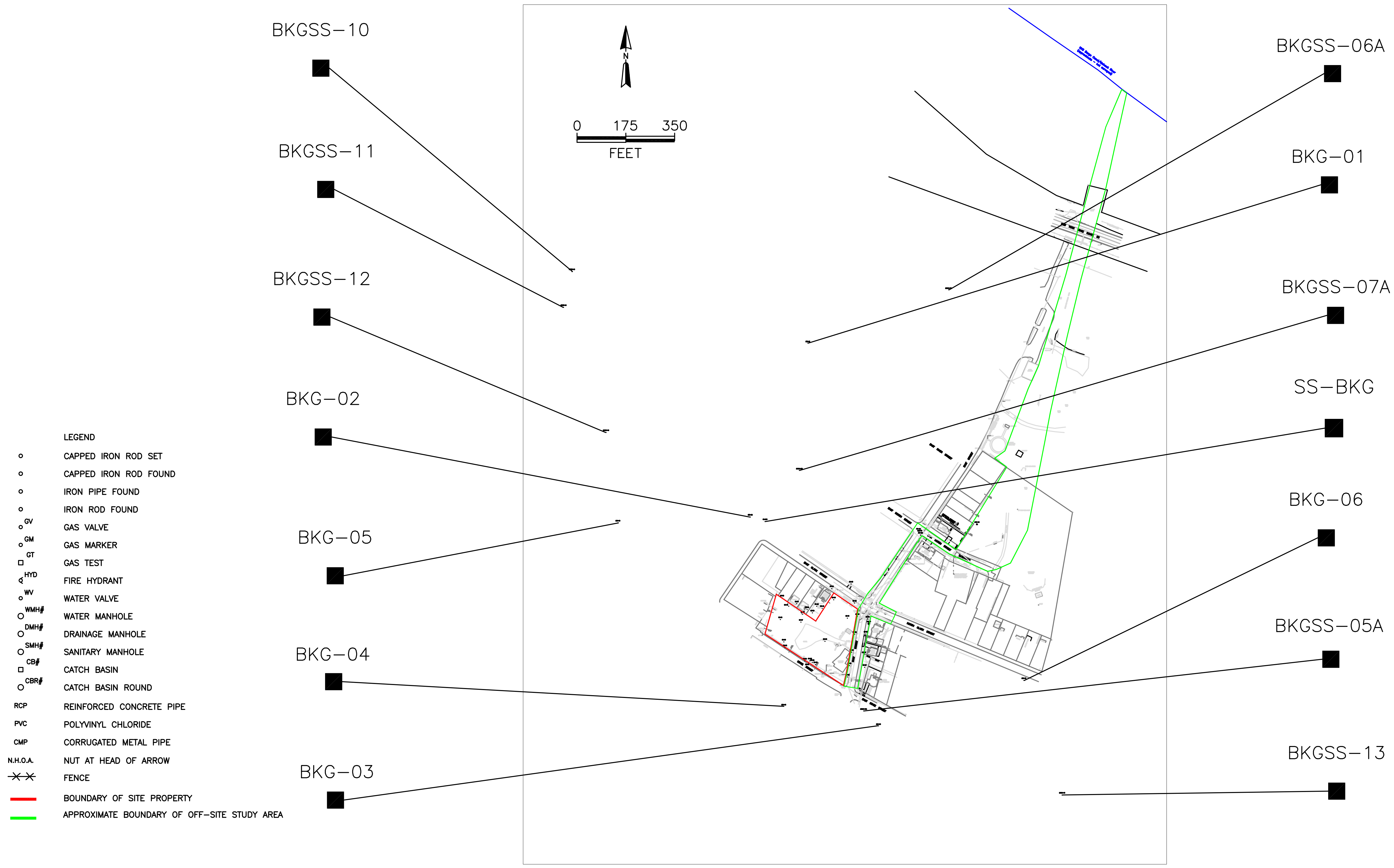
TETRA TECH EC, INC.

TITLE:
OFF-SITE STUDY AREA SAMPLING LOCATIONS
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN: CTS	DES.: CTS	PROJECT NO.: 2907.0003.0003	
CHKD: DPC	APPD: RC	FIGURE NO.: 2-2	
DATE: 05/09/08	REV.: 2		

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 2-2 SAMPLE LOCATIONS - OFF-SITE 050908.DWG



LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH#	WATER MANHOLE
○ DMH#	DRAINAGE MANHOLE
○ SMH#	SANITARY MANHOLE
□ CB#	CATCH BASIN
○ CBR#	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
—×—×—	FENCE
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF–SITE STUDY AREA

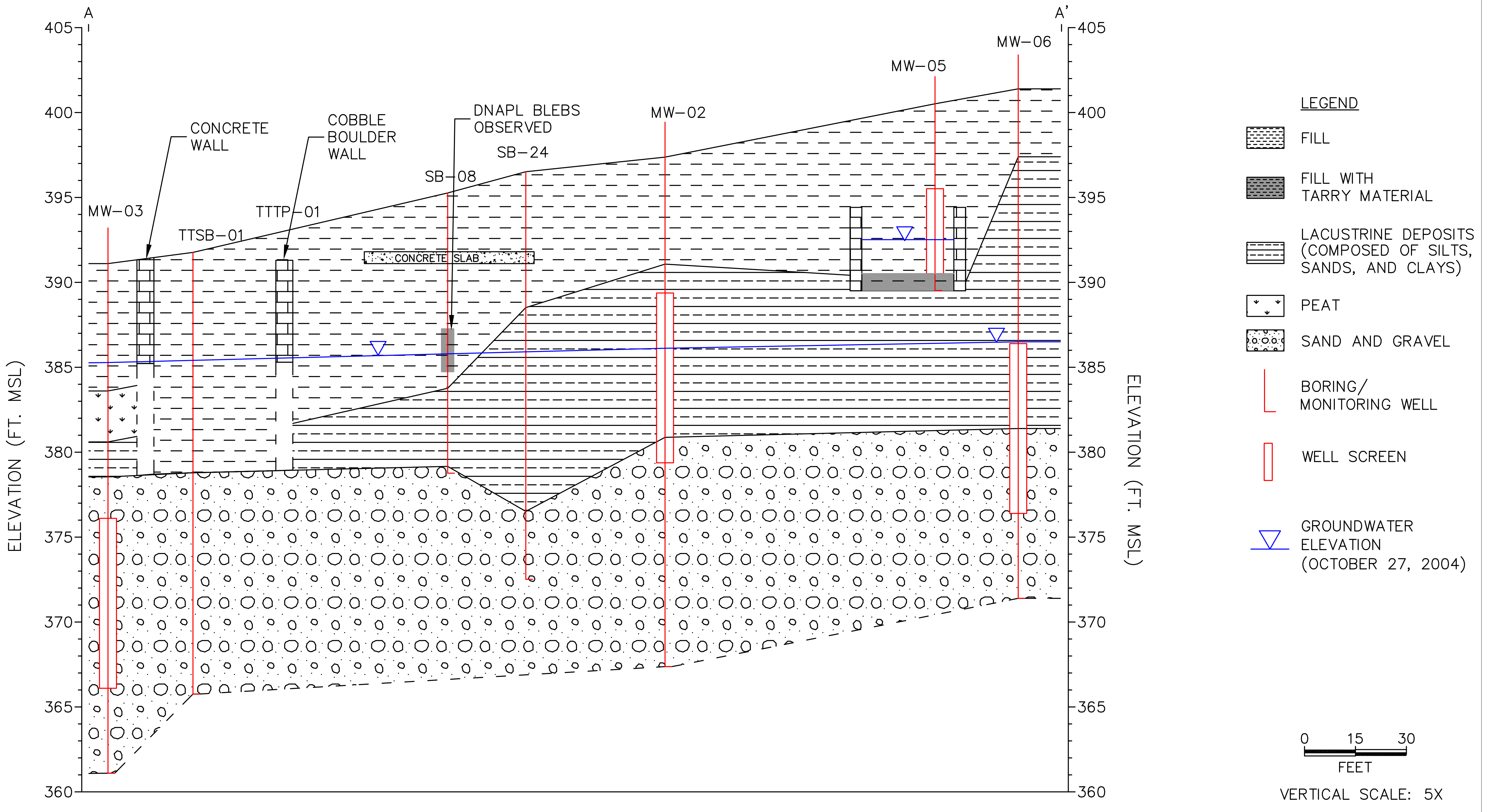
TETRA TECH EC, INC.

TITLE:
BACKGROUND SAMPLE LOCATIONS
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 02/16/05	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 2–3
DES.: CTS	APPD:	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE–REISSUE FIGURES\RI FIGURE 2–3 SAMPLE LOCATIONS – BACKGROUND.DWG



TETRA TECH EC, INC.

TITLE:

CROSS SECTION A–A'

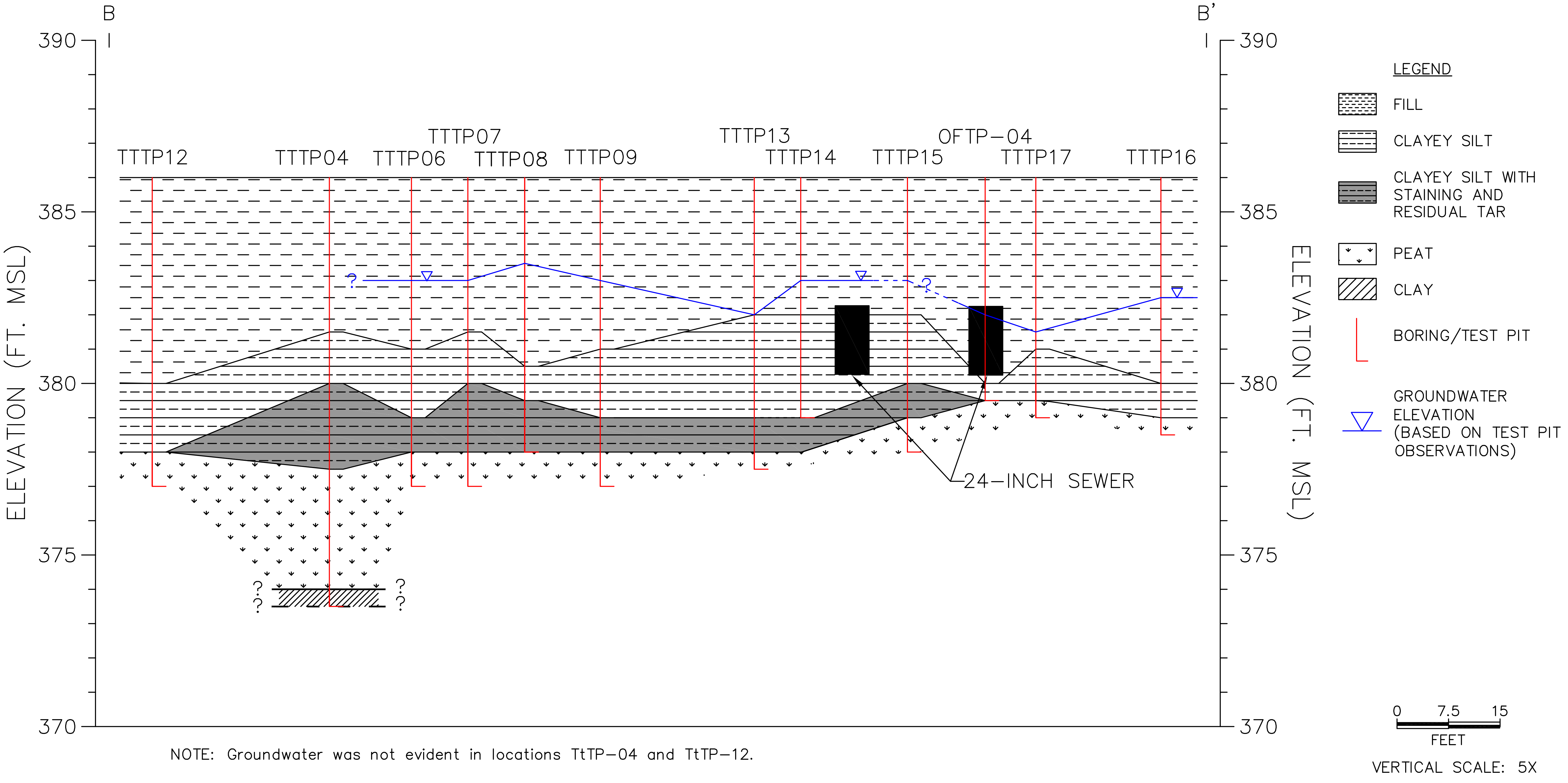
Remedial Investigation Report

Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 03/07/05	PROJECT NO.: 2907.0003.0003
CHKD.: DPC	REV.: 0	FIGURE NO.: 3–1
DES.: CTS	APPD: RC	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE–REISSUE FIGURES\RI FIGURE 3–1 A–A' XSECTION.DWG



NOTE: Groundwater was not evident in locations TtTP-04 and TtTP-12.

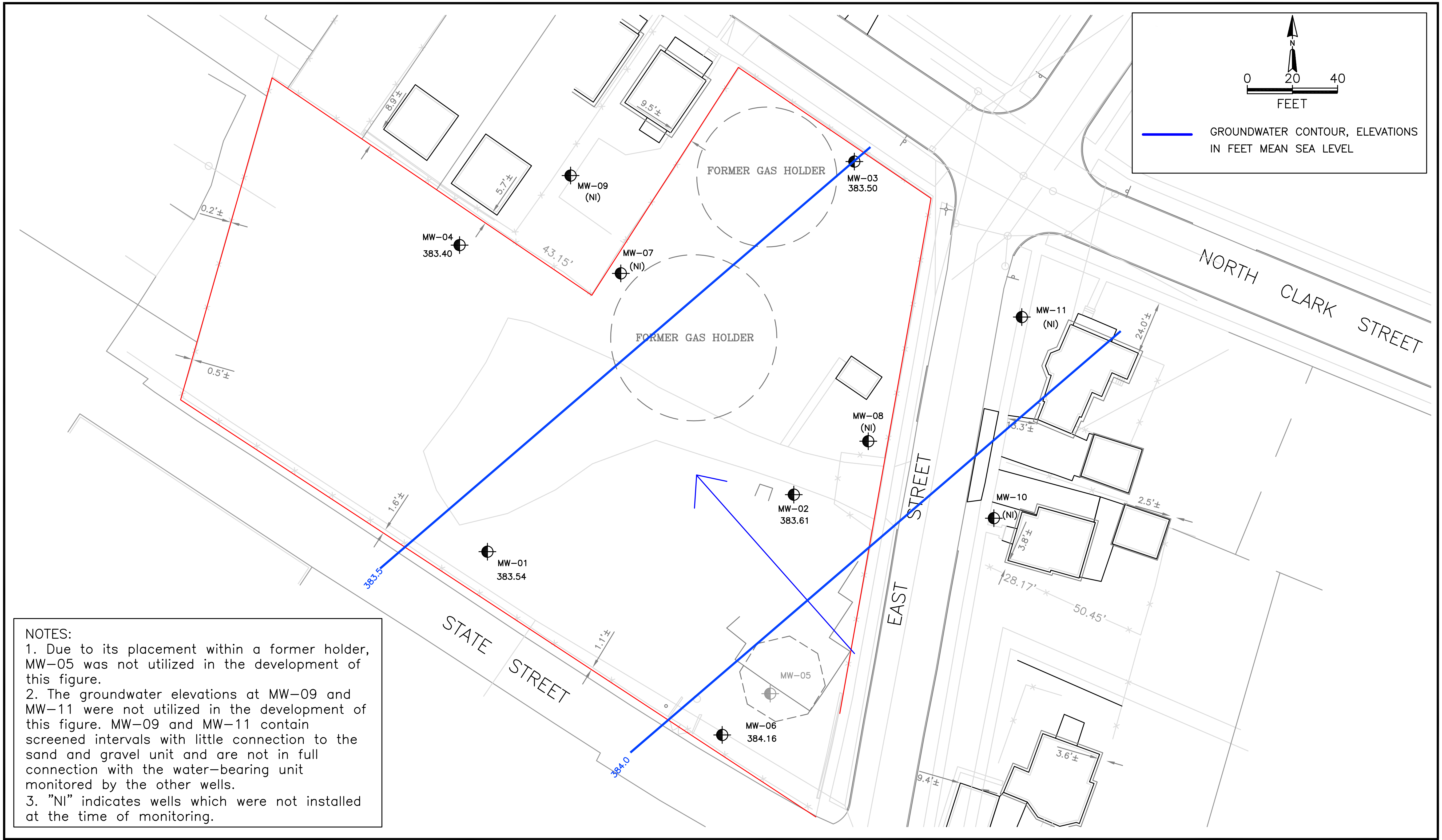
TETRA TECH EC, INC.

TITLE:
CROSS SECTION B-B'
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 02/15/05	PROJECT NO.: 2907.0003.0003
CHKD: DPC	REV.: 0	FIGURE NO.: 3-2
DES.: CTS	APPD: RC	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 3-2 B-B' XSECTION 032607.DWG



NOTES:
1. Due to its placement within a former holder, MW-05 was not utilized in the development of this figure.
2. The groundwater elevations at MW-09 and MW-11 were not utilized in the development of this figure. MW-09 and MW-11 contain screened intervals with little connection to the sand and gravel unit and are not in full connection with the water-bearing unit monitored by the other wells.
3. "NI" indicates wells which were not installed at the time of monitoring.

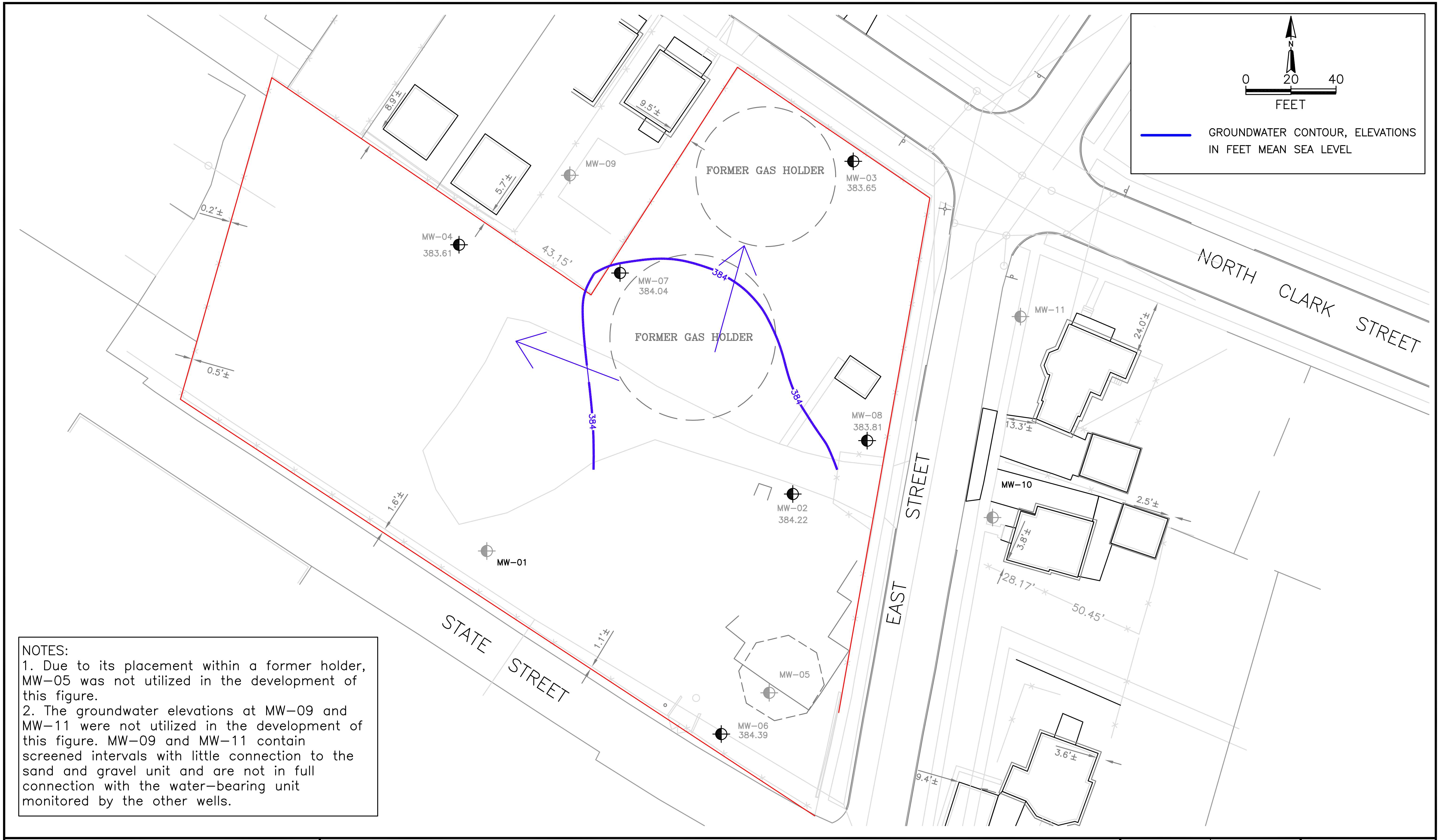
TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE – OCTOBER 29, 1997
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LEA	DATE: 05/16/08	PROJECT NO.: 2907.0003.0003
CHKD.: PC	REV.: 1	FIGURE NO.: 3-3
DES.: DPC	APPD.: RC	

N:\GIS\GISKey\Gisproj31\Ilion East Street\RI Re-reissue Figures\RI Figure 3-3 1997 GW Levels.DWG



NOTES:
1. Due to its placement within a former holder, MW–05 was not utilized in the development of this figure.
2. The groundwater elevations at MW–09 and MW–11 were not utilized in the development of this figure. MW–09 and MW–11 contain screened intervals with little connection to the sand and gravel unit and are not in full connection with the water–bearing unit monitored by the other wells.

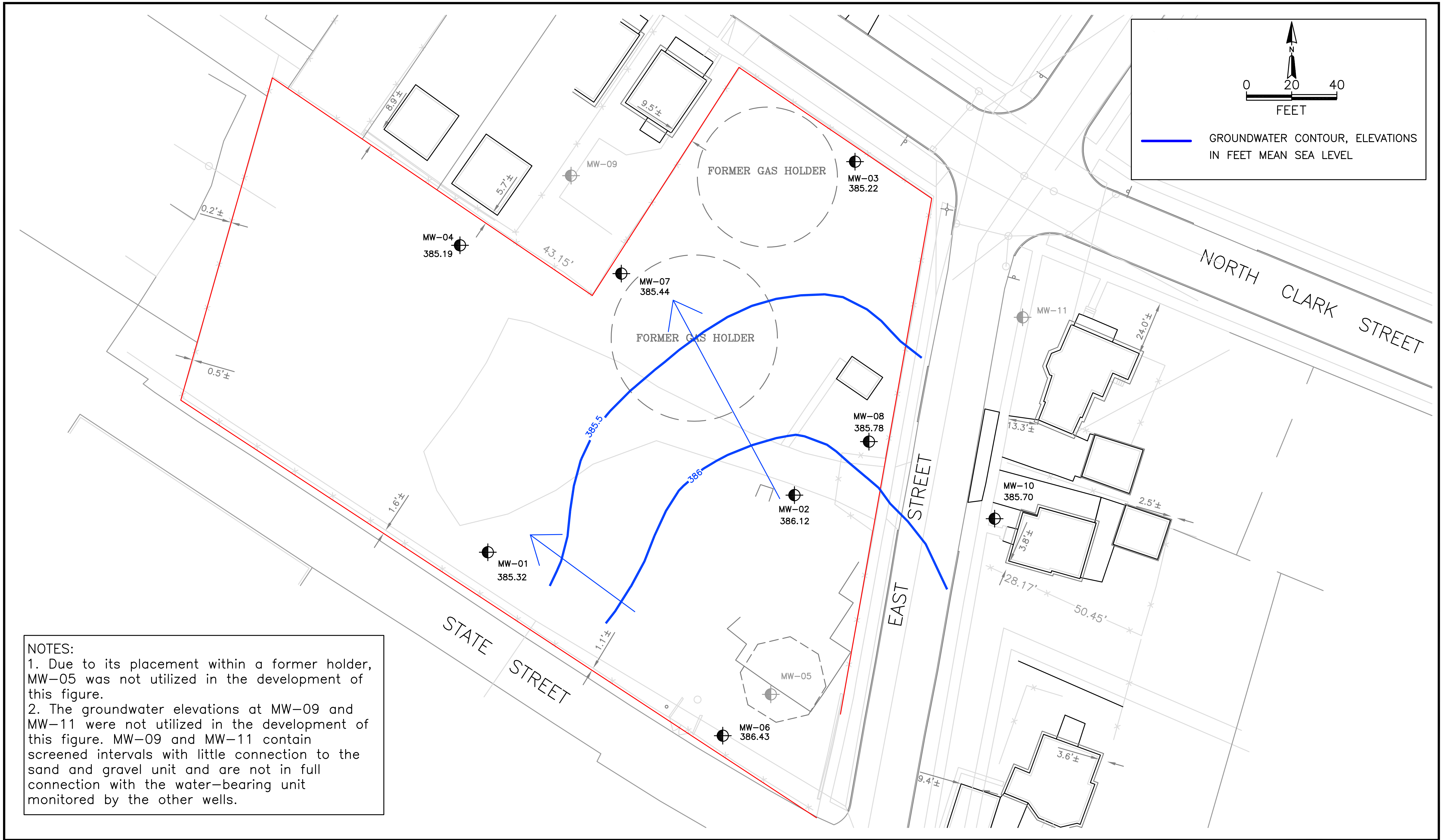
TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE – FEBRUARY 15, 2000
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LMB
CHKD: PC
DES.: SA
DATE: 05/16/08
REV.: 1
APPD:
PROJECT NO.: 2907.0003.0003
FIGURE NO.: 3–4

N:\GIS\GISKey\Gisproj31\Ilion East Street\RI Re–reissue Figures\RI Figure 3–4 02152000 GW Levels.DWG



NOTES:
1. Due to its placement within a former holder, MW—05 was not utilized in the development of this figure.
2. The groundwater elevations at MW—09 and MW—11 were not utilized in the development of this figure. MW—09 and MW—11 contain screened intervals with little connection to the sand and gravel unit and are not in full connection with the water—bearing unit monitored by the other wells.

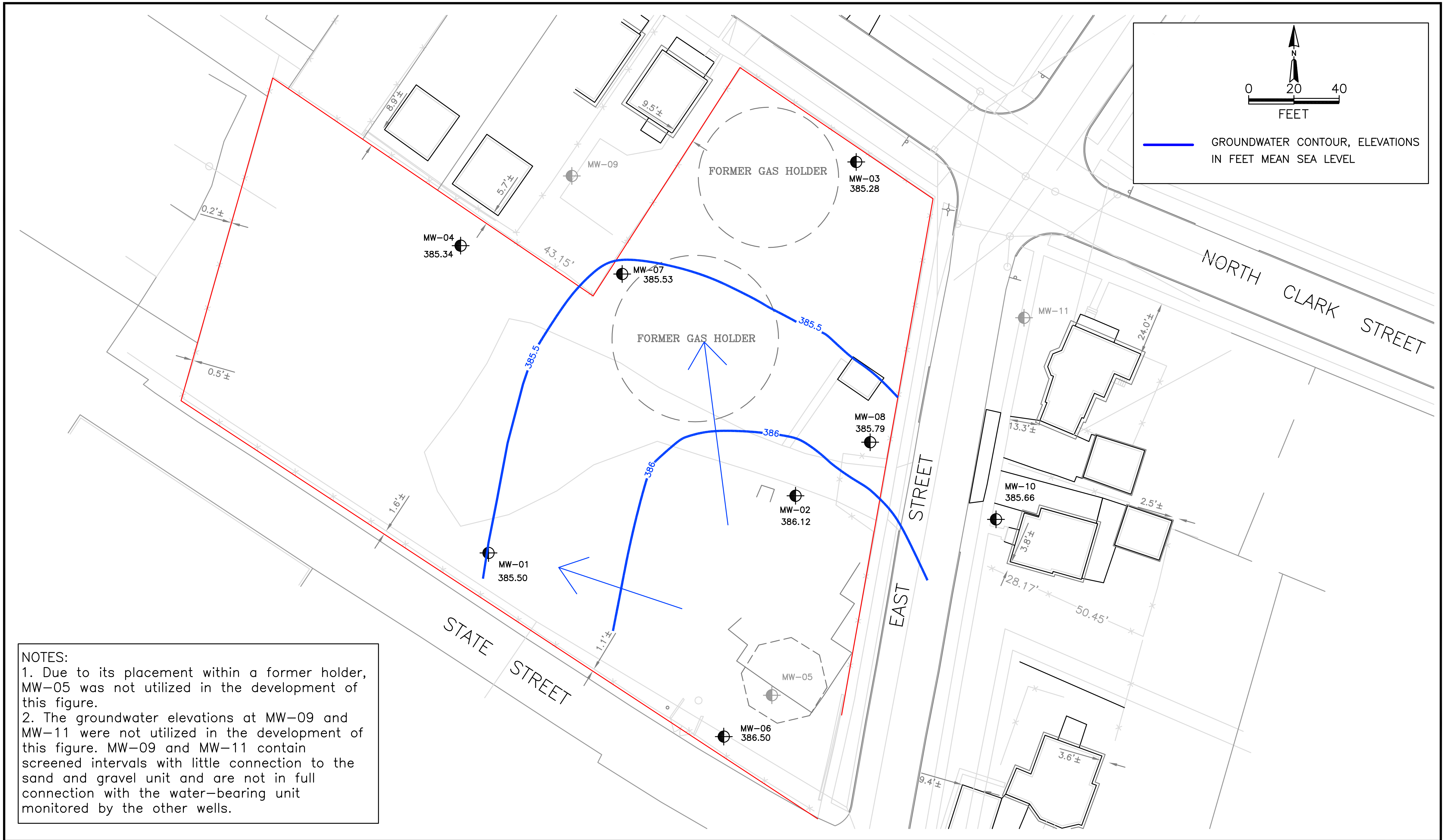
TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE — OCTOBER 19, 2004
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LEA
DATE: 05/16/08
CHKD: PC
REV.: 2
DES.: DPC
APPD: RC
PROJECT NO.: 2907.0003.0003
FIGURE NO.: 3-5

N:\GIS\GISKey\Gisproj31\Ilion East Street\RI Re-reissue Figures\RI Figure 3-5 10192004 GW Levels.DWG



NOTES:
1. Due to its placement within a former holder, MW–05 was not utilized in the development of this figure.
2. The groundwater elevations at MW–09 and MW–11 were not utilized in the development of this figure. MW–09 and MW–11 contain screened intervals with little connection to the sand and gravel unit and are not in full connection with the water–bearing unit monitored by the other wells.

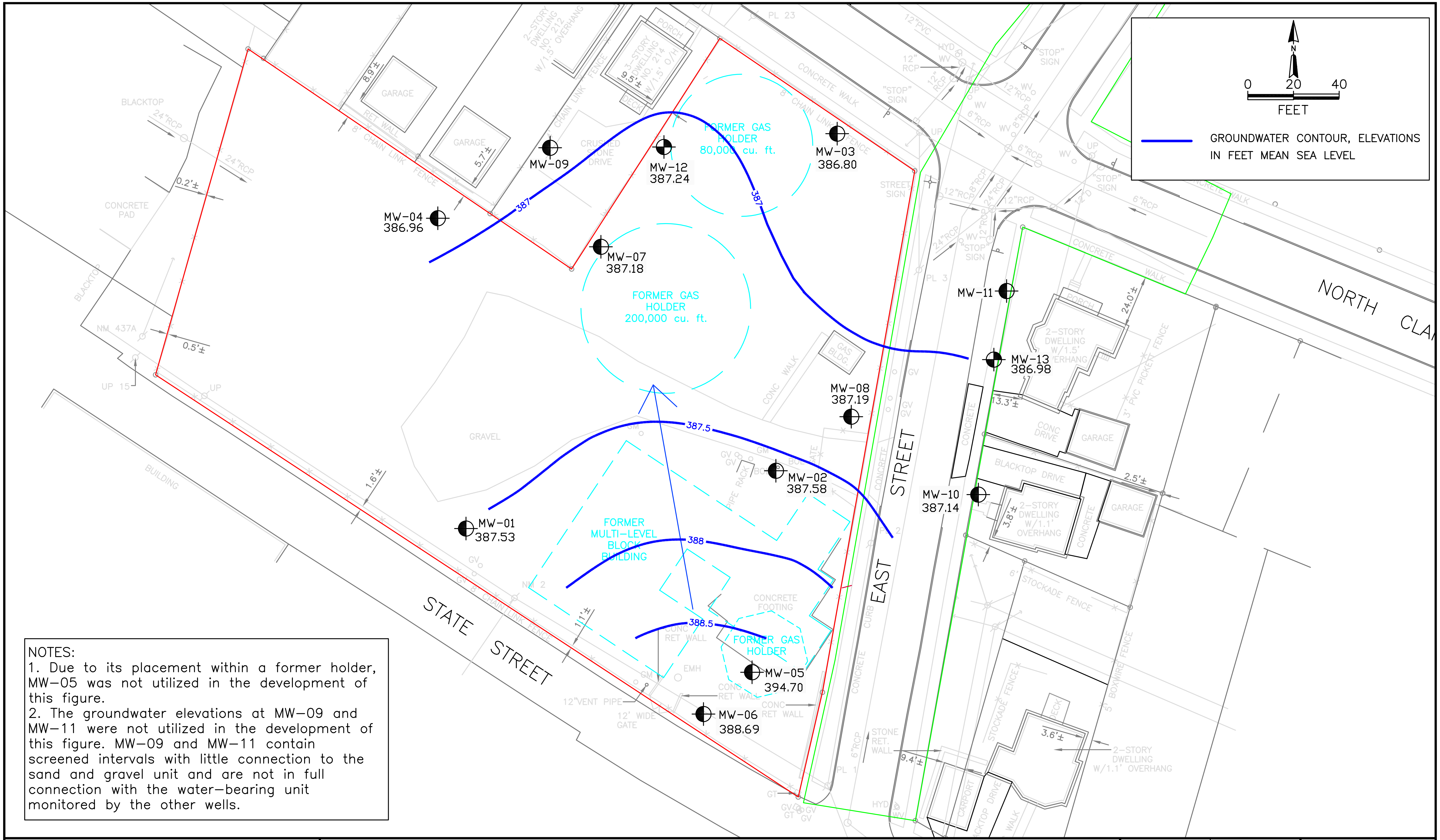
TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE – OCTOBER 27, 2004
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LEA
CHKD: PC
DES.: DPC
DATE: 05/16/08
REV.: 2
APPD: RC
PROJECT NO.: 2907.0003.0003
FIGURE NO.: 3–6

N:\GIS\GISKey\Gisproj31\Ilion East Street\RI Re–reissue Figures\RI Figure 3–6 10272004 GW Levels 051608.dwg



━━ GROUNDWATER CONTOUR, ELEVATIONS IN FEET MEAN SEA LEVEL

NOTES:
1. Due to its placement within a former holder, MW–05 was not utilized in the development of this figure.
2. The groundwater elevations at MW–09 and MW–11 were not utilized in the development of this figure. MW–09 and MW–11 contain screened intervals with little connection to the sand and gravel unit and are not in full connection with the water–bearing unit monitored by the other wells.

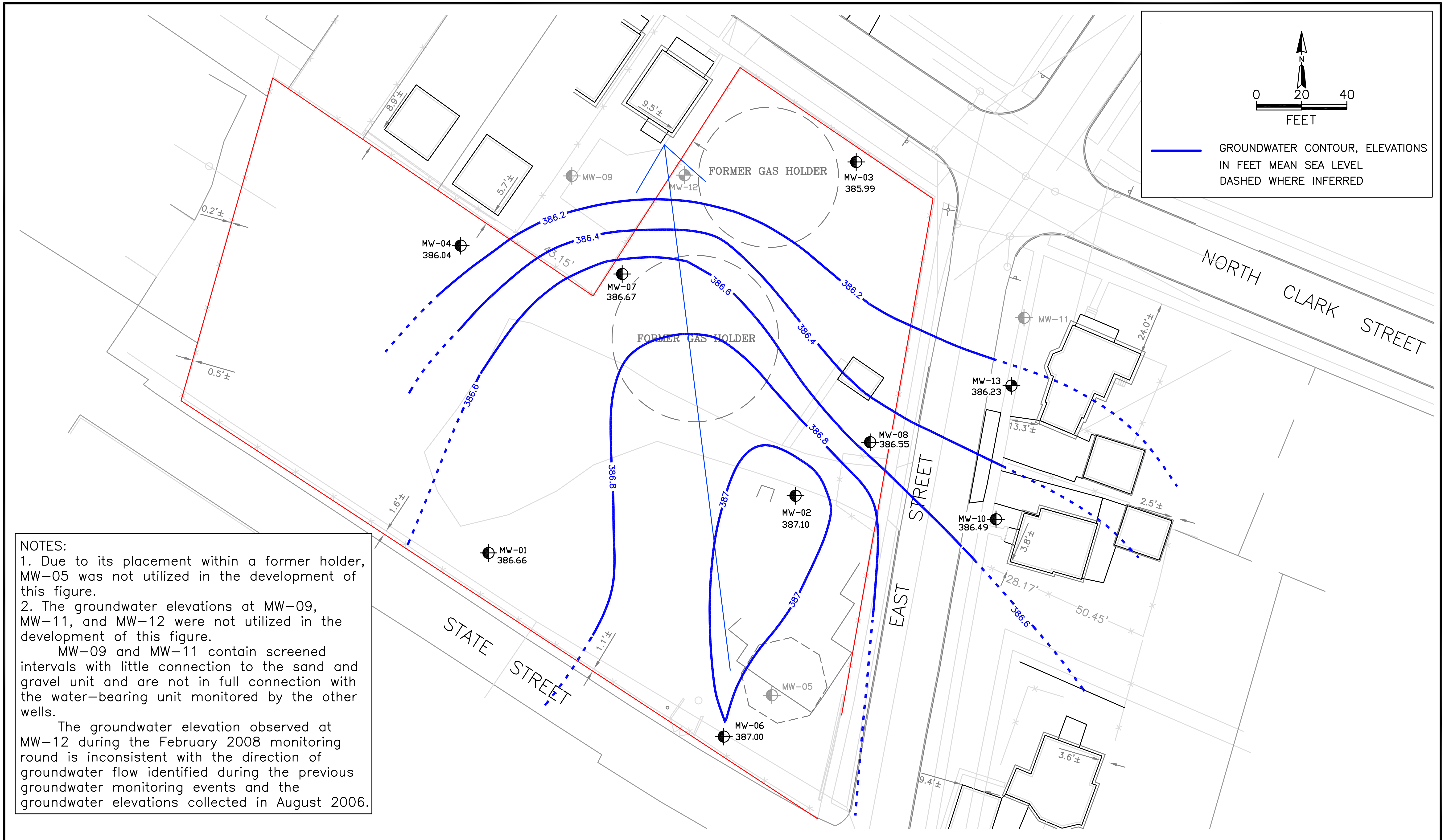
TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE – AUGUST 28, 2006
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.:	DATE:	PROJECT NO.:
LMB	05/16/08	2907.0003.0005
CHKD: SA	REV.: 1	FIGURE NO.: 3–7
DES.: LEA	APPD:	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 3-7 GW CONTOURS 051608.DWG



NOTES:

1. Due to its placement within a former holder, MW–05 was not utilized in the development of this figure.
2. The groundwater elevations at MW–09, MW–11, and MW–12 were not utilized in the development of this figure.

MW–09 and MW–11 contain screened intervals with little connection to the sand and gravel unit and are not in full connection with the water–bearing unit monitored by the other wells.

The groundwater elevation observed at MW–12 during the February 2008 monitoring round is inconsistent with the direction of groundwater flow identified during the previous groundwater monitoring events and the groundwater elevations collected in August 2006.

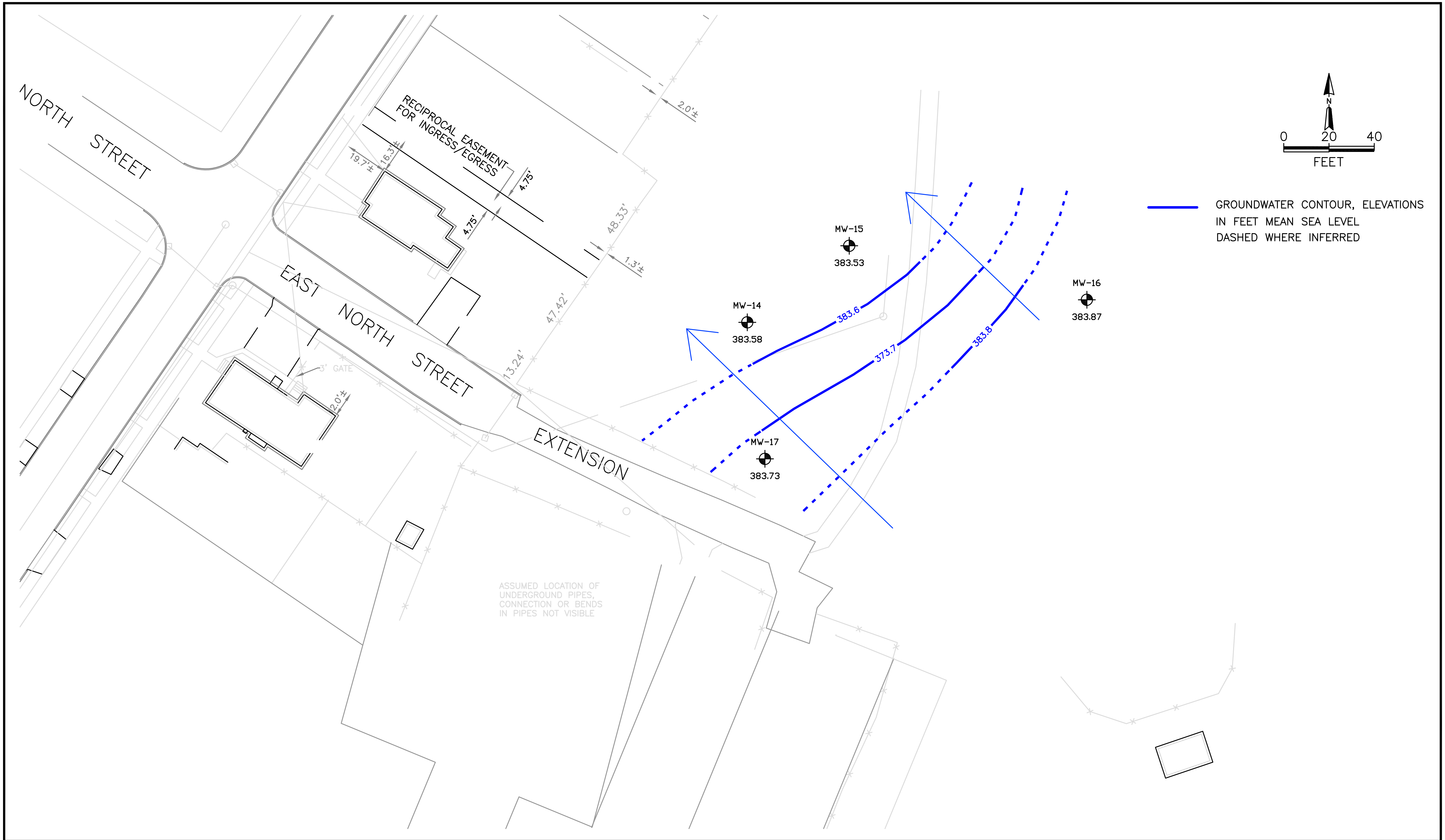
TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE (ON–SITE WELLS) – FEBRUARY 25, 2008
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LMB
DATE: 05/16/08
PROJECT NO.: 2907.0003.0003
CHKD:
REV.: 0
DES.: DPC
APPD: RC
FIGURE NO.: 3–8A

N:\GIS\GISKey\Gisproj31\Ilion East Street\RI Re-reissue\RI Figure 3-8A 02252008 GW Levels 051608.dwg



TETRA TECH EC, INC.

TITLE:
PIEZOMETRIC SURFACE (OFF-SITE WELLS) – FEBRUARY 25, 2008
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LMB
DATE: 05/13/08
CHKD: MK
REV.: 0
DES.: DPC
APPD: RC
PROJECT NO.: 2907.0003.0003
FIGURE NO.: 3-8B

N:\GIS\GISKey\Gisproj31\Ilion East Street\RI Re-reissue\RI Figure 3-8B 02252008 GW Levels 051208.dwg

TITLE:

TOTAL PAHs AND TOTAL cPAHs IN SITE AND NEAR SITE AREA SURFACE SOIL LOCATIONS

Remedial Investigation Report
Ilion (East Street) Site

TETRA TECH EC, INC.

nationalgrid

DWN:	LEA
DES.:	LEA
CHKD:	JG
APPD:	RC
DATE:	02/11/05
REV.:	1
PROJECT NO.:	2907.0003.0003
FIGURE NO.:	4-1

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-1 SITE SURFACE SOIL BLOCKS.DWG

BKGSS-10

BKGSS-10	BKGSS-10
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	0
Total Carcinogenic PAHs	0

BKGSS-07A

BKGSS-07A	SS-7A
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	25.189
Total Carcinogenic PAHs	13.16

BKG-01

BKG-01	BKG-01
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	5.912
Total Carcinogenic PAHs	3.27

BKGSS-06A

BKGSS-06A	SS-6A
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	13.057
Total Carcinogenic PAHs	7.91

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH#	WATER MANHOLE
○ DMH#	DRAINAGE MANHOLE
○ SMH#	SANITARY MANHOLE
□ CB#	CATCH BASIN
○ CBR#	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
—×—×—	FENCE
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA

BKGSS-11

BKGSS-11	BKGSS-11	Duplicate
	0.00 – 0.17	
Constituent (ppm)		
Total PAHs	2.705	1.805
Total Carcinogenic PAHs	1.35	0.875

BKGSS-12

BKGSS-12	BKGSS-12
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	22.672
Total Carcinogenic PAHs	11.87

BKG-05

BKG-05	BKG-05
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	4.073
Total Carcinogenic PAHs	2.06

BKG-06

BKG-06	BKG-06
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	6.245
Total Carcinogenic PAHs	3.47

BKG-02	BKG-02
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	12.555
Total Carcinogenic PAHs	6.77

BKG-02

SS-BKG

SS-BKG	SS-BKG
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	15.027
Total Carcinogenic PAHs	7.6

BKGSS-05A

BKGSS-05A	SS-5A
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	44.738
Total Carcinogenic PAHs	21.2

BKGSS-13

BKGSS-13	BKGSS-13
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	1.01
Total Carcinogenic PAHs	0.492

BKG-04

BKG-04	BKG-04
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	39.22
Total Carcinogenic PAHs	19.23

BKG-03

BKG-03	BKG-03
	0.00 – 0.17
Constituent (ppm)	
Total PAHs	8.867
Total Carcinogenic PAHs	4.31

TETRA TECH EC, INC.

TITLE:
TOTAL PAHs AND TOTAL cPAHs IN BACKGROUND SURFACE SOIL LOCATIONS
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN: LEA
DES.: LEA
CHKD: JG
APPD: RC
DATE: 02/14/05
REV.: 0
PROJECT NO.: 2907.0003.0003
FIGURE NO.: 4-2

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-2 BACKGROUND SURFACE SOIL BLOCKS.DWG

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH#	WATER MANHOLE
○ DMH#	DRAINAGE MANHOLE
○ SMH#	SANITARY MANHOLE
□ CB#	CATCH BASIN
○ CBR#	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
—×—×—	FENCE
▨	TEST PIT
— —	FORMER STRUCTURE
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF–SITE STUDY AREA

NOTES:

1. CONCENTRATIONS SHOWN IN RED INDICATE ELEVATED VALUES (i.e., >10 PPM FOR TOTAL BTEX, >500 PPM FOR TOTAL PAHs, >1600 PPM FOR CYANIDE).

2. LOCATIONS SHOWN IN PURPLE INDICATE OBSERVANCE OF NAPL DURING FIELD INVESTIGATION.

3. ALL DEPTHS ARE IN FEET BELOW GROUND SURFACE.

4. QUALIFIERS:

NA – NOT ANALYZED

ND – NON–DETECT

BTEX – BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES

PAHs – POLYCYCLIC AROMATIC HYDROCARBONS

cPAHs – CARCINOGENIC PAHs

ppm – PARTS PER MILLION

5. POSTING BLOCKS HIGHLIGHTED IN BLUE ARE FROM THE MOST RECENT INVESTIGATION.

TP–02 Constituent (ppm)	~ 9.50
Total BTEX	0.819
Total PAHs	161.1
Total Carcinogenic PAHs	53.5
Cyanide	8.33

CB–01 Constituent (ppm)	8.00 – 12.00	14.00 – 16.00
Total BTEX	0.033	ND
Total PAHs	5.318	0.0937
Total Carcinogenic PAHs	2.603	0.0251
Cyanide	ND	ND

TtTP01 Constituent (ppm)	7.00 – 8.00
Total BTEX	ND
Total PAHs	2.059
Total Carcinogenic PAHs	1.157
Cyanide	0.5

TtTP02 Constituent (ppm)	7.00 – 8.00
Total BTEX	ND
Total PAHs	2.227
Total Carcinogenic PAHs	1.355
Cyanide	2.2

TTSB01 Constituent (ppm)	10.00 – 12.00	10.00 – 12.00 Duplicate
Total BTEX	ND	NR
Total PAHs	2.076	NR
Total Carcinogenic PAHs	ND	NR
Cyanide	1.2	ND

MW–03 Constituent (ppm)	2.00 – 4.00	4.00 – 6.00	8.00 – 10.00	10.00 – 12.00
Total BTEX	ND	0.002	0.02	0.011
Total PAHs	42.83	3.676	ND	ND
Total Carcinogenic PAHs	17.3	1.37	ND	ND
Cyanide	ND	ND	ND	ND

TTSB03 Constituent (ppm)	12.00 – 12.50	15.50 – 16.00
Total BTEX	0.0204	NR
Total PAHs	4.564	0.092
Total Carcinogenic PAHs	1.404	NR
Cyanide	ND	ND

TP–01–SS–2 Constituent (ppm)	~ 6.50
Total BTEX	ND
Total PAHs	11.805
Total Carcinogenic PAHs	6.46
Cyanide	ND

TP–01–SS–1 Constituent (ppm)	~ 6.50
Total BTEX	ND
Total PAHs	0.107
Total Carcinogenic PAHs	ND
Cyanide	ND

SB–08 Constituent (ppm)	9.20 – 10.00	16.00 – 16.50
Total BTEX	119	ND
Total PAHs	9310	0.732
Total Carcinogenic PAHs	2780	0.15
Cyanide	256 J	ND

SS–01 Constituent (ppm)	0.00 – 2.00
Total BTEX	ND
Total PAHs	161.7
Total Carcinogenic PAHs	55.9
Cyanide	0.95 J

MW–07 Constituent (ppm)	8.80 – 9.30	18.80 – 19.40	20.70 – 21.30
Total BTEX	0.498	0.076	0.084
Total PAHs	118.44	119.3	147.91
Total Carcinogenic PAHs	29.94	27.1	35.41
Cyanide	ND	2.88 J	15.4 J

TTCB03 Constituent (ppm)	9.00 – 10.00	11.00 – 12.00	19.50 – 20.00
Total BTEX	0.198	ND	ND
Total PAHs	32.25	ND	ND
Total Carcinogenic PAHs	10.0	ND	ND
Cyanide	11.8	ND	ND

MW–04 Constituent (ppm)	4.00 – 6.00	6.00 – 8.00	Duplicate	10.00 – 12.00
Total BTEX	ND	ND	NA	ND
Total PAHs	10.119	4.831	17.521	1.185
Total Carcinogenic PAHs	3.213	2.46	7.158	0.557
Cyanide	ND	1.38 J	0.74 J	ND

SB–16 Constituent (ppm)	12.30 – 12.80	22.30 – 23.00	57.50 – 58.00
Total BTEX	0.002	ND	0.002
Total PAHs	32.9	0.452	0.772
Total Carcinogenic PAHs	10.01	0.105	0.158
Cyanide	ND	ND	ND

CB–03A Constituent (ppm)	8.00 – 10.00	18.00 – 20.00
Total BTEX	0.2954	0.0049
Total PAHs	15.678	5.058
Total Carcinogenic PAHs	3.048	1.37
Cyanide	ND	1

SS–04 Constituent (ppm)	0.00 – 2.00
Total BTEX	ND
Total PAHs	135.73
Total Carcinogenic PAHs	46.97
Cyanide	ND

SB–15 Constituent (ppm)	9.60 – 10.00	12.90 – 13.60	27.30 – 28.00
Total BTEX	1128	1.215	0.017
Total PAHs	15050	10.869	2.62
Total Carcinogenic PAHs	4160	2.21	0.725
Cyanide	266 J	ND	ND

SB–01 Constituent (ppm)	2.00 – 4.00	4.00 – 6.00	6.00 – 8.00	10.00 – 12.00
Total BTEX	0.009	ND	0.035	ND
Total PAHs	13.367	14.353	30.37	ND
Total Carcinogenic PAHs	6.015	6.336	19.96	ND
Cyanide	ND	ND	224	ND

SB–24 Constituent (ppm)	16.00 – 16.00	20.00 – 24.00
Total BTEX	0.0138	0.0030
Total PAHs	3.548	0.012
Total Carcinogenic PAHs	0.101	ND
Cyanide	NA	NA

TTSB04 Constituent (ppm)	10.00 – 10.50	15.50 – 16.00
Total BTEX	ND	ND
Total PAHs	ND	ND
Total Carcinogenic PAHs	ND	ND
Cyanide	23.1	2.1

TTSB05 Constituent (ppm)	10.00 – 10.50	14.00 – 14.50	19.50 – 20.00	19.50 – 20.00 Duplicate
Total BTEX	6.75	0.0173	0.0012	0.0008
Total PAHs	690.85	3.691	0.231	0.754
Total Carcinogenic PAHs	109.5	0.756	0.01	0.141
Cyanide	ND	3.3	0.66	ND

SB–09 Constituent (ppm)	12.40 – 12.90	39.40 – 40.00
Total BTEX	ND	0.002
Total PAHs	0.053	ND
Total Carcinogenic PAHs	0.03	ND
Cyanide	ND	ND

MW–08 Constituent (ppm)	7.00 – 7.60	13.30 – 13.80	39.40 – 39.90
Total BTEX	0.002	0.008	0.016
Total PAHs	114.2	2.077	ND
Total Carcinogenic PAHs	61.2	0.61	ND
Cyanide	57.3 J	ND	ND

TtSB02 Constituent (ppm)	4.00 – 5.00	6.00 – 8.00
Total BTEX	NA	NA
Total PAHs	142.45	0.233
Total Carcinogenic PAHs	71.9	0.139
Cyanide	NA	NA

MW–01 Constituent (ppm)	6.00 – 8.00	20.00 – 22.00
Total BTEX	ND	ND
Total PAHs	ND	35.09
Total Carcinogenic PAHs	ND	8.81
Cyanide	ND	4.91

MW–02 Constituent (ppm)	2.00 – 4.00	4.00 – 6.00	10.00 – 12.00	16.00 – 18.00	18.00 – 20.00	28.00 – 30.00
Total BTEX	ND	0.009	0.016	0.003	0.002	ND
Total PAHs	225.34	679.9	ND	8.298	4.747	ND
Total Carcinogenic PAHs	128.6	234	ND	1.43	1.021	ND
Cyanide	1	12.9	ND	ND	ND	ND

SS–03 Constituent (ppm)	0.00 – 2.00
Total BTEX	ND
Total PAHs	260.75
Total Carcinogenic PAHs	130.6
Cyanide	ND

SB–12 Constituent (ppm)	21.60 – 22.00
Total BTEX	ND
Total PAHs	ND
Total Carcinogenic PAHs	ND
Cyanide	R

SS–02 Constituent (ppm)	0.00 – 2.00
Total BTEX	ND
Total PAHs	113.46
Total Carcinogenic PAHs	62.07
Cyanide	ND

SB–12A Constituent (ppm)	5.50 – 6.00
Total BTEX	0.001
Total PAHs	3.232
Total Carcinogenic PAHs	1.84
Cyanide	R

MW–05 Constituent (ppm)	2.00 – 4.00	6.00 – 8.00	8.00 – 10.00
Total BTEX	ND	ND	0.022
Total PAHs	224.46	9.907	713
Total Carcinogenic PAHs	101.1	4.67	172.6
Cyanide	ND	ND	ND

MW–06 Constituent (ppm)	2.00 – 4.00	6.00 – 8.00	10.00 – 12.00
Total BTEX	ND	ND	ND
Total PAHs	0.086	3.823	ND
Total Carcinogenic PAHs	ND	1.84	ND
Cyanide	ND	ND	ND

SB–11 Constituent (ppm)	10.30 – 10.70
Total BTEX	76.58
Total PAHs	4458
Total Carcinogenic PAHs	324
Cyanide	11.9 J

SB–10 Constituent (ppm)	5.50 – 6.00	7.50 – 8.00
Total BTEX	ND	ND
Total PAHs	31.65	55.82
Total Carcinogenic PAHs	13.8	22.5
Cyanide	R	R

SB–13 Constituent (ppm)	5.00 – 5.80	39.30 – 40.00
Total BTEX	0.004	ND
Total PAHs	0.516	ND
Total Carcinogenic PAHs	0.14	ND
Cyanide	ND	ND

TETRA TECH EC, INC.

TITLE:

TOTAL BTEX, TOTAL PAHs, TOTAL cPAHS, AND CYANIDE IN SITE SUBSURFACE SOIL LOCATIONS
Remedial Investigation Report Addendum
Ilion (East Street) Site

nationalgrid

DWN.: LMB	DATE: 12/14/2006
CHKD: SA	REV.: 1
DES.: LEA	APPD:

PROJECT NO.: 2907.0003.0005

FIGURE NO.: 4–3

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE–REISSUE FIGURES\FIGURE 4–3 SITE SUBSURFACE SOIL BLOCKS 121406.DWG

MW-07 Constituent	Units	NY-GWQS	10/08/99	02/16/00	12/14/00	01/10/02	09/23/04	08/29/06	02/26/08
Cyanide	(mg/L)	0.2	0.749	1.2	0.67	0.62	2.2	0.97	0.86
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	ND	3.4	0.90
Total PAHs	(ug/L)	NC	134.00	ND	ND	ND	2.30	4.60	NR

MW-12 Constituent	Units	NY-GWQS	08/28/06	02/26/08
Cyanide	(mg/L)	0.2	ND	ND
Total BTEX	(ug/L)	NC	ND	ND
Total PAHs	(ug/L)	NC	ND	NR

MW-09 Constituent	Units	NY-GWQS	01/10/02	01/10/02 Duplicate	09/22/04	08/29/06	02/28/08
Cyanide	(mg/L)	0.2	ND	ND	ND	ND	ND
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	NR
Total PAHs	(ug/L)	NC	ND	ND	ND	ND	NR

MW-03 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/08/99	09/23/04	08/28/06	02/27/08
Cyanide	(mg/L)	0.2	ND	ND	0.038	ND	ND	ND
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	NR	ND
Total PAHs	(ug/L)	NC	ND	ND	ND	ND	NR	NR

MW-11 Constituent	Units	NY-GWQS	10/27/04	08/30/06	02/26/08
Cyanide	(mg/L)	0.2	0.075	0.11	0.069
Total BTEX	(ug/L)	NC	ND	NR	ND
Total PAHs	(ug/L)	NC	0.30	NR	NR

MW-04 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/07/99	09/22/04	09/22/04	08/30/06	02/27/08
Cyanide	(mg/L)	0.2	ND	ND	0.072	ND	ND	ND	ND
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	ND	NR	ND
Total PAHs	(ug/L)	NC	ND	ND	ND	ND	ND	NR	NR

MW-13 Constituent	Units	NY-GWQS	08/30/06	02/26/08
Cyanide	(mg/L)	0.2	ND	ND
Total BTEX	(ug/L)	NC	NR	ND
Total PAHs	(ug/L)	NC	NR	NR

MW-08 Constituent	Units	NY-GWQS	10/08/99	02/16/00	01/10/02	09/24/04	09/24/04 Duplicate	08/28/06	02/26/08
Cyanide	(mg/L)	0.2	2.63	1.2	0.99	2.2	2.1	4.8	3.6
Total BTEX	(ug/L)	NC	13.00	ND	ND	ND	ND	NR	1.1
Total PAHs	(ug/L)	NC	62.20	ND	ND	ND	ND	NR	NR

MW-02 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/08/99	02/16/00	02/16/00 Duplicate	01/08/02	01/08/02 Duplicate	09/24/04	08/29/06	02/27/08
Cyanide	(mg/L)	0.2	ND	ND	47.4	13.2	16.4	0.76	0.75	3.5	2.4	3.5
Total BTEX	(ug/L)	NC	444.00	46.00	ND	ND	ND	ND	ND	26.30	NR	77.7
Total PAHs	(ug/L)	NC	212.00	22.00	52.00	ND	ND	ND	ND	24.80	NR	NR

MW-10 Constituent	Units	NY-GWQS	10/27/04	08/29/06	02/26/08
Cyanide	(mg/L)	0.2	0.015	0.2	0.018
Total BTEX	(ug/L)	NC	ND	NR	ND
Total PAHs	(ug/L)	NC	ND	NR	NR

MW-01 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/07/99	09/23/04	08/30/06	02/27/08
Cyanide	(mg/L)	0.2	0.012	ND	0.017	ND	ND	ND
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	NR	NR
Total PAHs	(ug/L)	NC	ND	ND	ND	ND	NR	NR

MW-05 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/07/99	02/16/00	12/14/00	09/22/04	08/2006	02/27/08	02/27/08 Duplicate
Cyanide	(mg/L)	0.2	0.5	ND	1.77	0.13	0.25	0.13	NR	0.15	0.15
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	ND	ND	NR	4.1	4.2
Total PAHs	(ug/L)	NC	238.00	170.00	44.00	ND	ND	8.10	NR	NR	NR

MW-06 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/07/99	09/23/04	08/30/06	02/27/08
Cyanide	(mg/L)	0.2	ND	ND	ND	ND	ND	ND
Total BTEX	(ug/L)	NC	ND	ND	ND	ND	NR	ND
Total PAHs	(ug/L)	NC	ND	ND	ND	ND	NR	NR

LEGEND

⊕ MW-01	MONITORING WELL
○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH#	WATER MANHOLE
○ DMH#	DRAINAGE MANHOLE
○ SMH#	SANITARY MANHOLE
□ CB#	CATCH BASIN
○ CBR#	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
—×—×—	FENCE
- - - - -	FORMER STRUCTURE
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA

NOTES:

1. CONCENTRATIONS SHOWN IN RED FOR TOTAL BTEX AND/OR TOTAL PAHs INDICATE ONE OR MORE COMPOUNDS IN THESE GROUPS EXCEED NYSDEC GROUNDWATER QUALITY CRITERIA.

2. NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

3. QUALIFIERS:

NC – NO CRITERIA

ND – NON-DETECT

NR – NOT ANALYZED

BTEX – BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES

PAHs – POLYCYCLIC AROMATIC HYDROCARBONS

mg/L – MILLIGRAMS PER LITER

ug/L – MICROGRAMS PER LITER

TETRA TECH EC, INC.

TITLE:

TOTAL BTEX, TOTAL PAHs, AND CYANIDE IN ONSITE GROUNDWATER LOCATIONS

Remedial Investigation Report Addendum

Ilion (East Street) Site

nationalgrid

DWN.: LMB	DATE: 05/19/08	PROJECT NO.:	2907.0003.0005
CHKD.: SA	REV.: 3	FIGURE NO.:	4-4A
DES.: LEA	APPD.:		

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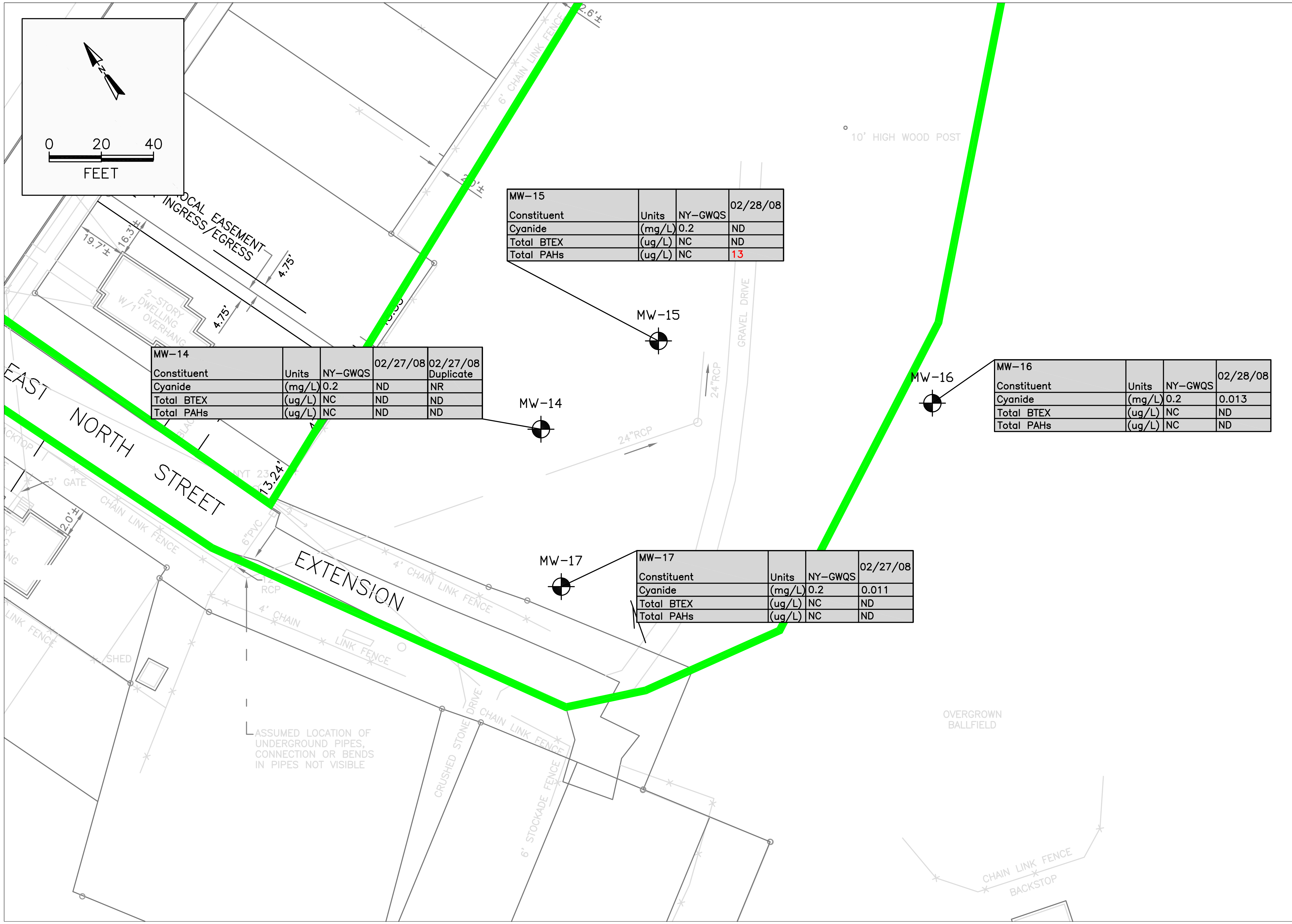

MW-15

Constituent	Units	NY-GWQS	02/28/08
Cyanide	(mg/L)	0.2	ND
Total BTEX	(ug/L)	NC	ND
Total PAHs	(ug/L)	NC	13

MW-14

Constituent	Units	NY-GWQS	02/27/08	02/27/08 Duplicate
Cyanide	(mg/L)	0.2	ND	NR
Total BTEX	(ug/L)	NC	ND	ND
Total PAHs	(ug/L)	NC	ND	ND

MW-16

Constituent	Units	NY-GWQS	02/28/08
Cyanide	(mg/L)	0.2	0.013
Total BTEX	(ug/L)	NC	ND
Total PAHs	(ug/L)	NC	ND

MW-17

Constituent	Units	NY-GWQS	02/27/08
Cyanide	(mg/L)	0.2	0.011
Total BTEX	(ug/L)	NC	ND
Total PAHs	(ug/L)	NC	ND

LEGEND

MW-01	MONITORING WELL
○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
GV	GAS VALVE
GM	GAS MARKER
GT	GAS TEST
HYD	FIRE HYDRANT
WV	WATER VALVE
WMH#	WATER MANHOLE
DMH#	DRAINAGE MANHOLE
SMH#	SANITARY MANHOLE
CB#	CATCH BASIN
CBR#	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
✕ ✕	FENCE
- - - -	FORMER STRUCTURE
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA

NOTES:

1. CONCENTRATIONS SHOWN IN RED FOR TOTAL BTEX AND/OR TOTAL PAHs INDICATE ONE OR MORE COMPOUNDS IN THESE GROUPS EXCEED NYSDEC GROUNDWATER QUALITY CRITERIA.

2. NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

3. QUALIFIERS:

NC – NO CRITERIA

ND – NON-DETECT

NR – NOT ANALYZED

BTEX – BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES

PAHs – POLYCYCLIC AROMATIC HYDROCARBONS

mg/L – MILLIGRAMS PER LITER

ug/L – MICROGRAMS PER LITER

TETRA TECH EC, INC.

TITLE:
TOTAL BTEX, TOTAL PAHs, AND CYANIDE IN OFFSITE GROUNDWATER LOCATIONS
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: LMB	DATE: 05/19/08	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 4-4B
DES.: LEA	APPD:	

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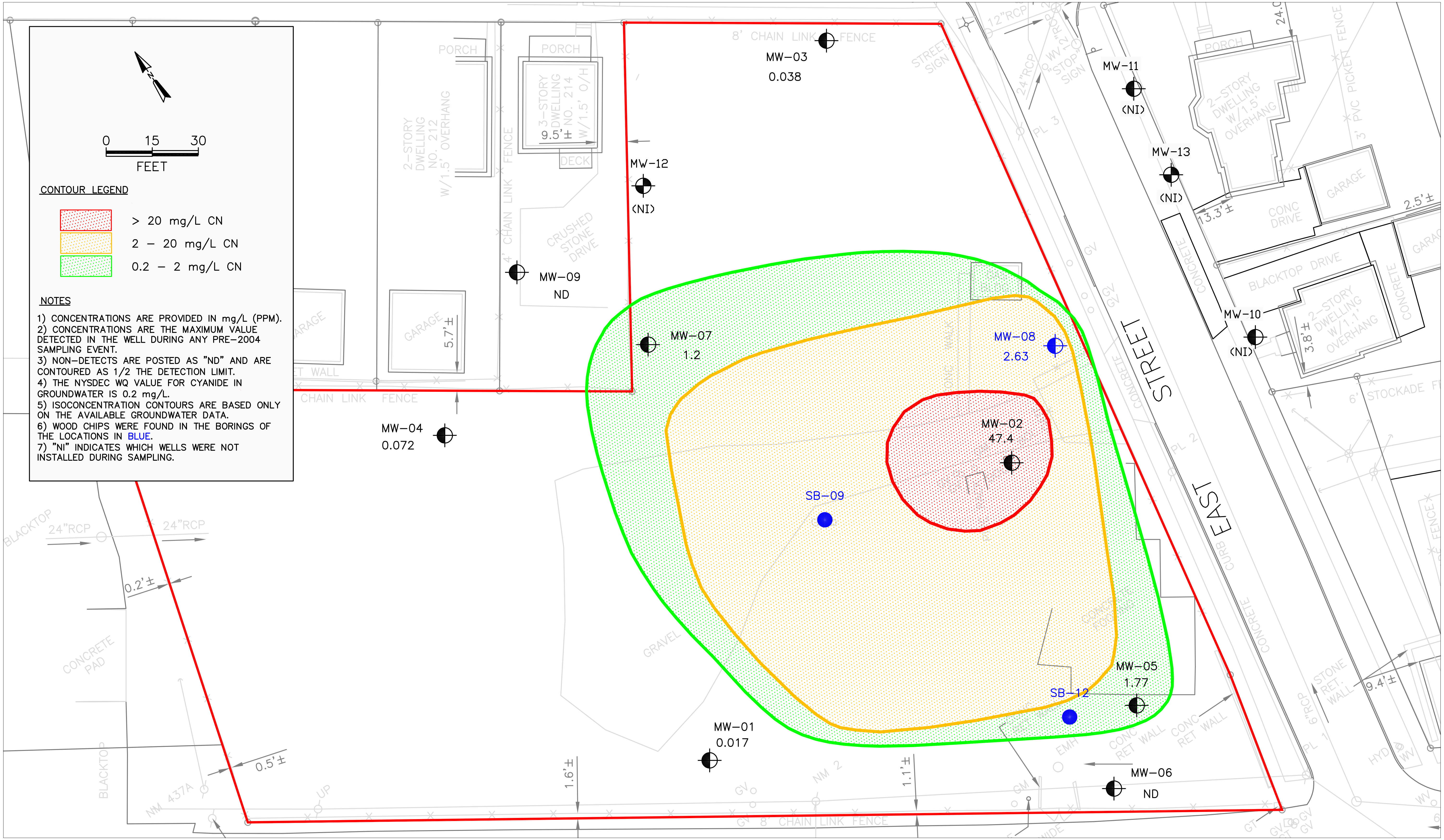


CONTOUR LEGEND

🟥	> 20 mg/L CN
🟧	2 – 20 mg/L CN
🟩	0.2 – 2 mg/L CN

NOTES

1) CONCENTRATIONS ARE PROVIDED IN mg/L (PPM).
2) CONCENTRATIONS ARE THE MAXIMUM VALUE DETECTED IN THE WELL DURING ANY PRE-2004 SAMPLING EVENT.
3) NON-DETECTS ARE POSTED AS "ND" AND ARE CONTOURED AS 1/2 THE DETECTION LIMIT.
4) THE NYSDEC WQ VALUE FOR CYANIDE IN GROUNDWATER IS 0.2 mg/L.
5) ISOCONCENTRATION CONTOURS ARE BASED ONLY ON THE AVAILABLE GROUNDWATER DATA.
6) WOOD CHIPS WERE FOUND IN THE BORINGS OF THE LOCATIONS IN BLUE.
7) "NI" INDICATES WHICH WELLS WERE NOT INSTALLED DURING SAMPLING.

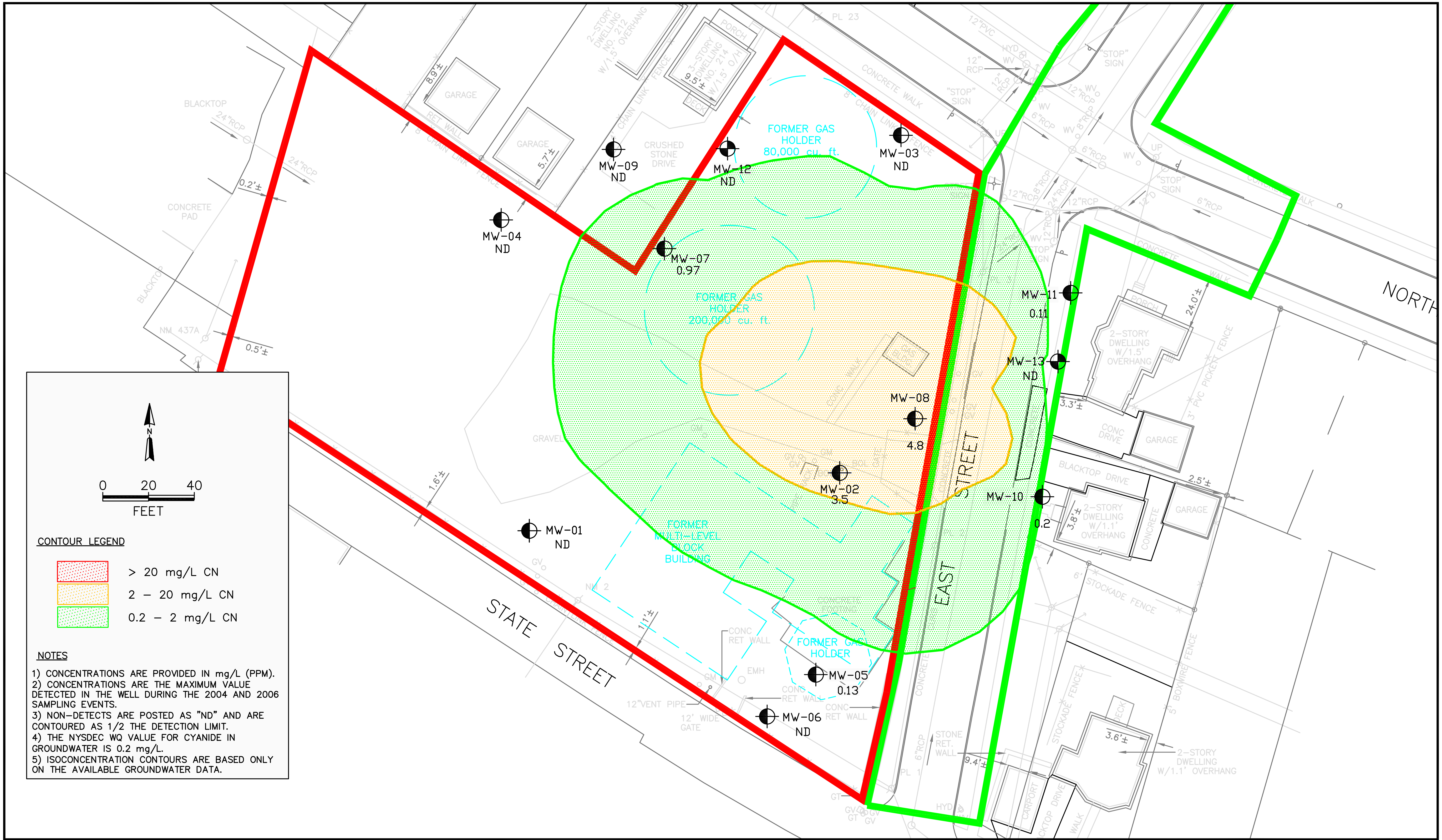
TETRA TECH EC, INC.

TITLE:
ISOCONCENTRATION CONTOUR FOR CYANIDE IN GROUNDWATER – PRE 2004 RESULTS
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 03/01/07	PROJECT NO.: 2907.0003.0003
CHKD.: JG	REV.: 1	FIGURE NO.: 4-5A
DES.: LEA	APPD.: RC	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-5A CN IN GW CONTOURS HISTORIC.DWG



CONTOUR LEGEND

🟥 > 20 mg/L CN

🟧 2 – 20 mg/L CN

🟩 0.2 – 2 mg/L CN

NOTES

1) CONCENTRATIONS ARE PROVIDED IN mg/L (PPM).
2) CONCENTRATIONS ARE THE MAXIMUM VALUE DETECTED IN THE WELL DURING THE 2004 AND 2006 SAMPLING EVENTS.
3) NON-DETECTS ARE POSTED AS "ND" AND ARE CONTOURED AS 1/2 THE DETECTION LIMIT.
4) THE NYSDEC WQ VALUE FOR CYANIDE IN GROUNDWATER IS 0.2 mg/L.
5) ISOCONCENTRATION CONTOURS ARE BASED ONLY ON THE AVAILABLE GROUNDWATER DATA.

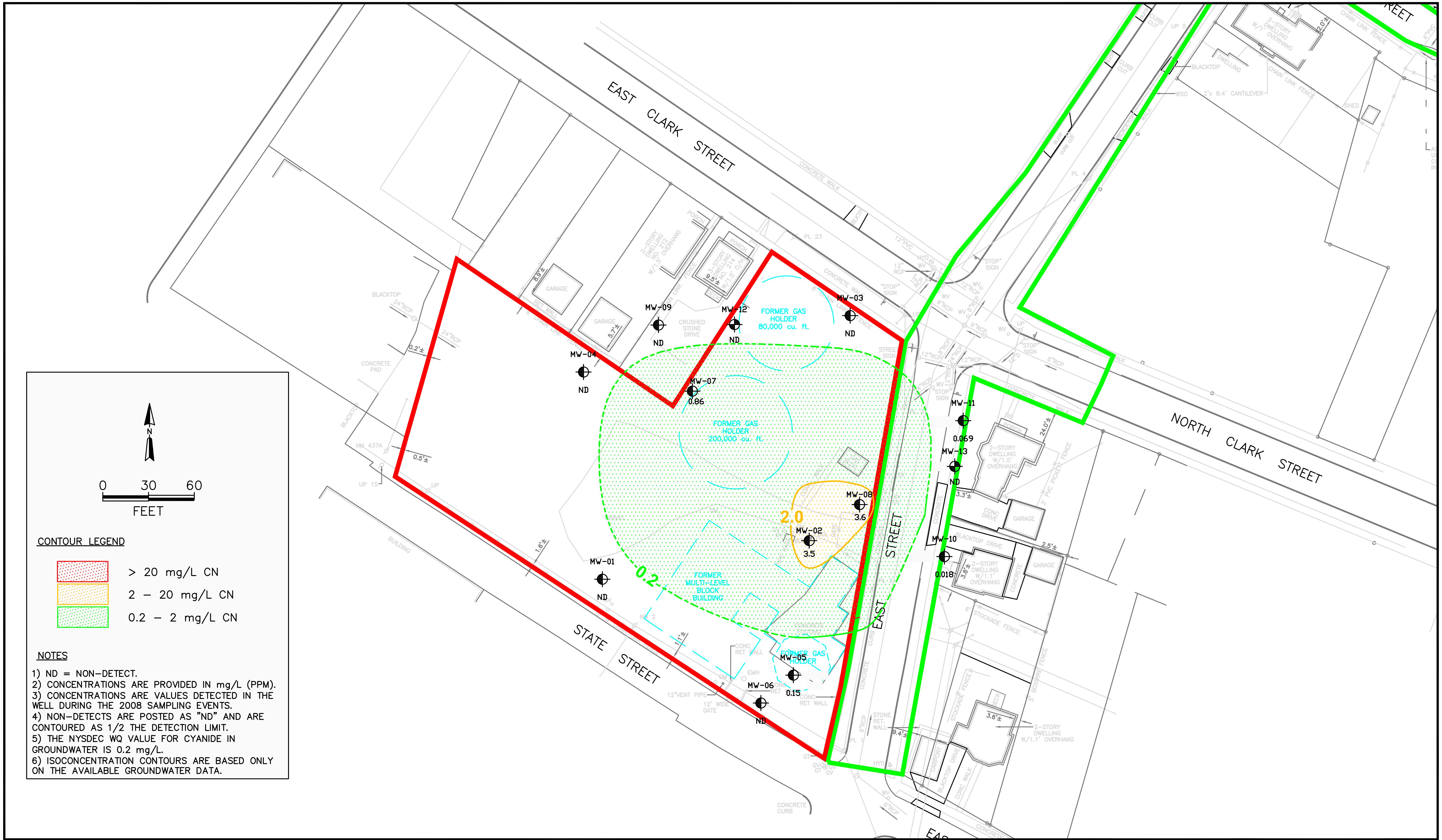
TETRA TECH EC, INC.

TITLE:
ISOCONCENTRATION CONTOUR FOR CYANIDE IN GROUNDWATER – 2004 AND 2006 RESULTS
Remedial Investigation Report Addendum
Ilion (East Street) Site

nationalgrid

DWN.: LMB
DATE: 03/26/07
CHKD.:
REV.: 0
DES.: LEA
APPD:
PROJECT NO.: 2907.0003.0005
FIGURE NO.: 4-5B

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-5B CN IN GW 032607.DWG



CONTOUR LEGEND

🟥	> 20 mg/L CN
🟧	2 – 20 mg/L CN
🟩	0.2 – 2 mg/L CN

NOTES

1) ND = NON-DETECT.
2) CONCENTRATIONS ARE PROVIDED IN mg/L (PPM).
3) CONCENTRATIONS ARE VALUES DETECTED IN THE WELL DURING THE 2008 SAMPLING EVENTS.
4) NON-DETECTS ARE POSTED AS "ND" AND ARE CONTOURED AS 1/2 THE DETECTION LIMIT.
5) THE NYSDEC WQ VALUE FOR CYANIDE IN GROUNDWATER IS 0.2 mg/L.
6) ISOCONCENTRATION CONTOURS ARE BASED ONLY ON THE AVAILABLE GROUNDWATER DATA.

TETRA TECH EC, INC.

TITLE:
ISOCONCENTRATION CONTOUR FOR CYANIDE IN SITE GROUNDWATER – 2008 RESULTS
Remedial Investigation Report Addendum
Ilion (East Street) Site

nationalgrid

DWN.: EAG
CHKD:
DES.: LEA
DATE: 05/09/08
REV.: 0
APPD:
PROJECT NO.: 2907.0003.0005
FIGURE NO.: 4-5C

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-5C CN IN GW 050908.DWG

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
☐ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH	WATER MANHOLE
○ DMH	DRAINAGE MANHOLE
○ SMH	SANITARY MANHOLE
☐ CB	CATCH BASIN
○ CBR	CATCH BASIN ROUND
⊕	MONITOR WELL
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
▬	TEST PIT
■	SURFACE SOIL SAMPLE
●	SOIL BORING
⚠	TEST PIT SAMPLE
◆	SOIL SAMPLE COLLECTED IN THE OPEN SWALE AREA
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF–SITE STUDY AREA
🟦	OUTLINE OF SWALE

NOTES:
LOCATIONS SHOWN IN RED INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs.

LOCATIONS SHOWN IN PURPLE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT.

LOCATIONS SHOWN IN ORANGE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs, FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT, AND OBSERVANCE OF NAPL IN LOCATION DURING FIELD INVESTIGATION.

LOCATIONS SHOWN IN GREEN INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE PETROLEUM PRODUCT AS PRIMARY CONSTITUENT

LOCATIONS SHOWN IN BLUE INDICATE THE PRESENCE OF NAPL OBSERVED DURING FIELD INVESTIGATION BUT NO ANALYTICAL SAMPLE WAS COLLECTED.

LOCATIONS SHOWN IN GRAY INDICATE THAT NO SAMPLE WAS COLLECTED WITHIN THE SOIL LAYER FOR THAT BORING/TEST PIT.

DETERMINATION OF THE SOIL INTERVAL IN WHICH THE SAMPLE WAS COLLECTED (i.e., ABOVE OR WITHIN/BELOW PEAT LAYER) WAS BASED ON MATERIAL DESCRIPTIONS FROM THE BORING LOGS/TEST PIT LOGS.

TETRA TECH EC, INC.

TITLE:
TOTAL PAH CONCENTRATIONS IN SAMPLES COLLECTED AT DEPTHS ABOVE PEAT LAYER
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN: CTS	DES.: LEA	PROJECT NO.: 2907.0003.0003
CHKD: JG	APPD: RC	FIGURE NO.: 4–6
DATE: 05/19/08	REV.: 2	

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE–REISSUE FIGURES\RI FIGURE 4–6 OFF–SITE PAHs ABOVE PEAT LAYER 051908.DWG

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
☐ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH	WATER MANHOLE
○ DMH	DRAINAGE MANHOLE
○ SMH	SANITARY MANHOLE
☐ CB	CATCH BASIN
○ CBR	CATCH BASIN ROUND
⌖	MONITOR WELL
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
▨	TEST PIT
■	SURFACE SOIL SAMPLE
●	SOIL BORING
⚠	TEST PIT SAMPLE
◆	SOIL SAMPLE COLLECTED IN THE OPEN SWALE AREA
🟥	BOUNDARY OF SITE PROPERTY
🟩	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
🟦	OUTLINE OF SWALE

NOTES:
LOCATIONS SHOWN IN RED INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs.

LOCATIONS SHOWN IN PURPLE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT.

LOCATIONS SHOWN IN ORANGE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs, FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT, AND OBSERVANCE OF NAPL IN LOCATION DURING FIELD INVESTIGATION.

LOCATIONS SHOWN IN GREEN INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE PETROLEUM PRODUCT AS PRIMARY CONSTITUENT

LOCATIONS SHOWN IN BLUE INDICATE THE PRESENCE OF NAPL OBSERVED DURING FIELD INVESTIGATION BUT NO ANALYTICAL SAMPLE WAS COLLECTED.

LOCATIONS SHOWN IN GRAY INDICATE THAT NO SAMPLE WAS COLLECTED WITHIN THE SOIL LAYER FOR THAT BORING/TEST PIT.

DETERMINATION OF THE SOIL INTERVAL IN WHICH THE SAMPLE WAS COLLECTED (i.e., ABOVE OR WITHIN/BELOW PEAT LAYER) WAS BASED ON MATERIAL DESCRIPTIONS FROM THE BORING LOGS/TEST PIT LOGS.

TETRA TECH EC, INC.

TITLE:
TOTAL PAH CONCENTRATIONS IN SAMPLES COLLECTED AT DEPTHS WITHIN/BELOW PEAT LAYER
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

DWN: CTS	DES.: LEA	PROJECT NO.:	2907.0003.0003
CHKD: JG	APPD: RC	FIGURE NO.:	4-7
DATE: 05/19/08	REV.: 2		

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-7 OFF-SITE PAHs WITHIN-BELOW PEAT LAYER 051908.DWG

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ WMH	WATER MANHOLE
CMP	CORRUGATED METAL PIPE

●	APPROXIMATE SOIL BORING LOCATION
◆	APPROXIMATE SOIL SAMPLE IN OPEN SWALE AREA LOCATION
━	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
━	OUTLINE OF OPEN SWALE
▨	AREA OF SEPTEMBER 1999 PROBING

NOTES:

1. LOCATIONS SHOWN IN RED CONTAINED ELEVATED CONCENTRATIONS (I.E., >500 PPM) OF TOTAL PAHs ABOVE THE PEAT LAYER. LOCATIONS SHOWN IN BLUE HAD A SHEEN ON THE SOILS IN THE SPLIT-SPOON. FOR SED-04B AND SED-11, A SHEEN WAS NOT NOTED IN BORING, HOWEVER, A SHEEN WAS NOTED ADJACENT TO THE BORING.

2. "A" AND "B" BORING LOCATIONS WERE INSTALLED TO DEFINE THE OPEN SWALE EDGES.

3. POSTING BLOCKS HIGHLIGHTED IN BLUE ARE FROM THE AUGUST 2006 MOBILIZATION.

TTSED05 (2006) Constituent (ppm)	0.00 – 2.00	2.00 – 4.00
Total BTEX	0.1884	NA
Total Carcinogenic PAHs	26.08	24.76
Total PAHs		57.05

SED-05A Constituent (ppm)	6.00	20.00
Total BTEX	0.0015	0.0033
Total Carcinogenic PAHs	ND	ND
Total PAHs	ND	ND

SED-05 Constituent (ppm)	4.00	12.00
Total BTEX	3.7	0.003
Total Carcinogenic PAHs	340.5	ND
Total PAHs	761	ND

SED-07 Constituent (ppm)	4.00	12.00
Total BTEX	0.0073	ND
Total Carcinogenic PAHs	0.06	0.07
Total PAHs	0.138	0.182

SED-01A Constituent (ppm)	12.00	20.00
Total BTEX	0.0032	ND
Total Carcinogenic PAHs	ND	0.24
Total PAHs	0.029	0.55

TTSED08 Constituent (ppm)	8.00
Total BTEX	NA
Total Carcinogenic PAHs	0.208
Total PAHs	0.764

TTSED02 Constituent (ppm)	1.50 – 2.00
Total BTEX	NA
Total Carcinogenic PAHs	101.2
Total PAHs	208

SED-02A Constituent (ppm)	12.00	20.00
Total BTEX	0.0044	0.0036
Total Carcinogenic PAHs	ND	ND
Total PAHs	ND	ND

TTSED10 Constituent (ppm)	0.00 – 2.00
Total BTEX	0.2138
Total Carcinogenic PAHs	15.5
Total PAHs	49.31

SED-06 Constituent (ppm)	4.00	12.00
Total BTEX	ND	0.0009
Total Carcinogenic PAHs	1.38	ND
Total PAHs	2.39	ND

SED-03A Constituent (ppm)	16.00	20.00
Total BTEX	ND	ND
Total Carcinogenic PAHs	0.190	0.15
Total PAHs	0.402	0.304

SED-03 Constituent (ppm)	4.00
Total BTEX	0.019
Total Carcinogenic PAHs	33.14
Total PAHs	89.3

TTSED04 Constituent (ppm)	1.50 – 2.00
Total BTEX	NA
Total Carcinogenic PAHs	ND
Total PAHs	ND

SED-04A Constituent (ppm)	300	7.00
Total BTEX	0.0007	ND
Total Carcinogenic PAHs	ND	ND
Total PAHs	ND	ND

TTSED05 (2004) Constituent (ppm)	0.00 – 2.00
Total BTEX	NA
Total Carcinogenic PAHs	1.26
Total PAHs	2.486

SED-10 Constituent (ppm)	4.00	10.00
Total BTEX	0.0051	ND
Total Carcinogenic PAHs	1.49	0.01
Total PAHs	4.664	0.066

SED-11 Constituent (ppm)	3.00	8.00
Total BTEX	0.3379	ND
Total Carcinogenic PAHs	14.84	3.782
Total PAHs	44.6	11.652

SED-04 Constituent (ppm)	4.00	7.00
Total BTEX	0.31	ND
Total Carcinogenic PAHs	7.50	ND
Total PAHs	25.68	0.04

SED-05B Constituent (ppm)	8.00	20.00
Total BTEX	0.0159	0.0049
Total Carcinogenic PAHs	55.6	1.1
Total PAHs	123.19	2.48

SED-01 Constituent (ppm)	4.00	10.00
Total BTEX	0.0968	6.46
Total Carcinogenic PAHs	76.9	ND
Total PAHs	211.83	42.82

SED-02B Constituent (ppm)	8.00	20.00
Total BTEX	0.0035	ND
Total Carcinogenic PAHs	ND	ND
Total PAHs	0.059	ND

SED-01B Constituent (ppm)	8.00	16.00
Total BTEX	ND	0.0031
Total Carcinogenic PAHs	ND	ND
Total PAHs	0.047	ND

SED-02 Constituent (ppm)	4.00	8.00 – 12.00
Total BTEX	0.0229	0.162
Total Carcinogenic PAHs	421	11.75
Total PAHs	819.5	22.757

TTSED03 Constituent (ppm)	1.50 – 2.00
Total BTEX	NA
Total Carcinogenic PAHs	42.2
Total PAHs	131.55

SED-04B Constituent (ppm)	7.00	10.00
Total BTEX	ND	ND
Total Carcinogenic PAHs	0.059	0.00
Total PAHs	0.145	0.014

TTSED06 Constituent (ppm)	0.00 – 2.00
Total BTEX	0.0024
Total Carcinogenic PAHs	28.1
Total PAHs	73.63

TTSED01 Constituent (ppm)	1.50 – 2.00
Total BTEX	NA
Total Carcinogenic PAHs	3.75
Total PAHs	8.6

TTSED07 Constituent (ppm)	0.00 – 2.00	2.00 – 4.00
Total BTEX	0.0387	NA
Total Carcinogenic PAHs	23.85	40.82
Total PAHs	62.94	124.69

TTSED09 Constituent (ppm)	0.00 – 2.00	2.00 – 4.00
Total BTEX	0.3012	NA
Total Carcinogenic PAHs	13.01	1340
Total PAHs	49.31	9390

TTSED11 Constituent (ppm)	0.00 – 2.00
Total BTEX	0.0687
Total Carcinogenic PAHs	9.05
Total PAHs	45.84

TTSED12 Constituent (ppm)	0.00 – 2.00
Total BTEX	ND
Total Carcinogenic PAHs	32.51
Total PAHs	60.96

SED-03B Constituent (ppm)	5.00	10.00
Total BTEX	NA	0.1043
Total Carcinogenic PAHs	NA	4.047
Total PAHs	NA	11.047
Cyanide	ND	NA

SED-08 Constituent (ppm)	5.00	10.00
Total BTEX	NA	ND
Total Carcinogenic PAHs	NA	0.00
Total PAHs	NA	0.035
Cyanide	ND	NA

SED-09 Constituent (ppm)	3.00	10.00
Total BTEX	0.0392	0.0007
Total Carcinogenic PAHs	4.094	ND
Total PAHs	11.094	ND

TETRA TECH EC, INC.

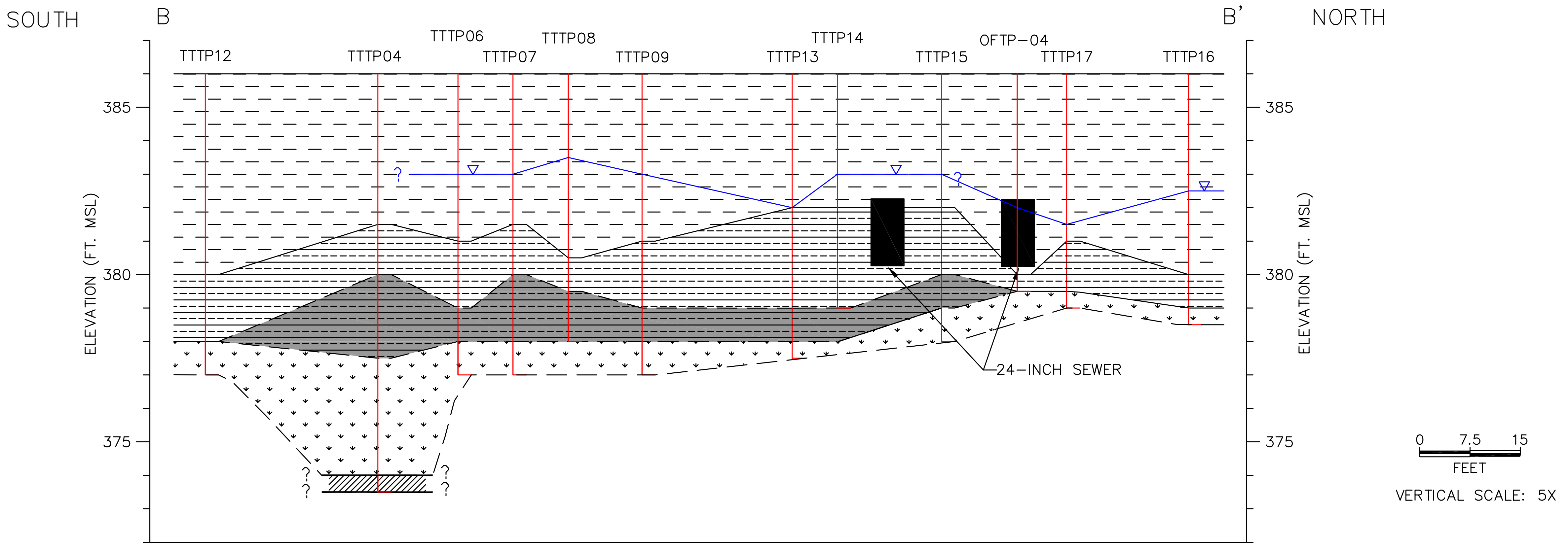
TITLE:
SAMPLE LOCATIONS IN OPEN SWALE AREA
Remedial Investigation Report
Ilion (East Street) Site

nationalgrid

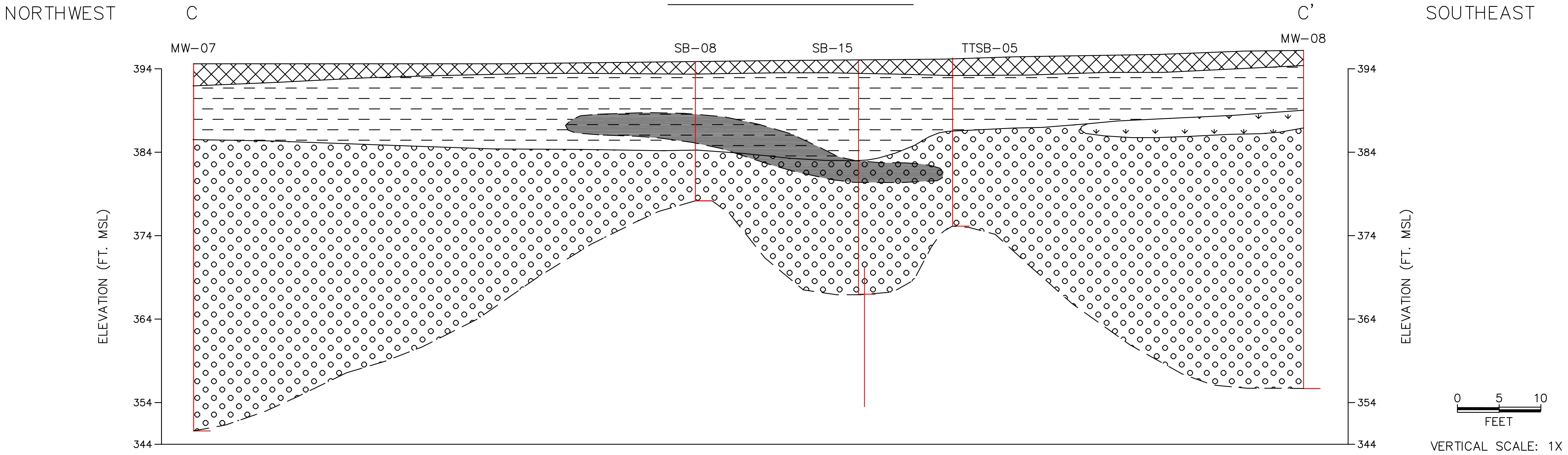
DWN: LMB	DES.: CTS	PROJECT NO.: 2907.0003.0005
CHKD: SA	APPD:	
DATE: 03/27/07	REV.: 0	FIGURE NO.: 4-8

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\FIGURE 4-8 SWALE BLOCKS 032607.DWG

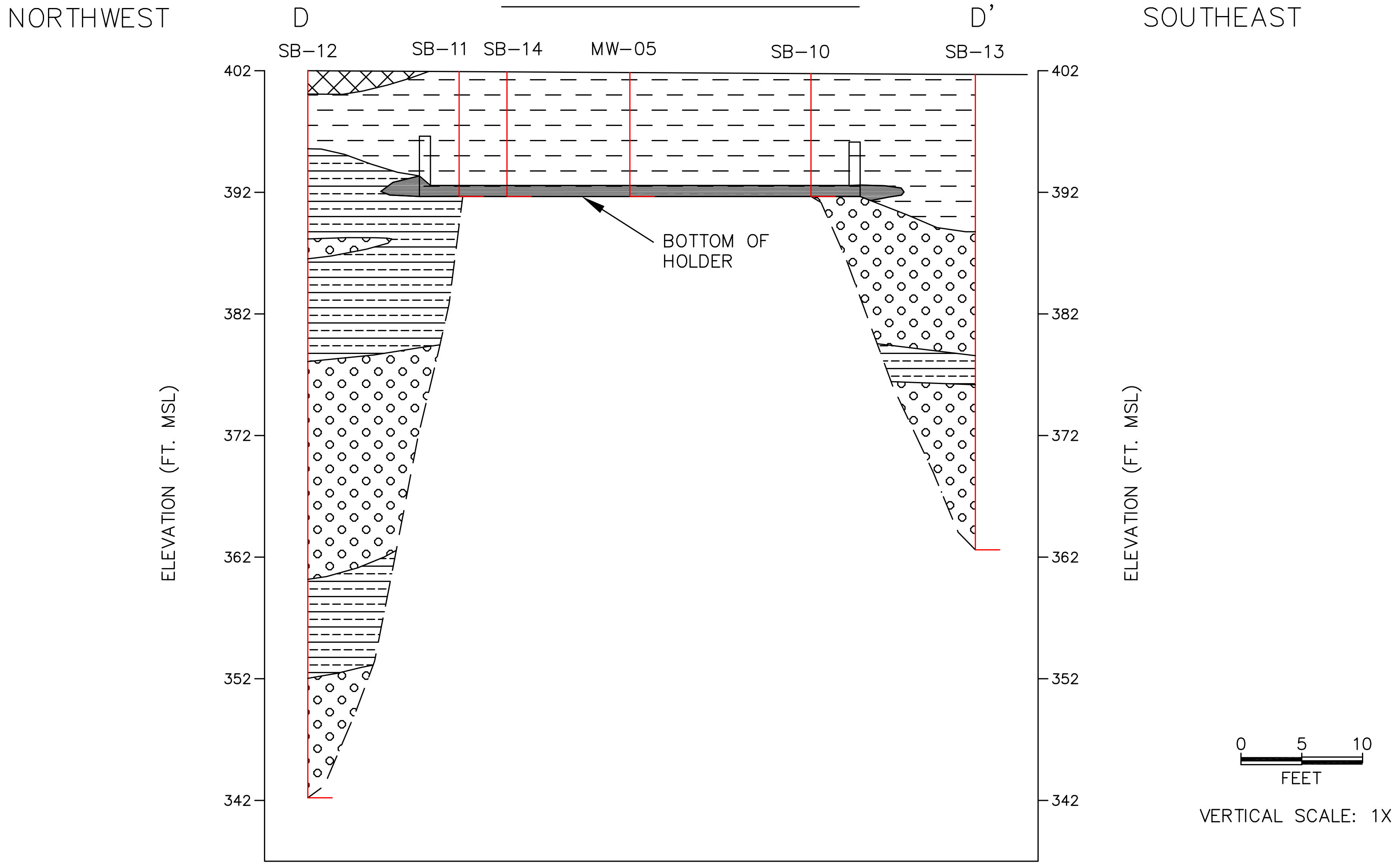
CROSS SECTION B-B'



CROSS SECTION C-C'



CROSS SECTION D-D'



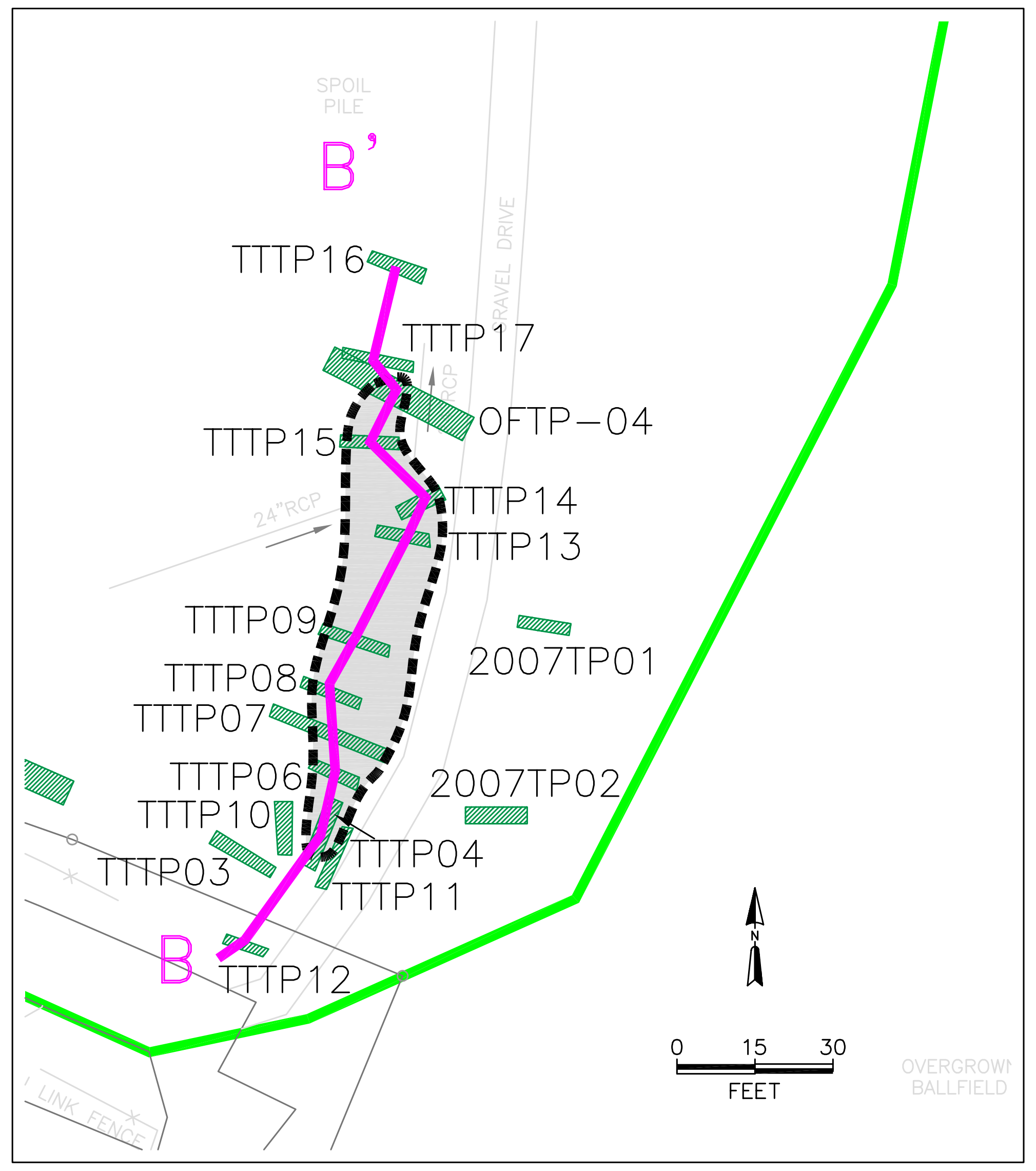
LEGEND

- ⊠ TOPSOIL
- ☐ FILL
- ⛶ SILTY, GRAVELLY SAND
- ☰ CLAYEY SILT
- ☐ PEAT
- ▨ CLAY
- ■ STAINING, RESIDUAL TAR AND NAPL
- | BORING/TEST PIT
- ▽ GROUNDWATER ELEVATION (BASED ON TEST PIT OBSERVATIONS)

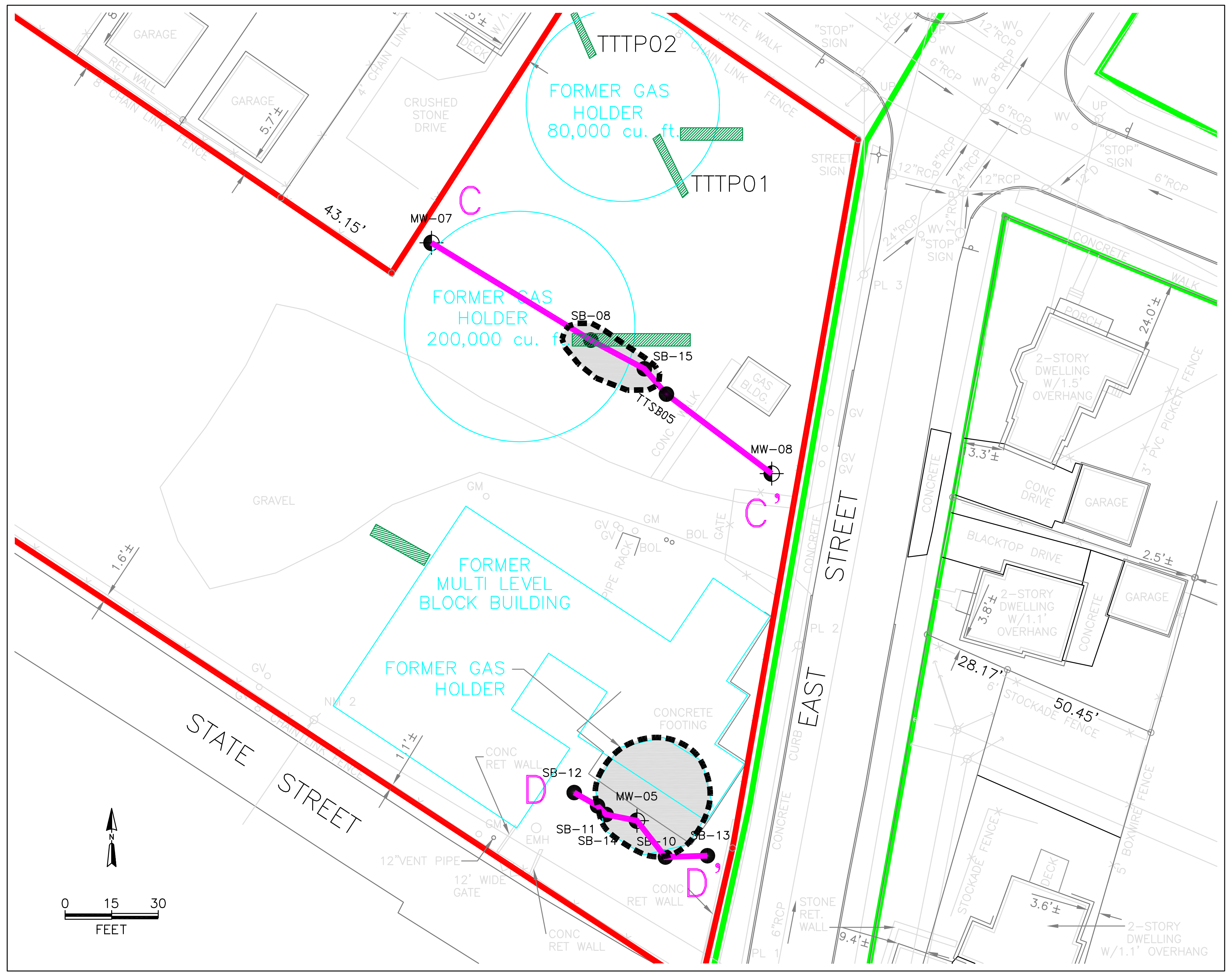
LEGEND

- 🟩 TEST PIT
- ● SOIL BORING
- △ TEST PIT
- 🟥 BOUNDARY OF SITE PROPERTY
- 🟩 APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
- — CROSS SECTION TRANSECT
- ⬭ ESTIMATED HORIZONTAL EXTENT OF NAPL

PLAN VIEW - CROSS SECTION B-B'



PLAN VIEW - CROSS SECTION C-C' AND D-D'



TETRA TECH EC, INC.

TITLE:

ESTIMATED HORIZONTAL AND VERTICAL EXTENT OF NAPL
IN SUBSURFACE SOIL MATRIX
Remedial Investigation Report – Ilion (East Street) Site

national**grid**

DWN: CTS
DES.: CTS
CHKD: DPC
APPD: RC
DATE: 06/04/08
REV.: 1
PROJECT NO.: 2907.0003.0006
FIGURE NO.: 4-9

N:\GIS\GISKEY\GISPROJ31\ILION EAST STREET\RI RE-REISSUE FIGURES\RI FIGURE 4-9 NAPL EXTENT 060408.DWG