nationalgrid

Steven P. Stucker
Lead Engineer
Environmental Department

August 8, 2012

John Spellman, P.E.
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Division of Environmental Remediation
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Div of Environmental Remediation

Subject: Alternatives Analysis Report
Oswego (West Utica Street) Former MGP Site
Operable Unit 1 (OU1) Soils
Oswego, New York

Dear John:

This letter serves to transmit the final Alternatives Analysis (AA) Report for the Operable Unit 1 (OU1) soils at Oswego (West Utica Street) Former Manufactured Gas Plant (MGP) located in Oswego, New York (Site No. 1-52-182).

The final report reflects modifications to the February 2012 draft AA Report based upon our responses to the New York Department of Environmental Conservation's (NYSDEC's) comments (June 22, 2012 letter) and the ensuing e-mail exchanges and telephone discussions. Please note that the Remedial Action Objectives (RAOs) presented in the draft AA Report have been modified based upon your e-mail, dated July 6, 2012, which stated that the NYSDEC was going to align the RAOs in the DEC's upcoming Decision Document to be consistent with the generic RAOs in DER-10.

If you should have any questions, comments or require any additional information, please do not hesitate to contact me (315-428-5652). I will await your feedback on the proposed schedule for the draft Decision Document.

Sincerely,

for:

Steven P. Stucker, C.P.G.
Lead Engineer, Environmental Department

cc: D. Jones – NYSDOH
J. Parkinson, Esq., National Grid (w/out enclosure)
K. Bogatch (Brown and Caldwell)

Alternative Analysis Report
Oswego (West Utica St.) Former MGP Site
Operable Unit No. 1 Soils
Oswego, Oswego County, New York

Prepared for

Niagara Mohawk Power Corporation
d/b/a National Grid

Syracuse, New York

August 2012

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Oswego (West Utica St.) Former MGP Site
Operable Unit No. 1 Soils
Oswego, Oswego County, New York

Prepared for

Niagara Mohawk Power Corporation d/b/a National Grid

300 Erie Boulevard West

Syracuse, New York 13202

August 2012

Project Number: 141691.100

Brown AND Caldwell

Brown and Caldwell Associates

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Certification Statement

I, Jeffrey Caputi, certify that I am currently a NYS registered professional engineer, this Alternatives Analysis Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10), and all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Jeffrey R. Caputi, P.E., CHMM, QEP
N.Y.P.E. License Number 082196

8-3-12
Date

Table of Contents

Appendices

List of Tables

List of Figures

List of Abbreviations

AA	Alternatives Analysis
AAR	Alternatives Analysis Report
ARAR	Applicable, Relevant and Appropriate Requirements
AWQS	Ambient Water Quality Standards
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
BC	Brown and Caldwell Associates
CAMP	Community Air Monitoring Program
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	Constituent of Concern
DER	Division of Environmental Remediation
DER-10	Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation (May 2010)
DNAPL	Dense Non-Aqueous Phase Liquid
FS	Feasibility Study
GC/FID	Gas Chromatograph/Flame Ionization Detector
GRA	General Response Action
HASP	Health and Safety Plan
ISS	In-Situ Solidification/Stabilization
ISTD	In-Situ Thermal Destruction
kcf	Thousand Cubic Feet
K_h	Horizontal Hydraulic Conductivity
LDR	Land Disposal Restriction
LNAPL	Light Non-Aqueous Phase Liquid
mg/kg	Milligrams Per Kilogram
MGP	Manufactured Gas Plant
MTBE	Methyl Tertiary Butyl Ether
POTW	Publicly Owned Treatment Works
NAPL	Non-Aqueous Phase Liquids
NPDES	National Pollutant Discharge Elimination System
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OGLC	Oswego Gas Light Company
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon

RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RIR	Remedial Investigation Report
SARA	Superfund Amendments and Reauthorization Act of 1986
SC	Site Characterization
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SPDES	State Pollutant Discharge Elimination System
SRI	Supplemental Remedial Investigation
TAGM	Technical and Administrative Guidance Memorandum
μg/L	Micrograms per Liter
VCO	Voluntary Consent Order

Section 1

Introduction

1.1 Scope

This Alternatives Analysis Report (AAR) documents the development, evaluation and recommendation of a remedial alternative to address environmental impacts to overburden soils at Operable Unit No. 1 (OU1) of the Oswego (West Utica St.) Former Manufactured Gas Plant (MGP) Site (i.e., herein referred to as the Site). Remedial alternatives pertaining to other impacted media at OU1 will be addressed under a separate investigation and AAR to be performed as part of OU2. In a letter dated December 10, 2010, the New York State Department of Environmental Conservation (NYSDEC) provided a determination to separate the Site into two operable units (OUs) as follows:

- **Operable Unit 1 (OU1):** soil, bedrock, groundwater and soil vapor beneath the five parcels that encompass the original MGP footprint area.
- **Operable Unit 2 (OU2):** soil, bedrock, groundwater and soil vapor beneath West Third St., West Fourth St., West Utica St., and a portion of the land south of West Utica St. The limits of the portion of land south of West Utica Street will be determined when the nature and extent of the MGP-related contamination is identified.

This determination was made during the implementation of field activities pursuant to the most recent Remedial Investigation (RI) Work Plan (Brown and Caldwell, 2010).

This AAR has been prepared in accordance with the Voluntary Consent Order (Index # D0-0001-0011) between Niagara Mohawk Power Corporation (now doing business as National Grid) and the NYSDEC executed on January 25, 2002 (NYSDEC, 2002). The VCO primarily covers former MGPs that are situated on properties not owned by National Grid, but for which National Grid has assumed responsibility for former MGP operations.

1.2 Applicable Regulations

The Alternatives Analysis (AA) has been prepared in accordance with the substantive portions of Title 6 of the New York Code of Rules and Regulations Part 375 for remedial action selection as well as the NYSDEC's "Technical and Administrative Guidance Memorandum (TAGM) #4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites)," dated May 1990, and the "Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation" dated May 2010.

1.3 Purpose and Report Organization

The purpose of this AAR is to develop and evaluate remedial alternatives to address the MGP-related environmental impacts occurring within the overburden soil at OU1. Soil vapor has not been identified as a media of concern at OU1 and therefore is not addressed in this AA. Other impacted media at OU1 as well as Site related impacts identified in the off-site areas will be addressed separately under OU2. The OU1 impacts to overburden soils are defined primarily by the presence of coal tar in the form of dense non-aqueous phase liquids (DNAPLs) as well as the related soil contamination.

The AA process begins with the establishment of remedial action objectives (RAOs) to address the risks posed by the presence of contaminants at concentrations in excess of the cleanup objectives and cleanup levels established for the Site [6 NYCRR Part 375 (soils)]. General response actions (GRAs) are then developed for the impacted media that can address the RAOs. The identification and screening of technologies applicable to each GRA is the next step in the AA process. Following the identification of process options for the retained technologies, representative process options are combined to form a remedial alternative. The remedial alternatives are screened to determine which alternatives are candidates for detailed evaluation consistent with the guidelines established in TAGM 4030. The detailed evaluation is conducted by applying the following criteria:

- Overall protection of public health and the environment;
- Compliance with Standards, Criteria and Guidelines (SCGs);
- Short-term effectiveness;
- Long-term effectiveness;
- Reduction of toxicity, mobility or volume through treatment;
- Implementability;
- Cost; and
- Land use

The results of this AA will be used for the selection of a final remedial action for the Site, the preparation of a Decision Document by the NYSDEC, and the preparation of a remedial design, as described in the VCO.

This AA Report comprises eight sections and was organized in accordance with Section 4.4(b) of DER-10 "Remedy Selection Reporting Requirements". The organization and content of the report are as follows:

- **Section 1** - Introduction - This section describes the scope of this report.
- **Section 2** - Site Description and History - This section describes the Site features, location, surrounding area and historical information about the Site use. It also summarizes the regulatory and investigative activities related to the Site.
- **Section 3** – Site Conditions - This section summarizes the Site geology and hydrogeology, as well as the nature and extent of contamination and results of the human health exposure assessment.
- **Section 4** - Remedial Action Goals and Objectives - This section lists the goals and objectives of the remedial alternatives evaluated for this Site.
- **Section 5** - General Response Actions - This section describes the general types of remedial actions that were evaluated for this Site.
- **Section 6** - Identification and Screening of Technologies - This section includes a listing of potential remedial technologies that meet the general response actions and a preliminary evaluation of each technology with regard to effectiveness, implementability and cost.
- **Section 7** – Development and Evaluation of Remedial Alternatives - This section includes the development of remedial alternatives from the technologies carried forward in the screening process and the evaluation of each remedial alternative with regard to the evaluation criteria specified in DER-10.
- **Section 8** - Recommended Remedial Alternative - This section describes the remedial alternative recommended for implementation at this Site and the basis for the recommendation.

Section 2

Site Description and History

This section of the AAR provides a summary description of OU1 of the Oswego (West Utica Street) Former MGP Site as well as a history of the former MGP operations and activities conducted at the Site. Additional details regarding these topics are provided in the Remedial Investigation Report (RIR) entitled "Remedial Investigation Report, Oswego (West Utica St.) Former MGP Site, Operable Unit No. 1" prepared by Brown and Caldwell Associates and dated April 2011 and revised August 2011.

2.1 Site Description

OU1 of the Oswego Former MGP Site is located on West Utica Street in the City of Oswego, Oswego County, New York (refer to Figure 2-1). The former MGP was located on land that is currently divided into five parcels of property. The five parcels are identified by the City of Oswego Assessors Office as Lots 5-10, 5-11, and 5-12 on Assessors Office's Map 128.070 and Lots 4-11 and 4-11.01 on Assessors Office's Map 128.062. According to the City of Oswego Assessors Office's records, Lots 128.070-5-10 and 128.070-5-12 are owned by Tracy L. Kells of Oswego, New York. Lot 128.070-5-11 is owned by Joseph Malone of Oswego, New York. Lot 28.062-4-11 is owned by the Sons of Italy Dante Alighieri Lodge of Oswego, New York. Lot 128.062-4-11.01 is owned by Ontario Lakeside Medical Associates of Oswego, New York. Per the City of Oswego's Assessment Department, the five parcels mentioned above fall within the area classified as B-1 Zoning for neighborhood business/commercial use.

The Site is abutted to the north-northwest by the remaining portions of Lots 128.062-4-11 and 128.062-4-11.01; to the west-southwest by West 4th Street; to the south-southeast by West Utica Street; and to the east-northeast by West 3rd Street. The area surrounding the Site to the west and south is primarily used for commercial purposes. Residences are located to the east and northwest of the Site.

The Site is generally covered with either buildings or pavement. The buildings located in the southwestern portion of the Site are occupied by two businesses [Advantage Carpets (a Carpets retail business) and Taylor Rental (an equipment rental business)]. The buildings are located adjacent to each other and form an L-shaped structure located on Lots 128.070-5-12 and 128.070-5-10. A small unpaved area is located in the western portion of Lot 128.070-5-10. The western and northern portions of the Site are paved parking lots for the Ontario Lakeside Medical Associates and the former Sons of Italy Dante Alighieri Lodge #436, which are situated on Lots 128.062-4-11.01 and 128.062-4-11, respectively. The eastern portion of the Site (i.e., Lot 128.070-5-11) is occupied by an automobile repair shop called The Car Shop. The area not covered with the repair shop building is paved. A slight circular ridge in the asphalt pavement indicates the position of the walls of 100 kcf gas holder remnants in the subsurface of this parcel. No other evidence of the former MGP is visible at the Site.

The topography of the Site is generally flat with a slight general decline from the north to the south. The ground surface of the site is elevated slightly (about 1 foot to 2 feet) above the ground surface of the neighboring streets (see Figure 2-2). The vicinity of the Site is part of an elevated area situated along the western bank of the Oswego River. The Oswego River is located approximately 1,000 feet east-northeast of the Site. Lake Ontario is located approximately three-quarters of a mile north of the Site.

2.2 Site History

Based on a review of available historical information (primarily Sanborn® Fire Insurance Maps), the former Oswego MGP employed the coal carbonization process which did not use petroleum feed stock; no information has been identified to indicate that the carbureted water gas process was used at the Site.

The original MGP was apparently built by the Oswego Gas Light Company (OGLC) according to the available historical information. According to the “Landmarks of Oswego County, New York”, published by D. Mason & Company Publishers in 1895, the OGLC was organized on March 23, 1852 and began producing gas in the fall of 1852. The “New Topographical Atlas of Oswego County, New York”, which was published by C. K. Stone in 1867, shows the original plant. This atlas indicates the plant included the smaller of the two holders (40 kcf gas holder) shown on Figure 2-2.

According to the “Landmarks of Oswego County, New York”, the plant was enlarged in 1869. The plant enlargement, conducted between 1866 and 1869, was apparently preceded by the purchasing of parcels that comprise current Lots 128.070-5-10 and 128.070-5-12.

The first “Brown’s Directory of American Gas Companies”, published in 1887, indicated the OGLC manufactured coal gas (i.e., gas produced by the coal gasification process). Later Brown’s directories indicated that the OGLC also produced electricity after 1889. This was supported by the “Landmarks of Oswego County, New York”, which indicated that the OGLC purchased the stock and plant of the Home Electric Light Company on January 1, 1888.

As shown on the 1890 Sanborn® Map, a typical arrangement of MGP structures existed at the Site, including a retort, a 100 kcf gas holder, a 40 kcf gas holder, an office, a coal bin, and several support structures. Between 1924, the date of the last Sanborn® Map that shows the former MGP, and 1890, little change occurred in the layout of the MGP and the associated structures. The changes to the structures that did occur during this period of time included the enlargement of the Retort House and the removal of a portion of the electric light plant. The 1924 Sanborn® Map does not indicate that the plant produced electricity at that time. Figure 2-2 shows the locations of the structures associated with the MGP that were indicated on the 1924 Sanborn® Map.

The available records indicate that the OGLC was sold to the Peoples Gas & Electric Company in 1900 but gas plant operations continued under this entity until the 1930s. According to the available records, sometime in the 1930s, gas manufacturing at the Site ceased after a gas main was laid from Syracuse to Oswego that supplied a mixture of natural gas and manufactured gas to Oswego.

During the operation of the MGP, the uses of the surrounding area were not significantly different from the present uses of these areas. The areas to the east and northwest were primarily residential with the exception of the building now occupied by Ontario Lakeside Medical Associates, which was apparently built in 1920 according to the City of Oswego Assessors Office’s records. The areas to the southeast and southwest along West Utica Street were commercial or industrial. One business of note was the Acme Oil Co. (later Standard Oil Co.) refinery that was located on the opposite side of West Utica Street from the Site, which now is occupied by a bank. The Sanborn® Maps show that a railway and rail yard existed south of the Site, covering much of the area now occupied by West Utica Street and the area to the south. One set of railroad tracks in this area, directly south of the former MGP and south of the current position of west Utica Street, was situated in a trench that decreased in grade toward the east. These tracks extended from the trench into a tunnel to the east. The tunnel, which is still present beneath the ground surface, began directly west of West Third street and extended eastward in the subsurface toward the Oswego River. The eastern end of the tunnel is at the river, and the tracks extend from the tunnel northward toward Oswego Harbor.

Sometime in the late 1930s or 1940s, the former MGP was demolished and the property sold. By 1947, according to the City of Oswego Assessors Office's records, the portion of the building now occupied by Advantage Carpets located along West Utica Street was constructed. Later Sanborn® Maps indicate that this building was used as a warehouse for beverage distributors until the 1990s. The building formerly occupied by the Sons of Italy was constructed in 1960 and used as a social organization lodge until 2009. This building is currently vacant and the lot is for sale. The available Sanborn® Maps indicate that the existing automobile repair shop was built sometime between 1960 and 1972. This building was originally used as a car wash.

The above discussion of the review of the historical City of Oswego maps and Sanborn® fire insurance maps was previously presented in the RI Report (Brown and Caldwell Associates, April 2011, revised August 2011) and is also presented in further detail in Appendix L of the RI Report, entitled "Phase IA Cultural Resources Investigation" (Panamerican Consultants, Inc., September 2010). Approximate locations of the former MGP structures based on the 1924 Sanborn® map are depicted on Figure 2-2.

A chronological summary of the property ownership is as follows:

- **1852-1900:** Oswego Gas Light Company
- **April 1900:** Transfer of ownership from Oswego Gas Light Company to People's Gas & Electric Company of Oswego
- **Late 1930s or 1940s:** Demolition of MGP structures and sale of property.

2.3 Regulatory and Remedial History

Remedial activities at the Site have been conducted in accordance with the VCO (Index # DO-0001-0011) between Niagara Mohawk Power Corporation (now doing business as National Grid) and the NYSDEC executed in January 25, 2002. The VCO primarily covers former MGPs that are situated on properties not by National Grid, but for which National Grid has assumed responsibility for former MGP operations.

The remedial history chronology is as follows:

- Site Characterization/Interim Remedial Measures Work Plan (January 2004).
- Implement SC/IRM Work Plan (November 2004 – December 2004).
- Site Characterization Data Summary Report (August 2005).
- Remedial Investigation (January 2007 - January 2011).
    - RI Work Plan Approval (September 8, 2006).
    - Implement RI Work Plan (January 2007 – November 2007). Phase I Soil Vapor Intrusion (SVI) activities (soil vapor sampling) performed.
    - Transmittal of validated Phase I SVI data and Data Usability Summary Report (September 19, 2007).
    - Phase II SVI Work Plan Approval (March 7, 2008).
    - Implement Phase II SVI Work Plan (March 13-17, 2008).
    - RI Data Summary Report (March 31, 2008).
    - Meeting of National Grid with NYSDEC and the New York State Department of Health (NYSDOH) to discuss RI findings and plan additional RI activities (March 31, 2008).
    - Technical memorandum for SVI evaluation (June 17, 2008).
    - Supplemental RI (SRI) Work Plan Approval (September 3, 2008).

  - Implement SRI Work Plan (November 2008 – April 2009).
  - SRI Data Summary Report (July 24, 2009).
  - Meeting of National Grid with the NYSDEC and NYSDOH to discuss SRI findings and plan additional RI activities (November 10, 2009).
  - Phase III RI Work Plan Approval (September 22, 2010).
  - Implement Phase III RI Work Plan (October 2010 – January 2011).
  - Letter from the NYSDEC providing determination to separate Site into two separate operable units (on-site [OU1] and off site [OU2] impacts) and requesting preparation of a RI Report for OU1 and a RI Work Plan for OU2 (December 10, 2010).
- Submitted initial version of RI Report for OU1 (April 2011)
- Submitted RI Work Plan for OU2 (April 2011)
- RI Work Plan for OU2 approved by NYSDEC (June 2011); begin activities to gain access permission for off-site properties
- Received comments from NYSDEC on RI Report for OU1 (July 2011)
- Submitted Addendum to RI Work Plan for OU2 based on NYSDEC comments on the RI Report for OU1 (August 2011)
- Submit revised version of RI Report (August 2011)
- Received approval of RI Report from NYSDEC on August 17, 2011
- Received approval of Addendum to RI Work Plan for OU2 from NYSDEC (October 2011)

Section 3

Site Conditions

The section of the AAR provides a summary of the stratigraphy and nature of subsurface materials, hydrostratigraphy, groundwater flow, and the nature and extent of contamination at OU1. This summary is based on data and information collected during historical site/remedial investigations. The summary is based on the information provided in the report entitled, "Remedial Investigation Report, Oswego (West Utica St.) Former MGP Site-Operable Unit No. 1" (Brown and Caldwell Associates, April 2011, revised August 2011).

3.1 Summary of Site Investigations

Site investigations have been conducted by National Grid at the Site pursuant to the 2002 VCO between Niagara Mohawk Power Corporation, doing business as National Grid, and the New York State Department of Environmental Conservation (NYSDEC). Initially, a Site Characterization (SC) was conducted in 2004 and 2005. SC findings indicated the presence of constituents in the subsurface associated with former MGP operation, as well as from other sources. Based on these findings, it was determined that a Remedial Investigation (RI) was required. Field activities for the RI were initiated in 2007.

The RIR for OU1, entitled "Remedial Investigation Report, Oswego (West Utica St.) Former MGP Site-Operable Unit No. 1" (Brown and Caldwell, 2011) was approved by letter from NYSDEC dated August 17, 2011, provided a comprehensive evaluation of the SC and RI findings to-date for both OU1 and OU2. Characterization of the nature and extent of impacts attributable to former MGP operations beneath the original MGP footprint area (OU1) is considered complete for the purposes of the RI. The evaluation of the nature and extent of MGP-related contamination associated with OU2 has not yet been completed. A work plan for additional RI activities in OU2 has been prepared and approved.

3.2 Stratigraphy, Hydrostratigraphy and Groundwater Flow

The following describes the stratigraphy of the subsurface conditions beneath the Site, including the characteristics of the overburden, bedrock and the nature and occurrence of groundwater flow in these intervals.

3.2.1 Overburden

Based on the site/remedial investigations performed at the Site, the following presents a summary of the pertinent characteristics of the overburden at the Site. A detailed description is included in the RIR (Brown and Caldwell Associates, April 2011, revised August 2011).

- The overburden at the Site generally consists of several feet of fill material overlying glacial till deposits. Locally, thin deposits of silt and clay or sand and silt are positioned above the till. The origin of these deposits was not confirmed, but they may be alluvial. Generally, the density of the till increases with depth, yet, there are instances where the density of till is variable. The fill is composed of various materials including sand, gravel, cinders, coal and demolition debris (e.g., brick and concrete). Finer-grained material (silt and clay), where present in the fill, is typically not the predominant component.

- The thickness of overburden at the Site varies between approximately 18 and 26 feet; the typical thickness across most of the Site is approximately 18 to 20 feet.
- The water table at the Site (refer to Figure 7 of the RI Report – all RI figures mentioned in this report are included in Appendix A of this AAR) is typically positioned in the lower part of the fill or in the glacial till. The depth to the water table is illustrated in the hydrogeologic cross-sections provided as Figures 4 through 6 of the RI Report and included in Appendix A of this AAR). Typically, only a thin interval of the lowermost fill is saturated with most of the saturated overburden being comprised of till material. The water table is generally about five to nine feet below ground surface (bgs) on-site, but is lower on off site properties across West Utica Street. The water table on properties across from the Site is approximately 10 to 14 feet bgs.
- The estimated geometric mean of the horizontal hydraulic conductivity (K_h) of the fill is 3.6×10^{-4} cm/sec; the estimated values range from 6.7×10^{-3} cm/sec, to as low as 1.8×10^{-5} cm/sec. The relatively high K_h is due to generally coarse grained nature of the fill materials. The estimated geometric mean K_h of the glacial till is 4.1×10^{-5} cm/sec with a range from 2.2×10^{-3} cm/sec, to as low as 3.5×10^{-6} cm/sec. The geometric mean is approximately one order of magnitude lower than the fill deposits and is related to the overall poor-sorting (i.e., mixture of fine-grained and coarse-grained materials) as well as the greater density and degree of cementation relative to the fill.
- Due to the minimal difference in the groundwater elevations between the shallower and deeper overburden materials (i.e., a low vertical hydraulic gradient), the saturated overburden deposits at the Site can be considered as one water-bearing zone, despite the contrast in hydraulic conductivity of the overburden deposits.
- Overburden groundwater at the Site flows generally from north to south across the Site toward West Utica Street with components of flow to the south-southwest and to the east. A component of the groundwater flow discharges to the sewers (and/or associated coarse bedding material) beneath West Utica Street, West Fourth Street and West Third Street. However, a component of flow from the southwestern part of the Site flows past West Utica Street discharging to the buried former railroad trench and tunnel system located just south of West Utica Street. There is a slight downward component of groundwater flow from the overburden to the underlying bedrock. The groundwater contained within the two subsurface gas holder structures appears to have little or no hydraulic connectivity with the surrounding groundwater.

3.2.2 Bedrock

Based on the site/remedial investigations performed at the Site, the following presents a summary of the pertinent characteristics of the bedrock at the Site. A detailed description is included in the RIR (Brown and Caldwell Associates, April 2011, revised August 2011).

- The bedrock beneath the Site consists of sandstone with occasional thin finer-grained layers of shale, mudstone or siltstone; this bedrock unit is referred to as the Oswego Sandstone.
- A water-bearing fracture zone occurs within the shallow bedrock (upper ±20 feet below the top of rock) that is apparently controlled, to a large degree, by approximately horizontal open bedding plane fractures. The estimated geometric mean K_h for the water-bearing zone in the shallow bedrock is 3.9×10^{-5} cm/sec and ranges from 3.0×10^{-3} to 1.8×10^{-6} cm/sec.
- In the deeper bedrock interval from ±20 to ±50 below the top of bedrock, no water-bearing zones were identified. This is corroborated by the steep vertical hydraulic gradient in the deeper interval relative to the shallow bedrock. Of the four deeper bedrock wells, the only well that recovered at a sufficient rate to assess the K_h via slug test analytical methods was the shallowest well, MW-131R2, located south of OU1. The estimated K_h for MW-131R2 is 1.7×10^{-6} cm/sec. During the slug testing at the other deeper bedrock wells (MW-128R2, MW-129R2, and MW-130R), water level recovery was

too slow to make a valid K_h estimate. For these wells, intervals of very minor flow indications from packer pressure testing were targeted. Although these wells do yield some groundwater, the yield is very low.

- Groundwater in the shallow bedrock generally flows from north to south or southwest across the Site. Downgradient of the Site, the flow direction in the vicinity of West Fourth Street appears to shift more to the southeast (refer to Figure 8 of the RI Report). The buried remnants of a former railroad trench and tunnel system that is located approximately 50 feet south of West Utica Street was identified as a possible discharge feature for groundwater in bedrock.
- In the relatively low hydraulic conductivity deeper bedrock (±20 to ±50 below the top of bedrock), the predominant component of groundwater flow is downward.

3.3 Nature and Extent of Contamination

3.3.1 Extent of NAPL

The following summarizes findings of the RI and SC with regard to the extent of NAPL in the subsurface.

3.3.1.1 General Findings

- As with other MGP sites where the coal carbonization processes were used, the tar encountered is typically a DNAPL with a density slightly greater than water.
- Occurrences of NAPL that is lighter than water (i.e., LNAPLs) have also been observed at the Site (e.g., within the former gas holders and in the area of the former tar tanks) and are likely attributable to sources unrelated to MGP operations.
- NAPL at the Site occurs within the overburden materials (i.e., fill, glacial till and the local deposits of silt and clay/sand and silt) and the underlying bedrock.

3.3.1.2 NAPL in Overburden Deposits

- In general, NAPL occurs as specks, droplets, veins, or lenses within the overburden materials. NAPL was also observed as a coating on coarser grained material or as a hardened material. Where lenses of NAPL were observed, they were documented as slightly viscous with an oil-like consistency. More viscous tar was also observed. NAPL was most frequently encountered in the southwestern portion of the former MGP Site (refer to Figure 9 of the RI Report included in Appendix A of this AAR). The NAPL in the overburden is generally encountered at depths of four to eight feet bgs or greater. NAPL has been observed to have entered few overburden monitoring wells at the Site. These observations are generally adjacent to areas where NAPL was identified in subsurface soils. The volume of NAPL recovered from these wells is low (e.g., a small volume of NAPL blebs with an associated sheen).
- Soil borings have not been drilled beneath the Taylor Rental and Advantage Carpet buildings. NAPL has been encountered in the soil at locations adjacent to these structures.
- A layer of solid tar was observed at a depth of 0.5 to 1.5 feet bgs in an area between the Advantage Carpet building and the former Southern Gas Holder. No NAPL was observed to be associated with the solid tar.

3.3.1.3 NAPL in Bedrock

- NAPL was observed along or near horizontal fracture surfaces.
- NAPL was observed in rock core samples at four bedrock well locations during the RI activities (MW-122R and MW-130R located within OU1; MW-131R1 and MW-131R2 located within OU2 (refer to Figure 10 in the RIR and included in Appendix A of this AAR). It should be noted that MW-122R and MW-130R are adjacent locations as are MW-131R1 and MW-131R2.

- The NAPL observations were in the shallow bedrock (upper ±20 feet below the top of rock). No NAPL indications have been observed in the deeper bedrock interval.
- NAPL has been observed to have entered wells MW-121R and MW-131R1. At these locations, equipment lowered into the well (e.g., bailers, interface probes, sampling pump, etc.) were partially coated with NAPL upon retrieval from the well.

3.3.2 Subsurface Structures

Remnants of several of the former MGP subsurface structures were identified during the SC and RI (refer to Figure 2-2). A summary of the findings related to each is provided below. Apparent MGP-related impacts, as well as non-MGP related impacts, were found to be associated with several of the structures: the northern gas holder (40 kcf), the area of the former tar tanks, and the area of the former meter room and purifier room.

3.3.2.1 Northern Gas Holder (40 kcf)

- The walls of the former 40 kcf gas holder, where observed, are constructed of concrete and brick.
- A portion of the base of the holder may have been excavated a few feet into rock during the construction of the holder.
- The holder contains fill material consisting of sand, gravel, brick, concrete, glass and wood.
- A thin layer of LNAPL was encountered on the surface of the groundwater in a test pit in the holder. Gas chromatograph/flame-ionization detector (GC/FID) analysis characterized it as lubricating oil.
- MGP-related NAPL impacts were encountered within the holder. The degree of NAPL saturation is apparently greater in the lower part of the holder.
- The groundwater elevation within holder is several feet above the groundwater elevations directly outside of the holder indicating that water in the holder has little or no hydraulic connectivity with surrounding groundwater.

3.3.2.2 Southern Gas Holder (100 kcf)

- The walls of the former 100 kcf gas holder, where observed, are constructed of brick.
- A portion of the base of the holder may have been excavated into rock during construction of the 100 kcf gas holder.
- The holder contains fill material consisting of sand, gravel, brick, wood, concrete, and to a lesser extent, silt and clay.
- NAPL was not encountered at the borings completed within the 100 kcf holder.
- A thin LNAPL layer with a gasoline odor was encountered on the surface of water in a test pit installed within the holder.
- The groundwater elevation within holder is approximately two to three feet higher than the groundwater elevations directly outside of the holder indicating that water in the holder has little or no hydraulic connectivity with surrounding groundwater.
- No indications of MGP-related impacts have been identified within the 100 kcf holder.

3.3.2.3 Tar Tanks

- No clear indications of building foundations or structures were encountered during a geophysical survey performed during the RI activities or during the advancement of borings in the area of the tar tanks.
- The upper five feet of overburden material in the area of the former tar tanks is composed of a mixture of sand, gravel, slag, concrete, brick, glass, pieces of coal, and other miscellaneous debris.

- NAPL impacts were encountered in the area of the tar tanks. Results from the GC/FID analysis of a sample collected from the area of the tar tanks and observations from a test pit excavation completed in the area of the tar tanks indicate both MGP-related impacts and non-MGP impacts are present in this area.

3.3.2.4 Retort House

- There were no indications of intact subsurface structures in the area of the former Retort House.
- The upper five to eight feet of overburden in the area of the former Retort House is composed of a mixture of sand, gravel, concrete, brick, clinkers, and pieces of coal and asphalt.
- No NAPL impacts were encountered in the area of the former Retort House.

3.3.2.5 Coal Bin

- There were no indications of intact subsurface structures in the area of the former coal bin.
- The upper portion of the overburden in the area of the former coal bin is composed of a mixture of sand, gravel, brick, clinkers, and gravel-sized pieces of coal.
- No NAPL impacts were encountered in the coal bin area.

3.3.2.6 Meter Room and Purification Room Area

- There were no indications of intact subsurface structures during the advancement of borings in the area of the former Meter and Purification Rooms.
- The upper portion of the overburden in the area of the former Meter and Purification Rooms is composed of a mixture of sand, gravel, brick, clinkers, cinders, wood chips and pieces of coal.
- NAPL impacts were frequently encountered in this area. Depths of the NAPL observations in this area ranged from approximately four to ten feet bgs. At the locations where NAPL was observed, the degree of NAPL saturation was relatively high.

3.3.3 Soil Quality

The applicable soil quality criteria for the Site were identified as the NYSDEC's Remedial Program Soil Cleanup Objectives (SCOs) for Protection of Public Health (commercial use) and Protection of Groundwater, as set forth in 6 NYCRR Subpart 375-6.

Benzene, toluene, ethylbenzene and xylene (BTEX) compounds and a number of PAHs were detected above the applicable SCOs (Protection of Groundwater or Protection of Public Health for commercial use) in soil samples collected from numerous locations at the Site (refer to Figures 11 and 12 of the RIR included in Appendix A of this AAR).

Concentrations of total cyanide in soil are generally below the applicable SCOs, with the exception of four soil boring locations in two areas of the Site where total cyanide was detected above the SCO for Protection of Public Health (commercial use)(refer to Figure 13 of the RIR included in Appendix A of this AAR).

3.3.4 Groundwater Quality

The following summarizes the findings of the RI and SC with regard to constituent concentrations in the groundwater in the overburden and bedrock intervals.

3.3.4.1 Overburden Groundwater Quality

- Constituent concentrations in overburden groundwater were measured at levels above the New York State Class GA Groundwater Quality Criteria for one or more constituents in samples from several overburden wells located on-site and from overburden wells located on adjacent, off-site properties (refer to Figures 14, 15, and 16 in the RIR and included in Appendix A of this AAR).

- Generally, the most prevalent organic constituents detected at levels above the Class GA Groundwater Quality Criteria were BTEX compounds and naphthalene. BTEX compounds, naphthalene and other PAHs are contributed by NAPL related to the former MGP, although these compounds may also be contributed by other sources/operations on Site. For example, the elevated benzene concentrations in groundwater in the eastern part of the Site are not clearly related to former MGP operations. Further, methyl tertiary butyl ether (MTBE) was detected in a total of 11 overburden wells installed on-site. Five of these wells contained MTBE concentrations above the respective Class GA Groundwater Quality Criteria of 10 micrograms per liter [µg/L (guidance value)]. These five locations are all located in the southeastern part of the Site. The presence of MTBE indicates sources unrelated to MGP operations have impacted groundwater at the Site.
- On the south side of West Utica Street, BTEX compounds and naphthalene were not detected with the exception of well MW-116 located downgradient of the southwest corner of the Site. This is the area where groundwater may not be completely captured by the sewer system under West Utica Street. Rather, some of the groundwater from the Site may flow past the sewer and toward the south. Noteworthy however, is that BTEX compounds and naphthalene can be derived from a variety of non-MGP sources as well.

  The only other off-site overburden well where BTEX compounds and naphthalene were identified at concentrations above the Class GA Groundwater Quality Criteria was at MW-107S. This well is located west of the Site on the west side of West Fourth Street. However, because of the groundwater flow directions and the distribution of concentrations of nearby wells, the impacts at MW-107S are not likely related to the former MGP operations. This will be further evaluated as part of the RI for OU2.
- Total cyanide was frequently detected in overburden groundwater on-site at concentrations above the Class GA Groundwater Quality Criteria. However, no sources of cyanide (e.g., purifier waste) have been identified. The data indicate that little or none of the total cyanide detected in groundwater is associated with free cyanide. This is typical of MGP sites.
- The concentrations of cyanide in overburden groundwater at most of the off-site well locations are below the Class GA criterion with the exception of MW-107S, located west of the Site. The direction of groundwater flow and the distribution of cyanide concentrations in nearby wells suggest the impacts at MW-107S are derived elsewhere than the Site.
- Constituent concentrations in groundwater samples from overburden wells located hydraulically upgradient of the former MGP structures (MW-103 and MW-104) were below the Class GA Groundwater Quality Criteria.

3.3.4.2 Bedrock Groundwater Quality

- Concentrations of BTEX and naphthalene in bedrock groundwater exceed the Class GA Groundwater Quality Criteria at several locations (refer to Figures 17 and 18 of the RI Report and included in Appendix A of this AAR). The lateral and vertical extents of dissolved-phase impacts in bedrock groundwater have not been defined and will be investigated as part of OU2.
- NAPL in the overburden and in bedrock is the source of MGP-related dissolved-phase organic compounds in the bedrock groundwater.
- BTEX compounds and naphthalene have apparently migrated downgradient from the Site and NAPL impacted areas in the shallow bedrock water-bearing zone, and vertically from the shallow bedrock zone into the deeper bedrock. With the exception of well MW-130R, the concentrations of naphthalene in the deeper bedrock are below the Class GA Groundwater Quality Criteria.
- Completion of the evaluation of the nature and extent of potentially Site-related impacts associated with NAPL and dissolved phase organic compounds (e.g., BTEX compounds and PAHs) in bedrock groundwater will require additional investigation activities as part of the RI for OU2.

- Total cyanide was detected in groundwater at concentrations above the Class GA criterion in shallow bedrock. The total cyanide concentration measured in deeper bedrock groundwater on Site is below the Class GA criterion. Groundwater samples collected from wells screened in the shallow bedrock downgradient of the Site, and in the wells screened in the deeper bedrock, indicated cyanide concentrations below the Class GA criterion. Thus, both the lateral and vertical extents of dissolved-phase cyanide concentrations in bedrock groundwater above the Class GA criterion have been defined.
- The data indicate that little or none of the total cyanide detected in bedrock groundwater is associated with free cyanide. This is typical of MGP sites.

3.3.5 Soil Vapor

- The soil vapor intrusion (SVI) evaluation indicated that intrusion of soil vapors related to subsurface MGP residuals into buildings is not a concern at this Site.

3.3.6 Human Health Exposure Assessment and FWRIA

- The qualitative human health exposure assessment indicated that there are potentially completed exposure pathways for PAHs, BTEX compounds and cyanide compounds in the surface and subsurface soil and groundwater to potential current and future receptors. The receptors were identified based on current land use and zoning.
  - **Surface soil:** The area of potentially exposed surface soil at the Site is very small. Potential for exposure to site-related constituents, primarily PAHs, exists via routes of incidental ingestion, dermal contact and inhalation of soil particles to current and future outdoor workers, utility workers trespassers and site visitors, and to future construction workers. However, the area is small, gravel covered, and used by the equipment rental company to stage and display heavy construction equipment and vehicles. These surface conditions serve to reduce the potential for exposure potential to MGP-related impacts via these routes.
  - **Subsurface soil:** Potential for exposure to Site-related constituents exists via routes of dermal contact, inhalation (dust particles and/or vapors) and accidental ingestion for potential receptors involved with excavation work (utility worker and future construction worker). Because Site-related impacts in soil are primarily in the deeper soil, excavations limited to the upper four to six feet of soil have a lower exposure potential. A potential exposure for outdoor workers, indoor workers, and trespassers or Site visitors may be via the route of inhalation of VOCs in ambient air that migrate from subsurface soil, through the vadose zone into ambient air or indoor air. However, BTEX compounds and naphthalene readily degrade when exposed to the atmosphere. Also, the Site is mostly paved or covered by buildings so the potential for this route of exposure via ambient air to exist is unlikely. Additionally, the soil vapor evaluation conducted as part of the RI indicated that vapors originating from subsurface, Site-related impacts are not impacting on-site buildings.
  - **Groundwater:** Potential for exposure to Site-related constituents exists via routes of dermal contact, inhalation of vapors volatilizing from the groundwater, and accidental ingestion for potential receptors involved with excavation work (utility worker and future construction worker). The water table is typically five to nine feet below grade through much of the Site. Therefore, groundwater would not always be encountered in excavations. A potential exposure for outdoor workers, indoor workers, and trespassers or Site visitors may be via the route of inhalation of VOCs that migrate from groundwater, through the vadose zone into ambient air or indoor air. However, BTEX compounds and naphthalene readily degrade when exposed to the atmosphere.

Also, the Site is mostly paved or covered by buildings, so the potential for this route of exposure via ambient air to exist is unlikely. Additionally, the soil vapor evaluation conducted as part of the RI indicated that vapors originating from subsurface, Site-related impacts are not impacting on-site buildings.

- As determined from the decision key provided in Appendix 3C of "DER-10: Technical Guidance for Site Investigation and Remediation" (NYSDEC, May 2010), a fish and wildlife resources impact analysis (FWRIA) is not needed for OU1.

Section 4

Remedial Action Goals and Objectives

4.1 Remedial Action Goals

The NYSDEC remedial program identifies the goal for site remediation, under 6 NYCRR Sub-Part 375-2.8(a), as "…restore that site to pre-disposal conditions, to the extent feasible. At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by contaminants disposed at the site through the proper application of scientific and engineering principles and in a manner not inconsistent with the national oil and hazardous substances pollution contingency plan as set forth in section 105 of CERCLA, as amended as by SARA."

Where site restoration to pre-release conditions is not feasible, the NYSDEC may approve alternative criteria based on the site-specific conditions as stated in 6 NYCRR Sub-Part 375-2-8(b)(1): "The remedial party may propose site-specific soil cleanup objectives which are protective of public health and the environment based upon other information."

4.2 Remedial Action Objectives

As defined in DER-10, Remedial Action Objectives (RAOs) are medium-specific or operable-unit specific objectives for the protection of public health and the environment. RAOs are developed based on the Standards, Criteria and Guidance (SCGs) to address contamination identified at the Site in consideration of the intended land use.

Activities at the Site are being performed under a Voluntary Consent Order (VCO), Index Number DO-0001-0011), dated January 25, 2002. In accordance with 6 NYCRR 375-1, NYSDEC-issued permits are not required for environmental remedial activities conducted at this Site. Rather, the activities are evaluated and implemented based on the substantive elements of the applicable and relevant and appropriate state environmental laws and regulations. Federal applicable, relevant and appropriate requirements (ARARs) must be complied with fully, including the requirements to obtain permits, if necessary. Since New York does not have ARARs in its statute, these State environmental laws and regulations, in conjunction with the Federal environmental laws and regulations, are collectively referred to as Standards, Criteria and Guidance (SCGs). SCGs are defined in DER-10. Standards and Criteria are New York State regulations or statutes which dictate the cleanup standards and other substantive environmental protection requirements, criteria, or limitations which are generally applicable, consistently applied, officially promulgated and are directly applicable to a remedial action. Guidance are non-promulgated criteria and guidance that are not legal requirements; however, those responsible for investigation and/or remediation of the site should consider guidance that, based on professional judgment, are determined to be applicable to the site.

4.2.1 Standards, Criteria, and Guidance (SCGs)

SCGs include chemical-specific, action-specific, and location-specific SCGs. SCGs that are considered potentially applicable to remediation activities at OU1 are summarized below.

Chemical-Specific SCGs

Chemical-specific SCGs that are applicable to OU1 of the Oswego (West Utica Street) Former MGP include:

- NYS Soil Cleanup Objectives (6 NYCRR Part 375);
- 6 NYCRR 375-1: General Remedial Program Requirements;
- 6 NYCRR 375-2: Inactive Hazardous Waste Disposal Site Remedial Program;
- 6 NYCRR 375-6: Remedial Program Soil Cleanup Objectives (SCOs); and
- Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) Limits (40 CFR 261 and 6 NYCRR Part 371).

Action-Specific SCGs

Action-specific SCGs that are considered potentially applicable to the proposed remedial actions at OU1 of the Oswego (West Utica Street) Former MGP Site include:

- NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation;
- NYSDEC, TAGM 4030: Selection of Remedial Actions at Inactive Hazardous Waste Sites;
- General health and safety requirements, including Occupational Safety and Health Administration (OSHA) regulations;
- New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP), which identifies air monitoring requirements for in work areas when certain activities are in progress at contaminated sites;
- Resource Conservation Recovery Act (RCRA) Land Disposal Restrictions (LDRs), which govern the land disposal of hazardous wastes;
- RCRA and New York State Department of Transportation (NYSDOT) regulations for the transportation and management of hazardous materials;
- NYSDEC, Division of Environmental Remediation (DER) document entitled "Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment" (DER-4); and
- National Pollutant Discharge Elimination System (NPDES) program (administered in New York State under the State Pollutant Discharge Elimination System Program – SPDES), which governs discharge of wastewater and storm water.

Location-Specific SCGs

Location-specific SCGs that are considered potentially applicable to OU1 of the Oswego (West Utica Street) Former MGP Site include:

- Local permits from the City of Oswego.

Based on the SCGs, and the nature of the MGP-related impacts, the OU1 RAOs were developed based on the protection of public health, for the environmental media of source materials as defined in Section 5.0.

4.2.2 Remedial Action Objectives (RAOs)

The following RAOs were developed for OU1 of the Oswego (West Utica Street) former MGP Site:

Soil/Source Material RAOs

- Prevent, to the extent practicable, ingestion/direct contact with MGP-related source materials or with soils contaminated with MGP-related constituents.

- Prevent, to the extent practicable, inhalation of or exposure from constituents volatilizing from MGP-related source materials or from soils contaminated with MGP-related constituents.
- Remove/treat, to the extent practicable, the source of MGP-related groundwater impacts.

Groundwater RAOs

- Prevent, to the extent practicable, ingestion of groundwater with concentrations of MGP-related constituents exceeding drinking water standards.
- Prevent, to the extent practicable, contact with or inhalation of volatiles resulting from groundwater impacted with MGP-related constituents.
- Restore, to the extent practicable, groundwater contaminated with MGP-related constituents to pre-disposal/pre-release conditions.

The recommended remedial alternative for OU1 of the Oswego (West Utica Street) Former MGP Site will be developed to meet the above RAOs.

Section 5

General Response Actions

Based on the results of the investigation activities on the Site, overburden soils and groundwater have been determined to be the impacted media of concern at the Site. The overburden soils are the media of concern to be addressed by this AA and are considered for the evaluation of General Response Actions (GRAs). Impacts to indoor air from soil vapor issues were not identified at the Site; therefore, this media is not considered in defining the GRAs and the corresponding RAOs. Other impacted media at the Site will be addressed as part of a separate investigation and AA process performed under part of OU2.

The major source of the impacts appears to be the MGP-related DNAPL. For the purpose of this AAR, the impacts located in the overburden will be remedied by addressing the MGP-impacted overburden source materials. Source materials are defined as NAPL-saturated soil and soil where NAPL gauging of wells indicated NAPL entry into wells. Source materials do not include globules, droplets or sheens and do not pertain to other non-MGP related impacts. A lens of solid tar, observed in the southern portion of the Site between the Advantage Carpet building and the former Southern Gas Holder, will be further evaluated as part of the pre-design investigation activities. Subsequently, a determination will be made whether the solid tar meet the definition of a source material.

Accessible MGP-impacted source materials (i.e., materials outside of the footprints of the Advantage Carpets and Taylor Rental Buildings) are present over approximately 0.3 acres of the Site and are distributed throughout various depth intervals depending on the location. The maximum depth is approximately 22 feet bgs at the location of the Former Northern Gas Holder. The depths of accessible MGP-related source material located outside of the area of the holder range from 15 to 18 feet bgs. Observations of accessible source materials are depicted on Figure 5-1. The visual observations are based on data collected during the RI as summarized in Section 2 of this AAR and on Figures 9 and 12 of the RI Report. The GRAs discussed below will be evaluated as means of achieving the RAOs. A brief description of the GRAs and example technologies are presented below. Each of the GRAs listed below may be applicable to either one or both of the components of MGP-related source materials (NAPL-saturated soil and soil where NAPL gauging of wells indicated NAPL entry into wells). This is reflected in the descriptions of the GRA presented below.

5.1 No Action

No Action would not involve any treatment, containment, removal or disposal but would implement long-term monitoring and reviews for periodic re-evaluation of Site conditions. No Action is retained as a baseline for comparison.

5.2 Treatment

Treatment can be applied to either NAPL, or NAPL-saturated soils. Treatment alters the physical and/or chemical nature of the medium to produce a reduction in contaminant mass, mobility, or toxicity. Treatment can be accomplished in-situ or ex-situ and can involve physical, chemical, thermal and/or biological processes. Examples of in-situ treatment technologies include chemical oxidation, soil vapor extraction, bioremediation, in-situ thermal destruction (ISTD), and solidification. In-situ treatment would be potentially applicable to soils and NAPL.

Ex-situ treatment technologies include thermal desorption, incineration, solidification, and biotechnologies. Ex-situ treatment may require the installation of large treatment systems and/or large staging areas, and due to the small size of the Site, may be not feasible. Ex-situ treatment would also require extensive handling of the excavated soils which may generate significant odors, as well as increase risk of impacts to Site workers and adjacent properties. Therefore, ex-situ treatment is not considered to be a viable general response action as applied on site. Ex-situ treatment may be applied off site, at the disposal facility, as part of disposal or following NAPL extraction (as described further).

This GRA is retained for further consideration in the form of in-situ treatment applied to the source material medium.

5.3 Extraction

This response action consists of the removal of NAPL using recovery wells or collection trenches with associated pumps and piping. This remedial technology is carried forward for further analysis.

5.4 Containment

Containment may be used to isolate source materials (NAPL-saturated soils and soil where NAPL gauging indicated NAPL entry into wells)) and to control the movement of potentially mobile NAPL, if present. Containment technologies provide protection of public health and the environment by reducing mobility of contaminants and/or eliminating pathways of exposure.

Horizontal barriers for migration control may be applicable to NAPL that generally follows the same pathway as groundwater (i.e., NAPL that is less dense than water or LNAPL). However, the NAPL identified at the Site is considered to be denser than water (DNAPL). DNAPL generally migrates predominantly vertically unless confining layers are present. There are no well-defined confining layers at the Site; therefore, horizontal NAPL flow is not expected to be significant relative to vertical flow. Therefore, horizontal flow barriers would not be effective.

Barriers also are response actions that minimize the potential for human exposures to the contaminated media by implementing physical impediments to prevent contact with the impacted media and/or migration of contaminants to potential receptors. Examples of these barriers include asphalt or concrete pavement, soil caps or geosynthetic liners. As the Site is, and is likely to remain occupied by commercial uses, engineering controls in the form of pavement is a viable option. Engineering controls would require monitoring and maintenance to maintain its protectiveness. Periodic certifications would be required to document the effectiveness of the engineering controls. This response action is applicable to source materials, soil and groundwater at the Site.

Horizontal flow barriers are not retained. Containment in the form of capping/engineering controls is retained for the source material media.

5.5 Excavation

This response action consists of the removal and subsequent treatment or off-site disposal of impacted soils. It is applicable to all source materials as significant quantities of NAPL absorbed into the soil matrix can generally be removed during the excavation activities. Excavation in the unsaturated zone can be accomplished using conventional construction equipment and methods. Due to the high groundwater table at the Site, excavation below the water table would require significant earth support and, depending on the depth of the excavation beneath the water table, may require dewatering. If dewatering is required, extracted groundwater may require treatment and off-site disposal at the publicly owned treatment works (POTW) or discharge to a surface water body under a SPDES Permit. Excavation would also require the replacement of excavated material with clean fill from off-site sources. Excavation is retained for source materials at OU1.

5.6 Disposal

This response action is typically combined with other response actions. Disposal consists of transporting excavated, treated, or extracted contaminated media off-site to a landfill, treatment facility, or recycling facility licensed and permitted to accept the various type of wastes. For the Site, disposal would be a component of the excavation, NAPL extraction, and possibly treatment response actions. This response action is applicable to source materials. This GRA is retained for the source material media.

5.7 Institutional Controls

Institutional controls are response actions that minimize the potential for human exposures to the contaminated media by establishing legal and administrative actions on the Site's future use. Types of institutional controls include access controls, environmental easements or deed restrictions, and established procedures for managing future ground-intrusive activities (e.g., Site Management Plan, Health and Safety Plans, etc.). Institutional controls would also establish protection of engineering controls that may be part of the remedy, restrict the use of on-site groundwater, and restrict future use of the Site. Periodic certification would be required to document the continued effectiveness of the institutional controls. This response action is retained, and is applicable to source material at the Site.

5.8 Summary of Retained GRAs

The following is the summary of the GRAs retained for further analysis in identifying the remedial technologies and in assembling the remedial alternatives.

Table 5-1. Summary of Retained GRAs

	General Response Actions						
Medium and Remedial Action Objectives	No Action	Treatment	Containment	Excavation	Extraction	Disposal	Institutional Controls
Source Materials[(1)] • Minimize direct contact. • Minimize source of groundwater impacts.	R	R	R	R	R	R	R

(1) Source materials are defined as NAPL-saturated soil, and soil where NAPL gauging of wells indicated NAPL entry into wells. Source materials do not include globules, droplets or sheens and do not pertain to other non-MGP related impacts.

R – Retained.

NR – Not Retained.

Section 6

Identification and Screening of Technologies

6.1 Introduction

The remedial technology types associated with each of the GRAs identified in Section 5, typically considered for the remediation of source materials as previously defined were developed from experience on other hazardous waste sites, knowledge of developing and emerging technologies, and the professional judgment of engineers performing the AA. Technology identification and screening involved the following steps:

- Assessment of technical issues posed by the Site and contaminants (Site constraints).
- Identification of potentially applicable technologies.
- Preliminary screening of the technologies with respect to effectiveness and implementability.

6.2 Site Constraints

The technical issues affecting the implementability and effectiveness of potentially applicable technologies at the Site include the following:

- Hydrogeologic and soil characteristics;
- Site location and use; and
- Nature of impacts.

Each of the Site-specific technical issues is discussed in further detail in the following paragraphs.

6.2.1 Hydrogeologic and Soil Characteristics

The hydrogeologic and soil characteristics of the Site pose several challenging issues. The overburden consists primarily of till which is non-homogeneous and locally very dense. The estimated horizontal hydraulic conductivity of the glacial till matrix is relatively low, on the order of 10^{-5} cm/sec. This is directly related to the overall poor-sorting (i.e., mixture of fine-grained and coarse-grained materials) as well as the density and degree of cementation of the till. Because of that, the nature of the groundwater and NAPL movement through the Site largely resembles that of a fractured as opposed to consolidated medium. Groundwater tends to flow within relatively sparse, thin and isolated permeable zones. As a consequence, extraction of the potentially mobile NAPL may be difficult. Further, a relatively high water table (approximately five to nine feet bgs) indicates that dewatering would be required if excavation were implemented. The density of the till, which is locally calcified and has shown local refusals during the boring program implemented as part of the investigation, has implications for intrusive methods, such as excavation or in-situ soil stabilization (ISS).

6.2.2 Site Location and Use

The Site is located in an urban area and is currently used for commercial activities. There are two buildings at the Site. Source materials are potentially present under the buildings located in the southwestern portion of the Site (occupied by Advantage Carpets and Taylor Rental). Based on this, technologies requiring direct access to the source materials, such as excavation or ISS, may not be applicable to the entire impacted areas, unless the buildings are demolished. In addition to the buildings, there are active underground and overhead utilities along the Site's boundaries (West Utica St, West Fourth St, and West Third St). The presence of these utilities, especially the overhead power lines, may limit the area where intrusive activities, including drilling and excavation, can be conducted. Further, considering the nature of the Site surroundings (commercial establishments and city streets), implementation of some remedial technologies would pose increased risk of impacts to adjacent property owners or the public due to odors, dust and vibrations. To minimize the generation and migration of odors to off-site areas, technologies that would involve extensive handling of soils (e.g. ex-situ treatments) may require additional controls. Based on the close proximity of the adjacent properties, minimizing odors and other disturbances may be difficult using certain technologies, such as excavation or ISS.

6.2.3 Nature of Impacts

The nature of the MGP-related source materials can also pose several challenges. NAPL was identified in the overburden. NAPL generally creates a long-term source of groundwater impacts. Technologies available for the remediation of NAPL are relatively limited, and include intrusive methods such as excavation and ISS. Biological or chemical in-situ methods are capable of treating dissolved-phase contamination in groundwater that originates from the NAPL, but not the NAPL itself.

The presence of NAPL inside sparsely distributed higher-permeability veins/lenses within the dense till matrix indicates that accessing the source materials using in-situ technologies or extraction may be challenging.

6.3 Identification and Screening of Potential Remedial Technologies

This section presents potentially applicable technologies and the results of the screening evaluation conducted to determine which technologies could be successfully implemented at the Site. The technologies were evaluated based on site-specific conditions, implementability, effectiveness (i.e., whether the RAOs can be attained), and cost. At the conclusion of the screening process, the technologies that have been retained were assembled into Site-wide remedial alternatives for further evaluation.

Remedial technologies potentially applicable to the Site were identified and screened as part of the AA process. A summary of the results of this process is included as Table 6-1. The potential remedial technologies were identified based on the impacted media and the corresponding GRA, as well as the overall RAOs for overburden soils at OU1. Screening was conducted based primarily on the technology's effectiveness in achieving the RAOs and its implementability at the Site.

6.4 Retained Technologies

Table 6-1 presents the summary of the screening process and the technologies that were retained for use in remedial alternatives development. In addition to the technologies considered in Table 6-1, the No Action and Institutional Control approaches were also carried forward. Therefore, the technologies that will be considered in the alternatives development in Section 7 are:

- Excavation with Off-Site Disposal
- NAPL Extraction/Off-Site Disposal
- Engineering Controls (Capping)
- Institutional Controls (Site Management Plan, Health and Safety Plan, Environmental Easements)
- No Action

Section 7

Development and Evaluation of Remedial Alternatives

This section presents the remedial alternatives developed from the retained remedial technologies detailed in Section 6.4. Each remedial alternative was further defined by remedial components with respect to the criteria set forth in 6 NYCRR Subpart 375-2.8(c)(2)(i) and in general accordance with Section 4.3(a) of the DER-10. The development of the alternatives is summarized in Table 7-1. The alternatives were then evaluated against the eight criteria outlined 6 NYCRR Subpart 375-2.8(f) and a comparative analysis of the alternatives was performed.

7.1 Development of Remedial Alternatives

Each remedial alternative was developed to address the Site RAOs (see Section 4) and to the extent practicable, remove, contain, or treat source materials in the subsurface. In consideration of technical implementation, media, specific contaminants, and Site conditions, alternatives were developed for consideration and evaluation. As Alternative 1 contains no active on-site remediation, there is no figure associated with this alternative. The remedial components of Alternatives 2 and 3 are depicted in Figures 7-1 and 7-2, respectively.

The selected alternatives and the major components of each are as follows:

1. **Alternative 1** – No Action.
    - No remedial activities at the Site. MGP-impacted soils would remain in-place.
    - No engineering or institutional controls.
    - Thirty years of periodic post-remedial groundwater monitoring program.
2. **Alternative 2** – Excavation of Accessible Source Material, NAPL Extraction, Engineering and Institutional Controls, Post-Remedial Monitoring Program
    - Excavation and off-site disposal of MGP-impacted source materials from the ground surface to depths shown on Figure 7-1 in accessible areas of the Site. Accessible areas are those not covered with structures as shown on Figure 7-1 (i.e., Advantage Carpets and Taylor Rental buildings). Total excavation volume is approximately 7,000 cubic yards (cy).
    - Periodic passive extraction/removal of NAPL from overburden wells along the south-west side of the Advantage Carpets building where excavation would not be feasible due to the proximity of the building and the presence of overhead power lines.
    - Site restoration (backfill, pavement).
    - Engineering controls consisting of pavement and existing building foundations.
    - Institutional controls (environmental easement, Site Management Plan (SMP), Health and Safety Plan (HASP)).

- Thirty years of periodic post-remedial groundwater monitoring program.
- Thirty years of annual engineering and institutional controls monitoring.

3. **Alternative 3** – Restoration of Site to Pre-Release Conditions
   - Excavation and off-site disposal of all MGP-impacted materials, including all source and residually impacted materials. Residually impacted materials include soils containing blebs, specks, veins, and droplets of NAPL as well as concentrations of contaminants in excess of the applicable Part 375 SCOs. For the purpose of this AA, it was assumed that the MGP-impacted materials (source and residually impacted materials) are located in areas identified in Alternative 2, as well as under the buildings. The excavation is assumed to extend from the ground surface to the top of bedrock (typically located at a depth of approximately 20 feet bgs). Total volume of excavation is approximately 19,000 cy.
   - Demolition of the Advantage Carpets and Taylor Rental buildings in order to access all on-site source and residually impacted materials. This includes negotiating with the property owners and temporary relocation of the commercial establishments currently occupying the Site.
   - Site restoration (backfill and pavement).
   - Five years of periodic post-remedial groundwater monitoring program.

7.2 Remedial Alternatives

The three remedial alternatives developed for evaluation are described in detail below. Figures 7-1 and 7-2 depict the remedial areas for Alternatives 2 and 3.

7.2.1 Common Elements of the Remedial Alternatives

The common element of Alternatives 1, 2, and 3 is the post-remedial groundwater monitoring program.

Once the remedial activities are implemented, groundwater impacts are anticipated to be addressed by the partial or full removal of source materials (Alternative 2, versus Alternative 3, respectively). Source material would remain in place under Alternative 1. A groundwater monitoring program to assess the effects of the remedial activities on groundwater and monitor for the change in concentration of MGP-related constituents is included with each alternative. The post-remedial groundwater monitoring program would be implemented on a periodic basis to assess the effects of the implementation of the remedial alternative on groundwater. For Alternatives 1 and 2, the monitoring period is anticipated to be 30 years, based on the fact that source materials would remain in the subsurface throughout the Site (Alternative 1) or under Site buildings (Alternative 2). A five-year period is anticipated for Alternative 3, where all the impacts would be removed and it is anticipated that groundwater quality would improve.

7.2.2 Remedial Alternatives

The three remedial alternatives developed for evaluation are described in detail below. A visual depiction of the limits of the various components of Alternatives 2 and 3 is included on Figures 7-1 and 7-2, respectively. Each alternative has been defined with respect to the parameters set forth in DER-10 Chapter 4 Section 4.3(a)(5)(ii). These parameters include: (1) size and configuration; (2) remediation time; (3) spatial requirements; (4) disposal options; (5) permit requirements; (6) limitations; and (7) beneficial and/or adverse impacts on fish and wildlife resources. A summary of the alternatives with respect to the seven aforementioned criteria is presented as Table 7-1.

7.2.2.1 Alternative 1 – No Action

This alternative does not include any remedial measures. No active remediation, engineering or institutional controls are implemented under this alternative. The evaluation of the No Action alternative is required by CERCLA as a baseline for comparison with other remedial alternatives. In addition, NYSDEC requires this evaluation stating that the No Action alternative should evaluate the adverse (or beneficial) site changes that may occur in the absence of a proposed remedial action.

7.2.2.2 Alternative 2 – Removal of Accessible Source Material, NAPL Extraction, Engineering and Institutional Controls, and Post-Remedial Groundwater Monitoring Program

Alternative 2 includes the excavation of MGP-impacted source materials from the ground surface to depths of approximately 22 feet in the area of the Former Northern Gas Holder and 15 to 18 feet bgs elsewhere in accessible areas of the Site. Accessible areas are considered to be areas outside of the footprint of the existing structures (i.e., Advantage Carpets and Taylor Rental buildings). The areas to be subject to excavation, as well as an overall view of the conceptual plan, are depicted on Figure 7-1. The total volume to be excavated is approximately 7,000 cubic yards (cy). The site would be restored by backfilling the excavation with "clean" backfill meeting the sampling and integrity requirements contained DER-10 for the import and use of off-site fill materials or excavated soils meeting the regulatory criteria for reuse at the Site. The excavation area would be finished at the surface with asphalt pavement which would, along with the existing site buildings, serve as an environmental cap (i.e., an engineering control) to prevent direct contact with impacted soils that would remain on-site after completion of the implementation of the remedial alternative. This alternative also includes the establishment of institutional controls (i.e., environmental easement or deed restrictions), Site Management Plan, Health and Safety Plan (HASP) and implementation of the post-remedial groundwater monitoring program.

Based on the hydrogeologic characteristics of the Site, excavation deeper than approximately five feet bgs will encounter the groundwater table. Due to the depth of the excavation and as a result of the shallow water table, it is anticipated that the excavation would require the use of an engineered excavation support system and construction dewatering. Water generated from the dewatering operation would be treated at the Site via an on-site temporary treatment system, and either discharged to the publicly owned treatment works (POTW) or an adjacent surface water body, via the nearby storm sewer. Excavation support systems (e.g., sheet piling, slide rail, trench boxes) would be required to stabilize excavation walls. The excavation support system would be designed based on the proposed depth of the excavation , the soil properties and the proximity of the Site buildings (which are to remain in place and be protected). The type of excavation support system design would be selected during the remedial design process.

The Advantage Carpets and Taylor Rental buildings, as well as the surface features (i.e., overhead utilities along West Fourth Street), would be protected during implementation of the remedial action. Pre- and post-construction surveys of the surface features as well as vibration monitoring would be conducted to assess potential damage to the features from implementation of the remedy.

Soils generated from the excavation of the source materials would be visually screened and segregated for potential on-site reuse or for off-site disposal. Materials to be disposed of off-site would be directly loaded into transport trucks, if waste characterization has been performed, or staged on-Site for waste characterization and would be transported and disposed off-Site at an approved landfill or permitted treatment facility. For the purpose of this AAR, it is assumed that the excavation would be backfilled with material meeting the regulatory requirements for reuse or imported fill materials. Based on the evaluation of the Site features and logistics, it has been determined that excavation of source materials would not be practicable in the area immediately west of the northern portion of the Advantage Carpets building. NAPL has been detected in monitoring wells (MW-102 and MW-108) in this area that are screened in overburden. These monitoring wells are located immediately adjacent to the west side of the Advantage Carpet building in a narrow strip of land adjacent to West Fourth Street. This narrow strip of land is also bound to the west by overhead power lines. To address the presence of these source materials, in lieu of excavation, a program of periodic passive NAPL recovery would be implemented. A total of three recovery wells would be installed in the area and NAPL recovered passively using either bailers or portable pumps. National Grid is currently conducting an evaluation of the feasibility of recovering NAPL from wells at the Site. The ongoing evaluation includes the measuring of water levels and gauging for NAPL at each monitoring well followed by NAPL recovery activities at wells where the gauging identified NAPL (except wells in areas designated for source material removal).

Engineering and institutional controls are proposed as a component of Alternative 2 based on the fact that impacted materials would remain on-site. The discussion includes an evaluation in accordance with the DER-10 “Development and Evaluation of Alternatives” Section 4.3(b).

The proposed engineering controls associated with Alternative 2 include establishment of an environmental capping system consisting of the existing building foundations and asphalt pavement. This capping system would minimize direct contact with MGP-impacted source materials and soils that would remain on-site after the implementation of this alternative. The existing building foundations and asphalt would serve to prevent exposure to impacted materials which may remain at the Site after completion of the remediation. The limits of the environmental cap are depicted on Figure 7-1. The final components of the cap would be developed during the design phase of the project.

Engineering controls would require monitoring and maintenance to remain protective of public health and the environment. The proposed engineering controls are readily implementable and relatively simple to monitor and maintain. Monitoring of the engineering controls would include periodic inspections performed by the Site owner, manager, or designated representative. The inspections would be performed to document the existing conditions of the engineering controls and disturbances, if any, and recommended repairs, as needed. Maintenance of the engineering controls would include repairs to the building foundation slabs and patching of the asphalt.

The proposed institutional controls to be included as part of Alternative 2 include the establishment of an environmental easement(s) or a deed restriction(s) to restrict both the future uses of the property and the use of Site groundwater. The environmental easement or deed restriction will specify that, should the Taylor Rental and Advantage Carpet buildings be removed in the future, soils underlying the buildings will be characterized. The institutional controls will include the development of a Site Management Plan (SMP) and a Health and Safety Plan (HASP) to manage future invasive activities at the Site. The SMP and HASP would describe the required procedures for performing ground-intrusive work, including potential removal of the Taylor Rental and Advantage Carpet buildings, and would include worker and public health and safety, handling and management of impacted soil or groundwater, notification of authorities and responsible parties, site restoration and documentation. The SMP would identify the engineering/institutional controls required to be maintained in order to manage the potential risks related to future earth disturbing activities from residual contamination that may remain on-site after the implementation of the remedial alternative. The SMP would include:

- Procedures to manage remaining impacted soils related to future earth disturbing activities performed for site development purposes. Included would be procedures for handling, management, disposal of impacted soils as well as health and safety aspects related to on-site workers and the surrounding community;
- Institutional controls to maintain site use restrictions as identified in the environmental easement;

- Schedule and requirements for the monitoring and certification of engineering and institutional controls so they remain protective of public health and the environment; and
- Requirements of the post-remedial groundwater monitoring program.

Institutional controls would require monitoring and enforcement to remain protective of public health and the environment. Institutional controls are readily implementable and relatively simple to monitor and enforce.

The effectiveness of the remedy with respect to reducing impacts to groundwater would be assessed by means of water quality sampling from the on-site monitoring wells screened in the overburden. The set of wells that would be subject to the monitoring program would include both the existing wells located in Site areas undisturbed during excavation as well as new wells installed within the restored excavation areas. Off-site wells would not be sampled as part of this monitoring program; groundwater impacts in off-site areas would be addressed under OU2. Alternative 2 includes 30-years of periodic groundwater monitoring for the Site constituents of concern (COCs).

7.2.2.3 Alternative 3 – Restoration of Site to Pre-Release Conditions

Alternative 3 consists of the excavation of all MGP-impacted source materials and residually impacted materials from the Site, both outside of and under the Advantage Carpets and Taylor Rental buildings. The depth of these materials is assumed to extend to a depth corresponding with the top of bedrock (i.e., approximately 20 feet bgs). The approximate limit of the proposed excavation is depicted on Figure 7-2.

Implementation of this alternative would require the demolition of the Advantage Carpets and Taylor Rental buildings to allow complete access to all MGP-impacted soils. The limits of the MGP-impacted materials are based on documented observations of MGP-impacts presented in the RI. The total volume to be excavated is approximately 19,000 cy. This alternative would restore the Site to “pre-release conditions”.

Remedial components of Alternative 3 include:

- Excavation of all MGP-impacted materials throughout the Site. Excavation activities would require dewatering, treatment of the water and discharge of the extracted groundwater to either the local POTW or an adjacent surface water body;
- Excavation support systems to stabilize excavation walls;
- Disposal of impacted soils at an off-site approved landfill or permitted treatment facility;
- Backfilling with imported fill materials meeting the requirements of DER-10;
- Restoration of the Site; and,
- A post-remedial groundwater monitoring program.

As all MGP-impacted materials would be removed as part of the implementation of Alternative 3, groundwater quality is anticipated to improve as no source of impacts would remain. As such, the duration of the program is anticipated to be significantly less than under Alternative 2. A five-year monitoring period is assumed.

For Alternative 3 to be implemented, the Advantage Carpets and Taylor Rental buildings currently located on-site would need to be demolished in order to make all MGP-impacted materials accessible. Demolition would be performed in accordance with local rules and regulations. Demolition debris would be transported and disposed off-site at an approved landfill or recycling facility. Prior to demolition, commercial establishments currently occupying the Site would be relocated.

No engineering or institutional controls would be required for Alternative 4 since no MPG-impacted materials would remain on the Site after implementation of the remedial action.

7.3 Evaluation Criteria

The evaluation of each remedial alternative considers the following criteria consistent with DER-10 guidance:

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

Detailed descriptions of the relative criteria are provided below.

7.3.1 Overall Protectiveness of Public Health and the Environment

This criterion is an evaluation of the remedial alternative's ability to protect public health and the environment, assessing if risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, engineering controls or institutional controls. It evaluates the remedial alternative's ability to achieve each of the remedial goals identified in Section 4.1. The overall assessment of protection overlaps with, and is based on, assessments performed under other evaluation criteria, particularly long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs. The remedial alternative's ability to achieve each of the RAOs is included in the evaluation.

7.3.2 Compliance with Standards, Criteria, and Guidance (SCG)

This criterion is an evaluation of the remedial alternative's ability to comply with SCGs and determines whether a remedial alternative would meet applicable environmental laws, regulations, standards, and guidance. The remedial alternatives for the Site would be evaluated to determine whether the remedial alternative would achieve compliance with the SCGs. For those SCGs that are not met, an evaluation of the impacts of each and whether waivers are necessary is performed. Refer to Section 4.2 for discussion of applicable SCGs.

7.3.3 Reduction of Toxicity, Mobility, or Volume with Treatment

This criterion evaluates the remedial alternative's ability to reduce the toxicity, mobility or volume of Site contamination. The evaluation focuses on the following specific factors for a particular remedial alternative:

- The amount of contaminated materials that would be destroyed or treated;
- The degree of expected reduction in toxicity, mobility, or volume;
- The degree to which the treatment would be irreversible; and
- The type and quantity of treatment residuals that would remain following treatment.

Preference is given to remedial alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.

7.3.4 Short-Term Impacts and Effectiveness

This criterion evaluates the potential short-term adverse impacts and risks of the remedial alternative upon the community, the workers, and the environment during the construction and/or implementation. The evaluation includes how identified adverse impacts and health risks at the Site to the community or workers, if any, would be controlled, and the effectiveness of the controls. Further, this criterion considers engineering controls that would be used to mitigate short-term impacts (i.e., dust control measures). The length of time needed to achieve the remedial objectives is estimated and included in the evaluation.

7.3.5 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of the remedial alternative after implementation. If wastes or treated residuals remain on-Site after the selected remedial alternative has been implemented, the following items are evaluated:

- The magnitude of the remaining risks (i.e., would there be any significant threats, exposure pathways, or risks to the community and environment);
- The adequacy of the engineering and institutional controls intended to limit the risk;
- The reliability of these controls; and
- The ability of the remedy to continue to meet RAOs in the future.

7.3.6 Implementability

This criterion evaluates the technical and administrative feasibility of implementing the remedial alternative. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedial alternative. Administrative feasibility includes the availability of the necessary personnel and material along with potential difficulties in obtaining specific operating approvals, access for construction, permits, etc. for remedial alternative implementation.

7.3.7 Cost Effectiveness

This criterion includes an evaluation of the capital, operation, maintenance and monitoring costs. These costs are developed and presented on a present worth basis for comparison purposes. Under this criterion, capital, operation, maintenance and monitoring costs for the remedial alternative are estimated and presented on a present worth basis. The estimated costs are considered a Class 4 Cost Estimate with an expected accuracy of 30 to +50%, which is consistent with USEPA's RI/FS Guidance (USEPA, 1988). A contingency of 25% was applied to address unforeseen costs and account for uncertainty. Present worth costs are estimated using a discount factor of 3%.

7.3.8 Land Use

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

7.4 Evaluation of Remedial Alternatives

This section compares the relative performance of each remedial alternative using the specific evaluation criteria presented in Section 7.4. Comparisons are presented in a qualitative manner and identify substantive differences between the alternatives. As part of the evaluation, consideration was given to an alternative to determine if it satisfies the criteria, meets the minimum applicable standards and is suitable for the Oswego Site based on site specific conditions. The detailed evaluation of each of the alternatives against the criteria has been summarized and is presented on Table 7-2.

A summary discussion of the evaluation is included in the following subsections. Each of the criteria is listed and a summary of the results of the evaluation is presented. The alternative that meets the criteria with the highest rating is discussed first; the alternatives in descending criteria rating are listed subsequently.

7.4.1 Overall Protectiveness of Public Health and Environment

Alternative 3 was considered to offer the greatest overall protectiveness of public health and environment as this alternative includes the removal of all MGP-impacted materials restoring the Site to pre-release conditions. Alternative 2 was rated next highest as this alternative includes the removal of all accessible MGP-impacted source materials (the source of the groundwater contamination) by excavation and off-site disposal. Alternative 2 includes the installation of engineering controls (capping) over the areas where residually impacted material would remain in place, and implementation of institutional controls (i.e., Environmental Easement, SMP and HASP). Alternative 1 does not satisfy this evaluation criterion as it includes no active remedial actions or establishment of engineering or institutional controls to minimize potential exposure risks. Therefore, Alternative 1 is not protective of public health and the environment.

7.4.2 Compliance with SCGs

Alternative 3 offers the greatest ability to meet this evaluation criterion and it is the only alternative that fully complies with chemical, action and location specific SCGs as all MGP-impacted materials would be removed and the Site restored to pre-release conditions. Alternative 2 would partially comply with the chemical specific SCGs as accessible MGP-impacted source materials would be removed. However, after the implementation, inaccessible MGP-impacted source materials would remain on-site under the buildings without treatment. Alternative 1 does not comply with chemical-, action-, or location-specific SCGs since this alternative includes no remedial actions.

7.4.3 Long-Term Effectiveness and Permanence

Alternative 3 offers long term permanence as all MGP-related impacted materials would be removed from the Site. For Alternative 2, the accessible source materials would be removed; however, the source and residually impacted materials in inaccessible areas would only be addressed via the engineering and institutional controls. Alternatives 4 offers long-term effectiveness and permanence with regard to groundwater impacts as the source of the impacts would be removed and/or treated. Alternative 2 does not offer long-term effectiveness and permanence as inaccessible source materials would remain as a source of groundwater contamination and the impacted groundwater would not be treated. Therefore, Alternative 3 is considered to have the highest degree of long term effectiveness and permanence. Alternative 1 does not comply with this criterion and is considered unsatisfactory since no remedial actions would be conducted for this alternative.

7.4.4 Reduction of Toxicity, Mobility or Volume of Contamination

Alternatives 2 and 3 offer reduction in toxicity, mobility and volume of contamination as each alternative includes some degree of removal of source material from the Site. Implementation of Alternative 3 offers the greatest degree of reduction by removing all MGP-impacted materials. Alternative 2 would include the removal of source materials in accessible areas. Alternative 1 does not offer any reduction in toxicity, mobility or volume of contamination as this alternative does not include any removal or treatment of the MGP-related impacted soils.

7.4.5 Short-Term Impacts and Effectiveness

No short-term impacts would be realized through the implementation of Alternative 1 since on-site activities or construction would be performed. Alternative 2 offers the next least amount of impacts due to the smaller amount of remedial operations that would be conducted on-site as compared to Alternative 3, and a shorter remediation time (six months versus 11 months, respectively). Alternative 3 would result in the most short-term impacts due to the large number and scale of the remedial components (i.e., building demolition, larger size of the remedial area, larger remedial operations and the longer duration of implementation).

Short-term impacts that would be realized during the implementation of Alternatives 2 and 3 include:

- Traffic impacts from the truck/construction vehicle traffic due to the number of processes (i.e., soil handling, soil conditioning, staging, stockpiling, blending/stabilizing, loading for off-site disposal, deliveries of backfill, etc.);
- Dust and odor impacts from disturbance of source materials and associated impacted soils;
- Noise, dust and odor impacts generated by construction equipment and excavation of MGP-related impacted soils; and
- Potential impacts to occupants of neighboring properties due to the fact that National Grid may need to arrange access agreements. Implementation of Alternatives 2 and 4 may require portions of neighboring properties to be utilized as the Site is not of sufficient size to contain all operations necessary to implement the remedial alternative.

These impacts would be controllable with the use of proper engineering controls during construction (i.e., odor suppression foams, noise reduction equipment on machinery, covering stockpiles and open excavations, etc.). Odors may also be addressed by excavating in stages to limit the amount of MGP-impacted source material exposed at a given time. Final impact mitigation measures would be developed during the remedial design process.

7.4.6 Implementability

7.4.6.1 Technical Feasibility

Each of the remedial alternatives being considered is technically feasible to implement. Alternative 1 is technically feasible since it would require no remedial components to implement. Alternatives 2 and 3 are technically feasible to implement with readily available, conventional construction methods that can be obtained from a wide variety of vendors. Alternative 1 is the most feasible. Implementation of Alternative 2 is more technically feasible than Alternative 3because Alternative 3 contains larger amount of remedial components

7.4.6.2 Administrative Feasibility

Each of the alternatives is administratively feasible to implement. Alternative 1 would require the least administrative activities as there is no remedial action to be performed. Alternatives 2 and 3 would require obtaining permits and approvals from local agencies for the excavation, demolition activities, and discharge of treated water. In addition, off-site disposal of soil and demolition debris (Alternatives 2 and 3) would require coordination, sampling and characterization of the material for acceptance at a disposal facility.

Alternative 3 would require that the existing commercial establishment be relocated to facilitate the demolition of the Advantage Carpets and Taylor Rental buildings. Even though the buildings would not be demolished under Alternative 2, the scope and extent of both remedies may result in disruption to existing business operations.

7.4.7 Cost Effectiveness

Costs associated with Alternative 1 are limited to a groundwater monitoring program (30 years of periodic sampling and reporting). There are no capital costs associated with Alternative 1. The estimated net present value of the 30 years of periodic groundwater is estimated to be $630,000.

Alternative 2 is ranked second with respect to cost. The capital costs for Alternative 2, which includes excavation of accessible MGP-impacted source material, installation of three NAPL recovery wells and restoration of the Site, is $5,970,000. Annual costs for periodic NAPL recovery events, long term inspection, maintenance and monitoring of the integrity of the engineering and institutional controls and groundwater monitoring for a period of 30 years are estimated at $1,260,000. The estimated net present value of Alternative 2 is $7,230,000.

The most costly alternative is Alternative 3. The capital costs for Alternative 3 are estimated at $14,400,000 due to the fact that this alternative includes the largest amount and scale of remedial processes (i.e., removal of all MGP-impacted material). Implementation of this alternative includes the demolition of the Taylor Rental and Advantage Carpets buildings. The largest volume of soil would be excavated by implementing this alternative. However, the annual costs are reduced since inspections and maintenance activities are expected to be less (estimated net present worth is $150,000 for five years of periodic groundwater monitoring). The estimated net present value of Alternative 3 is $14,550,000.

A summary of the estimated costs for each of the alternatives is shown on Table 7-2. Detailed cost estimates are included in Appendix B.

7.4.8 Land Use

The Site is located in an urban area and is currently used for commercial activities. There are several commercial buildings at the Site and the remaining portions of the property are used for parking. Future uses of the Site are likely to remain commercial given the nature of the Site surroundings (commercial establishments and city streets). Potential future uses and construction design must be in accordance with the requirements of the engineering and institutional controls. For example, if future development requires disturbance of the existing building slabs (part of the environmental cap), the cap must be replaced.

Section 8

Recommended Remedial Alternative

Based on the results of the comparative analysis conducted as part of the AA process, Alternative 2 is the recommended alternative. Alternative 2 utilizes the following approach:

- Removal of Accessible MGP-Impacted Source Materials;
- Periodic NAPL extraction;
- Engineering and Institutional Controls; and
- Post-Remedial Groundwater Monitoring Program.

Alternative 2 achieves the RAOs established for the Site and complies with the SCGs (Section 4). The RAOs are achieved through the excavation and extraction of MGP-related source materials from accessible area (areas not covered by buildings). The source materials would be disposed of in an off-site permitted disposal facility. Alternative 2 also includes periodic extraction of NAPL from wells located in area where NAPL has been observed to accumulate in the monitoring wells. Engineering and institutional controls would also be established to address exposure pathways to impacted materials that may remain on the Site after the implementation of the remedial alternative. The engineering controls would consist of the establishment of a capping system (i.e., asphalt pavement and building foundations). Institutional controls would consist of the establishment of an environmental easement or deed restriction in order to restrict both the future uses of the property and the use of Site groundwater, and the development of a Site Management Plan, including a Health and Safety Plan, to govern future soil disturbing activities.

Alternative 3 would restore the Site to pre-release conditions. However, this alternative is not recommended because of the potential impacts to the property, specifically the need to demolish the existing buildings, the associated approximately 100% higher cost relative to Alternative 2, and the potential for disruption to the area. Alternative 1 does not achieve the RAOs and is not recommended.

Components of the recommended Alternative 2 are described below and are depicted on Figure 7-1.

- Excavation and off-site disposal of approximately 7,000 cy of MGP-related source materials in accessible portions of the Site.
- Installation of three NAPL recovery wells outside of the limits of the excavation and periodic passive extraction of NAPL from the recovery wells.
- Site restoration (backfill of excavated areas with imported off-site backfill materials meeting regulatory requirements, and installation of pavement).
- Engineering controls in the form of a capping system consisting of asphalt pavement and existing building foundations.
- Institutional controls (i.e., environmental easement, SMP, HASP);
- Post-remedial groundwater monitoring program.

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Tables

TABLE 6-1
TECHNOLOGY IDENTIFICATION AND SCREENING SUMMARY
OSWEGO (WEST UTICA ST.) FORMER MGP SITE – OPERABLE UNIT No. 1
OSWEGO, NEW YORK

Media and RAOs	General Response Action	Technology	Advantages	Disadvantages	Implementability	Status for Alternative Development
Soil and Source Material: 1) Minimize direct contact; 2) Minimize source of groundwater impacts	Treatment	**In-Situ Biological Treatment** Involves the application of nutrients and microorganisms to enhance the population of microorganisms that use the contaminants as a food source.	Applied periodically, no continuous disruption.	Not effective in treating NAPL in source application. Lengthy periodic disruption to Site occupants.	Relatively easy to implement in open areas. Difficult to implement beneath buildings. Difficult to implement in tight/non-homogenous soils.	Not Retained – would not achieve RAOs
	Treatment	**In-Situ Chemical Oxidation** Involves applying reagent(s) to the subsurface to chemically break down the contaminants.	Applied periodically, no continuous disruption.	Not effective in treating NAPL in source application. Potential negative impact to utilities. Lengthy periodic disruption to Site businesses and occupants.	Relatively easy to implement in open areas. Difficult to implement beneath buildings. Difficult to implement in tight/non-homogenous soils.	Not Retained – would not achieve RAOs
	Treatment	**In-Situ Solidification (ISS)** Involves in-situ mixing of soil with solidification/stabilization agents to reduce the mobility of contaminants.	Effective in treating Site COC's in soil and NAPL. Relatively short disruption to Site occupants.	Pre-excavation of significant percentage of the original impacted volume would be required. Potential short-term impacts from construction activities.	Difficult to implement at the Site because of the presence of very dense till containing calcite cementation. Not feasible to implement beneath buildings.	Not Retained – similar to excavation, includes partial excavation to dispose of swell.
	Treatment	**In-Situ Thermal Destruction** Involves heating soils/NAPL to volatize and mobilize contaminants. Mobilized contaminants are recovered via vacuum extraction and treated above ground.	Effective in treating the light fraction of Site COCs in soil and NAPL.	Lengthy periodic disruption to Site businesses and occupants. Potential mobilization and migration of NAPL adsorbed within soils and associated soil vapor. Does not address the heavier MGP-related hydrocarbons. Visual impacts may remain.	Not implementable under buildings at the Site (Requires collection of vapors from unsaturated zone; however, unsaturated zone is absent under some buildings as a result of high groundwater table).	Not Retained – limited effectiveness on the MGP-related COCs, potential difficulties in controlling migration of mobilized NAPL and vapors.
	Excavation, Disposal	**Excavation and Off-Site Disposal** Involves excavating soils and source material, and disposing of off-site.	Effective in treating Site COC's in soil and NAPL. Relatively short disruption to Site occupants.	Potential short-term impacts from construction activities.	Not feasible to implement beneath buildings.	Retained
	Extraction, Disposal	**Extraction and Off-Site Disposal of NAPL** Involves removing mobile NAPL, and disposing of off-site.	Removes significant source mass. Applicable to areas inaccessible to more intrusive methods.	Only applicable to mobile fraction of the source. Applicable to NAPL which accumulates in wells. Does not address dissolved-phase groundwater impacts.	Relatively easy to implement.	Retained for areas not accessible to other source removal methods
	Containment	**Engineering Controls through Capping** Consists of a physical barrier that prevents contact with the impacted soil and source material.	Prevents direct contact with impacted media.	Does not treat or remove source materials.	Easy to implement.	Retained
	Institutional Controls	Environmental Easement, Site Management Plan, Health and Safety Plan	Prevents or manages exposure to impacted media.	Does not treat or remove source materials.	Easy to implement.	Retained

TABLE 7-1
SUMMARY OF REMEDIAL ALTERNATIVES
OSWEGO (WEST UTICA ST.) FORMER MGP SITE – OPERABLE UNIT No. 1
OSWEGO, NEW YORK

PARAMETER	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Removal of Accessible Source Material, NAPL Extraction, Engineering and Institutional Controls, Post-Remedial Monitoring Program	ALTERNATIVE 3 Restoration to Pre-Release Conditions
Size and Configuration	None	Remedial activities would take place in accessible areas of source materials. This would include two areas of combined 8,500 square foot area located north of the Advantage Carpets and Taylor Rental buildings, and two smaller areas of combined 1,000 square feet located east of the Advantage Carpets and Taylor Rental buildings. These areas would be excavated from the ground surface down to between 15 to 22 feet bgs. Total volume of excavation is approximately 7,000 cubic yards. Between the west wall of the Advantage Carpets and Taylor Rental buildings and the overhead power lines immediately to the west, mobile NAPL would be removed by periodic extraction from wells.	Remedial activities would take place within the limits of the MGP-impacted soils. This area extends from north of the former gas holder to West Utica St and from West Fourth Street to the eastern limit of MGP impacted-soils. These areas would be excavated from the ground surface down to bedrock which is at approximately 18 to 26 feet bgs (typical depth to bedrock in the impacted area is approximately 20 feet). This alternative would require the demolition of the Advantage Carpets and Taylor Rental buildings and would include the excavation of approximately 19,000 cubic yards of soil.
Remediation Time	Groundwater monitoring would continue for 30 years.	Approximately six months to complete remedial activities NAPL removal, groundwater monitoring and engineering and institutional controls inspection and maintenance would continue for 30 years.	Approximately 11 months to complete remedial activities. Groundwater monitoring would continue for five years.
Spatial Requirements	None	May require additional space on adjacent properties to conduct remedial activities.	May require additional space on adjacent properties to conduct remedial activities.
Disposal Options	None	Excavated soils would need to be disposed of at an approved facility. Water generated from dewatering would be treated on-site and discharged.	Excavated soils would need to be disposed of at an approved facility. Water generated from dewatering would be treated on-site and discharged.
Substantive Permit Requirements	None	State permits for remedial activities. Discharge permit for treated water generated from dewatering.	State permits for remedial activities. Discharge permit for treated water generated from dewatering.
Limitations	None	Dewatering systems and excavation support may present significant technical problems and added costs. Potential extensive short-term impacts will require mitigation. Will not address GW impacts from source material remaining under buildings.	Dewatering systems and excavation support may present significant technical problems and added costs. Potential extensive short-term impacts will require mitigation.
Beneficial and/or Adverse Impacts on Fish and Wildlife Resources	There are no recognized fish/wildlife resources at the Site.	There are no recognized fish/wildlife resources at OU1.	There are no recognized fish/wildlife resources at OU1.

Notes:
1. *Area and volumes presented in the table are preliminary estimates.*
2. *The conceptual plans for Alternatives 2 and 3 are presented as Figures 7-1 and 7-2.*

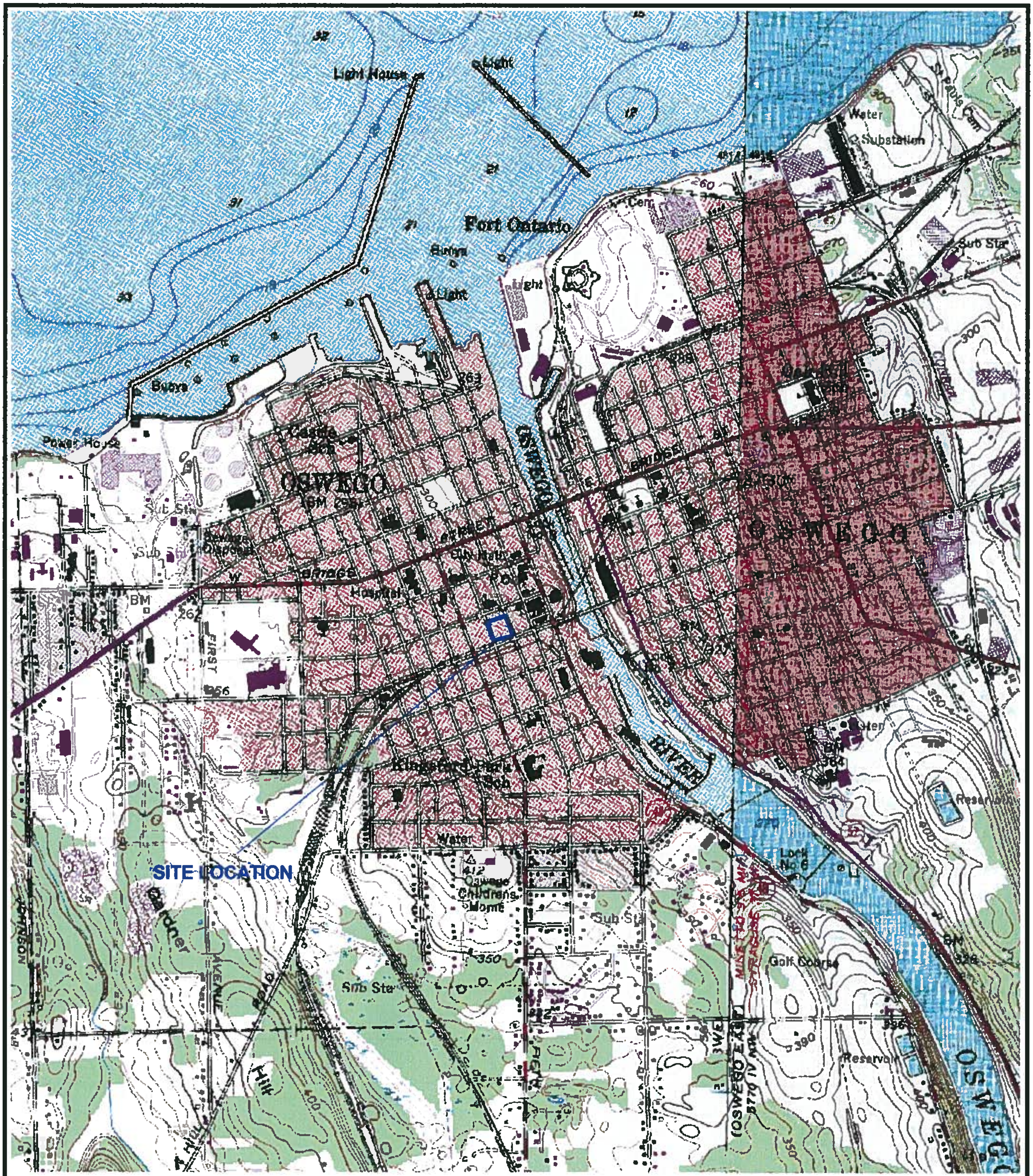
TABLE 7-2
REMEDIAL ALTERNATIVES EVALUATION
OSWEGO (WEST UTICA ST.) FORMER MGP SITE – OPERABLE UNIT NO. 1
OSWEGO, NEW YORK

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Parameter	No Action	Removal of Accessible Source Material, NAPL Extraction, Engineering and Institutional Controls, Post-Remedial Monitoring Program	Restoration to Pre-Release Conditions
Overall Protectiveness of Public Health and Environment	Not protective of public health and the environment. Includes no remedial actions or engineering or institutional controls to minimize potential exposure risks.	Would protect public health and the environment. Includes the removal of accessible MGP-impacted source materials and engineering controls (capping) over areas where residually impacted material will remain in place.	Offers the greatest overall protectiveness of public health and the environment. Includes the removal of all MGP impacted materials to restore the Site to pre-release conditions.
Compliance with the SCGs	Does not comply with chemical specific, action, or location SCGs since this alternative includes no remedial actions.	Partially complies with the chemical specific SCGs as significant fraction of MGP-impacted source materials will be removed. After implementation of this alternative, some MGP-impacted materials will remain on-site without treatment that would satisfy the action and location specific SCGs.	Offers the greatest ability to comply with the SCGs
Long-Term Effectiveness and Permanence	Considered unsatisfactory since no actions would be performed for this alternative.	Offers long term effectiveness and permanence; however, requires continuous maintenance of engineering and institutional controls. Source materials remaining under buildings would only be addressed via engineering and institutional controls.	Offers long term effectiveness and permanence.
Reduction in Toxicity, Mobility, or Volume with Treatment	Offers no reduction in toxicity, mobility, or volume of contamination.	Expected to reduce the toxicity and volume of impacted media by removing significant fraction of the source materials.	Expected to reduce the toxicity and volume of impacted groundwater by fully removing the source.
Short-Term Impacts and Effectiveness	No short-term impacts would be realized through the implementation of this alternative.	Short-term impacts would include construction traffic; noise, dust, and odor; and possible impacts to neighboring properties since the Site is not of sufficient size to contain all operations. Impacts would be controllable with the proper use of engineering controls.	Short-term impacts would include construction traffic; noise, dust, and odor; and possible impacts to neighboring properties since the Site is not of sufficient size to contain all operations. Impacts would be controllable with the proper use of engineering controls. Would result in the most short-term impacts because of the need to demolish onsite buildings.
Implementability			
a. **Technical Feasibility**	Alternative is easily implementable.	Technically feasible to implement. Would require cranes to install and move sheet piling and excavation support systems, as well as excavation dewatering. Would require excavators and backhoes to excavate soils. Would require pug mills to condition saturated soils. Would require front loaders and transport trucks to remove excavated soils from the site. May require additional space on adjacent properties to conduct activities.	Technically feasible to implement. Would require cranes to install and move sheet piling and excavation support systems, as well as excavation dewatering. Would require excavators and backhoes to excavate soils. Would require pug mills to condition saturated soils. Would require front loaders and transport trucks to remove excavated soils from the site. May require additional space on adjacent properties to conduct activities.

TABLE 7-2
REMEDIAL ALTERNATIVES EVALUATION
OSWEGO (WEST UTICA ST.) FORMER MGP SITE – OPERABLE UNIT NO. 1
OSWEGO, NEW YORK

Parameter	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Removal of Accessible Source Material, NAPL Extraction, Engineering and Institutional Controls, Post-Remedial Monitoring Program	ALTERNATIVE 3 Restoration to Pre-Release Conditions
b. **Administrative Feasibility**	Would require the fewest administrative activities.	Would require permits and approvals from local agencies for excavation activities. Would require permits for discharge of water from the dewatering operation. Off-site disposal would require coordination, sampling and characterization of the material. Will require displacement and relocation of some commercial establishments currently utilizing the Site.	Would require permits and approvals from local agencies for excavation and demolition activities. Would require permits for discharge of water from the dewatering operation. Will require displacement and relocation of all commercial establishments currently utilizing the Site. Off-site disposal would require coordination, sampling and characterization of the material.
Cost Effectiveness	Capital Cost = $0 O&M Costs = $630,000 Total Cost = $630,000	Capital Cost = $5,970,000 O&M Costs = $1,260,000 Total Cost = $7,230,000	Capital Cost = $14,400,000 O&M Costs = $150,000 Total Cost = $14,550,000
Land Use		Site is currently used for commercial activities. Any future uses and construction designs must be in accordance with the requirements of the engineering and institutional controls.	Site is currently used for commercial activities. Any future uses and construction designs must be in accordance with the requirements of the engineering and institutional controls.

Notes:
1. *The conceptual plans for Alternatives 2, and 3 are presented as Figures 7-1 and 7-2.*
2. *Costs are rounded to the nearest $10,000.*



Source:
USGS 15 Minute Quadrangles
Oswego East, NY, 1954, Photorevised 1978
Oswego West, NY, 1954, Photorevised 1978

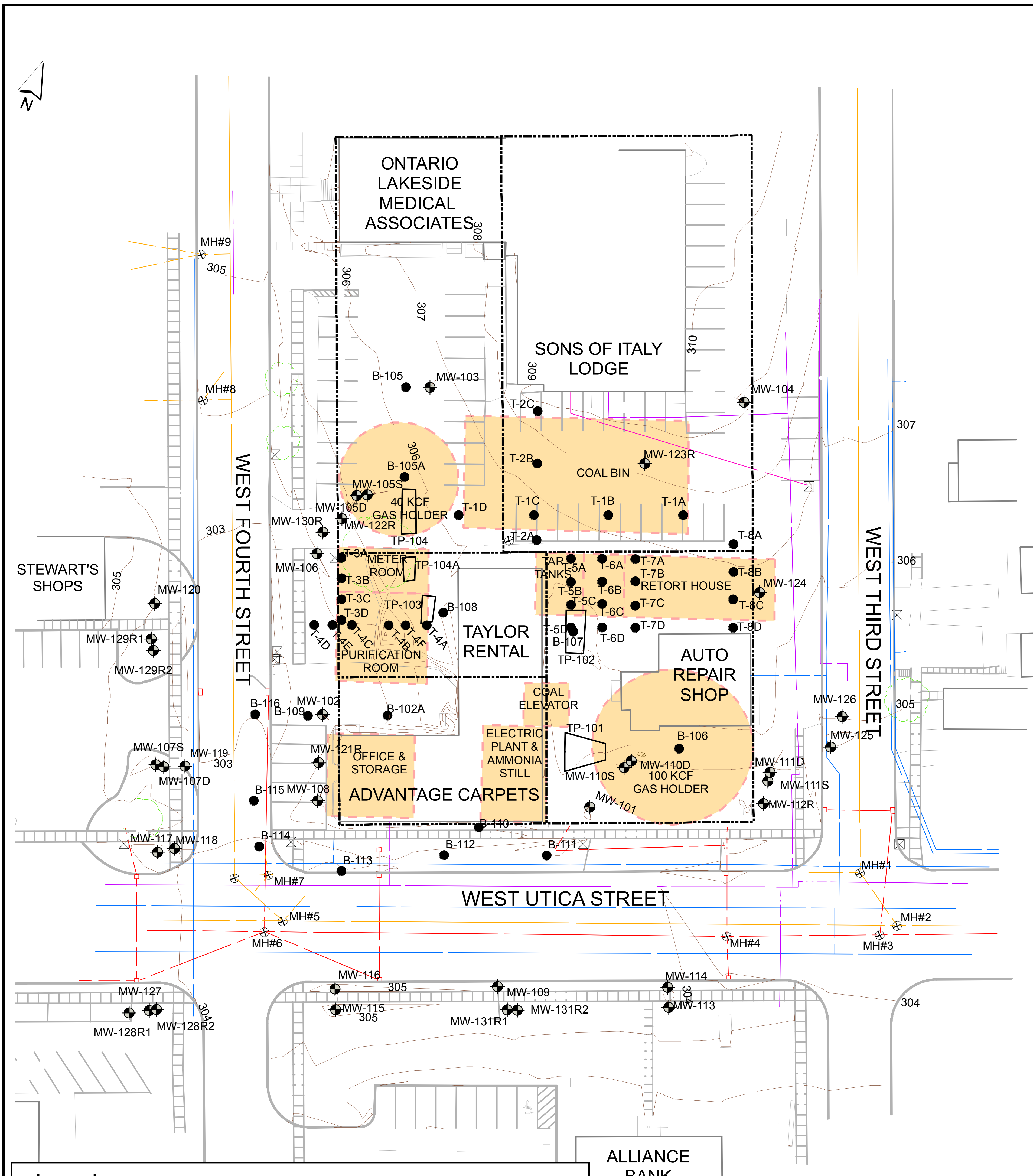
N

2000 0 2000 4000 Feet

FIGURE 2-1
SITE LOCATION MAP

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

Brown AND Caldwell
Associates



Legend

- ● Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line and Approximate Limits of Operable Unit (OU) 1
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 2-2

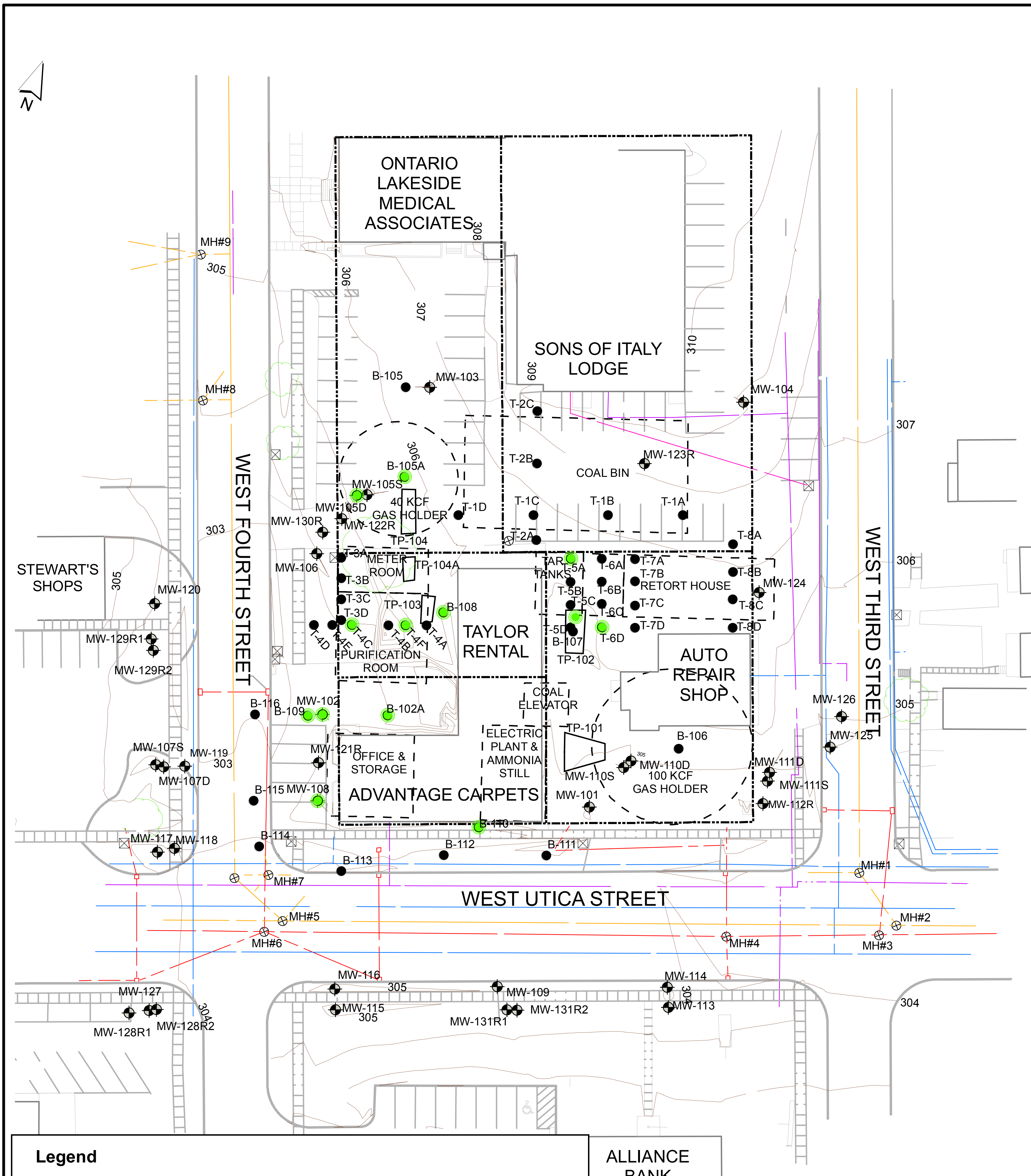
SITE PLAN

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OPERABLE UNIT (OU) 1
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
1/6/12	141691.100

Brown AND Caldwell
Associates

p:/GIS/National_Grid/Oswego/Oswego_Site_Plan_AA_rpt.mxd



Legend

- ● Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line and Approximate Limits of Operable Unit (OU) 1
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Locations Meeting Source Material Criteria
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Note: Source materials are defined as soil saturated with NAPL/tar or soil where NAPL gauging of wells indicated NAPL entry into wells.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

FIGURE 5-1

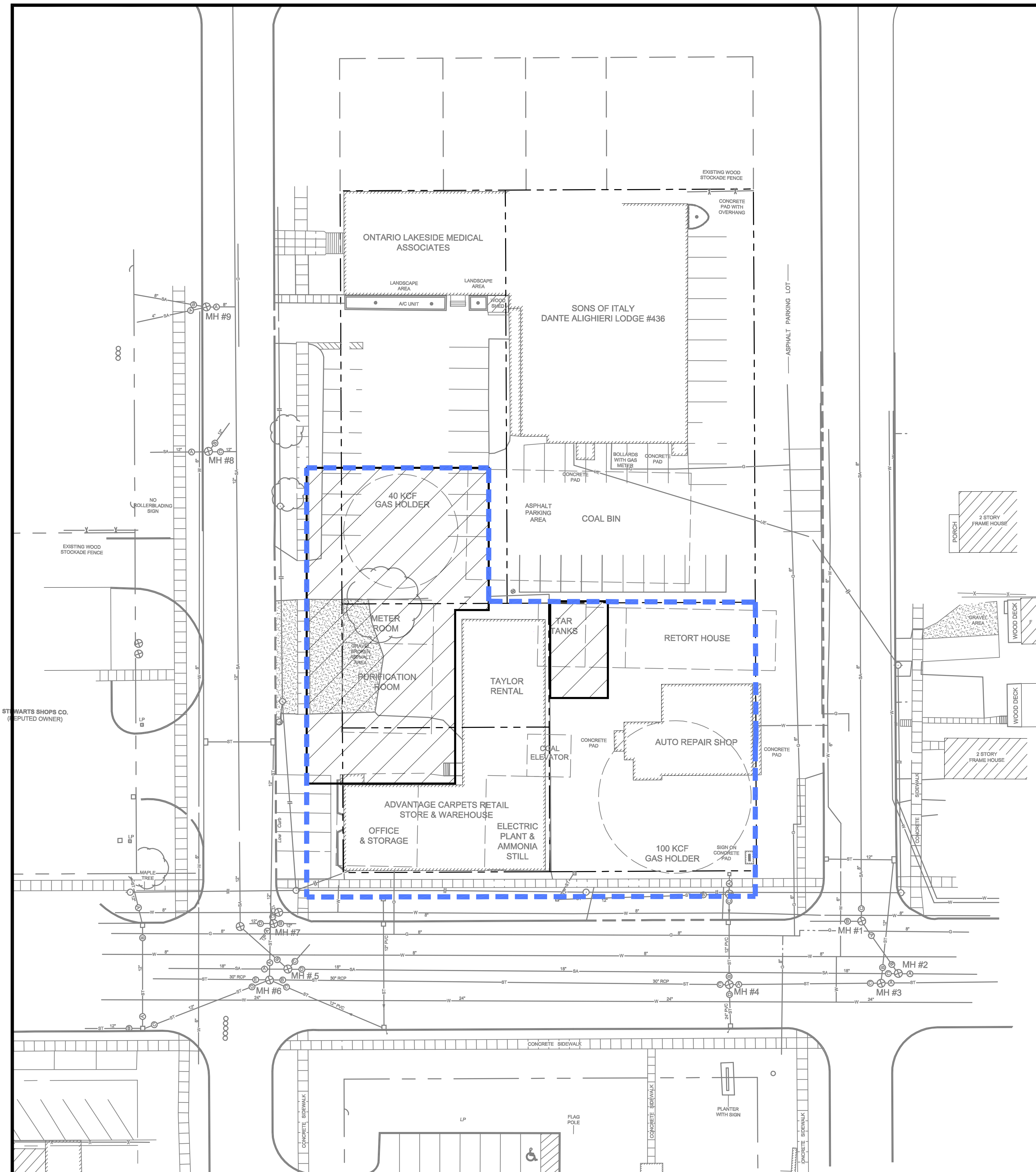
SOURCE MATERIAL OBSERVATIONS IN THE OVERBURDEN

OSWEGO (WEST UTICA ST.) FORMER MGP SITE OPERABLE UNIT (OU) 1 OSWEGO, NEW YORK

DATE	PROJECT NUMBER
1/6/12	141691.100

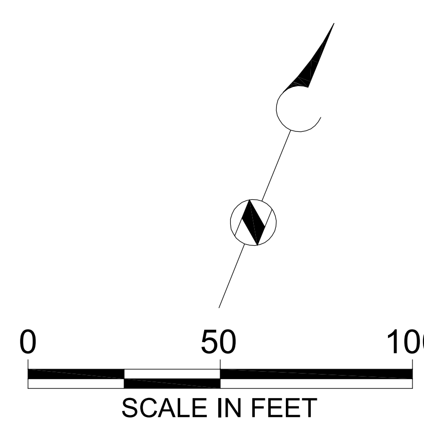
Brown AND Caldwell Associates

p:/GIS/National_Grid/Oswego/Oswego_source_materials_locs_AA_rpt.mxd



LEGEND:

- MANHOLE
- POWER POLE
- W — WATER LINE
- G — GAS LINE
- SA — SANITARY SEWER
- ST — SEWER LINE
- UE — UNDERGROUND ELECTRIC LINE
- PROPERTY LINE AND LIMITS OF OPERABLE UNIT (OU) 1
- FORMER MGP STRUCTURE LOCATION. LOCATIONS ARE APPROXIMATE, BASED ON 1924 SANBORN FIRE INSURANCE MAP.
- LIMIT OF ENGINEERING AND INSTITUTIONAL CONTROLS, (EC/IC)
- LIMIT OF EXCAVATION



SOURCE:
BASE MAP DEVELOPED BASED ON DRAWING PREPARED BY SNYDER ENGINEERING & LAND SURVEYING, LLP (JANUARY 11, 2005: REVISED DECEMBER 10, 2010)
REFER TO THIS DRAWING FOR SITE DETAILS.

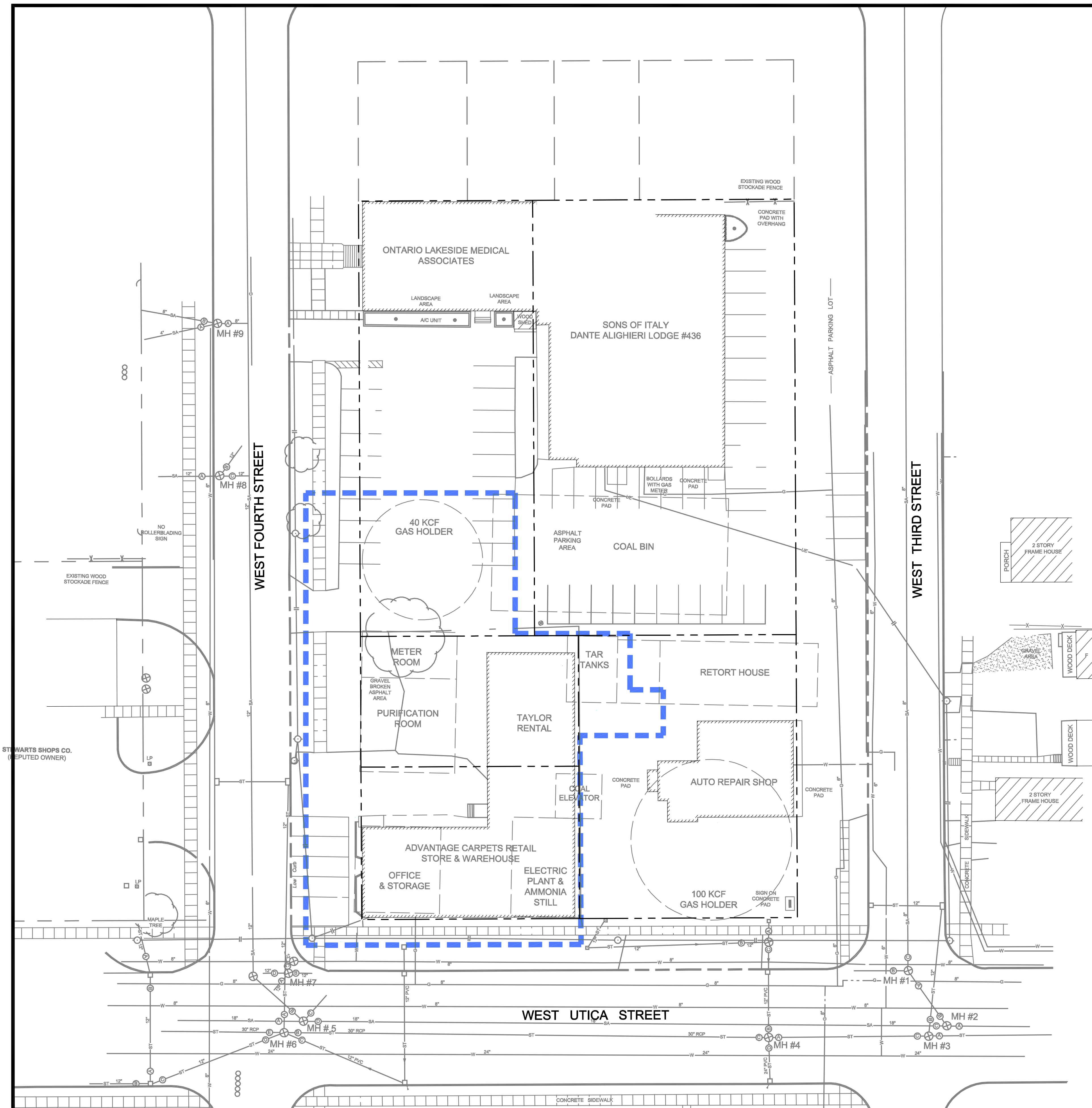
ALTERNATIVE 7-1
REMOVAL OF ACCESSIBLE SOURCE MATERIALS, EC/IC, AND POST-REMEDIAL GROUNDWATER MONITORING PROGRAM

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OPERABLE UNIT (OU) 1
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
1/12	141691

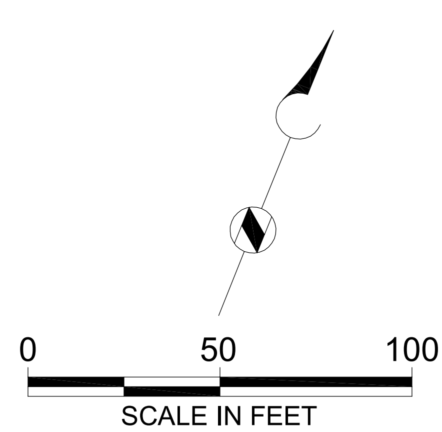
Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\NATIONAL_GRID\OSWEGO\141691_OU1_ALTERNATIVES_ANALYSIS\CADD\2-SHEETS\C-CIVIL\141691-ALTERNATIVE-7-1.DWG 07/27/2012 10:15:23AM By:RJames XREFS: 141691-BC-Basemap
141691-BC-Topo
141691-BC-Utilities



LEGEND:

- MANHOLE
- POWER POLE
- W — WATER LINE
- G — GAS LINE
- SA — SANITARY SEWER
- ST — SEWER LINE
- UE — UNDERGROUND ELECTRIC LINE
- PROPERTY LINE AND LIMITS OF OPERABLE UNIT (OU) 1
- FORMER MGP STRUCTURE LOCATION. LOCATIONS ARE APPROXIMATE, BASED ON 1924 SANBORN FIRE INSURANCE MAP.
- LIMIT OF EXCAVATION



SOURCE:
BASE MAP DEVELOPED BASED ON DRAWING PREPARED BY SNYDER ENGINEERING & LAND SURVEYING, LLP (JANUARY 11, 2005: REVISED DECEMBER 10, 2010)
REFER TO THIS DRAWING FOR SITE DETAILS.

FIGURE 7-2
ALTERNATIVE 3
RESTORATION TO PRE-RELEASE CONDITIONS

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OPERABLE UNIT (OU) 1
OSWEGO, NEW YORK

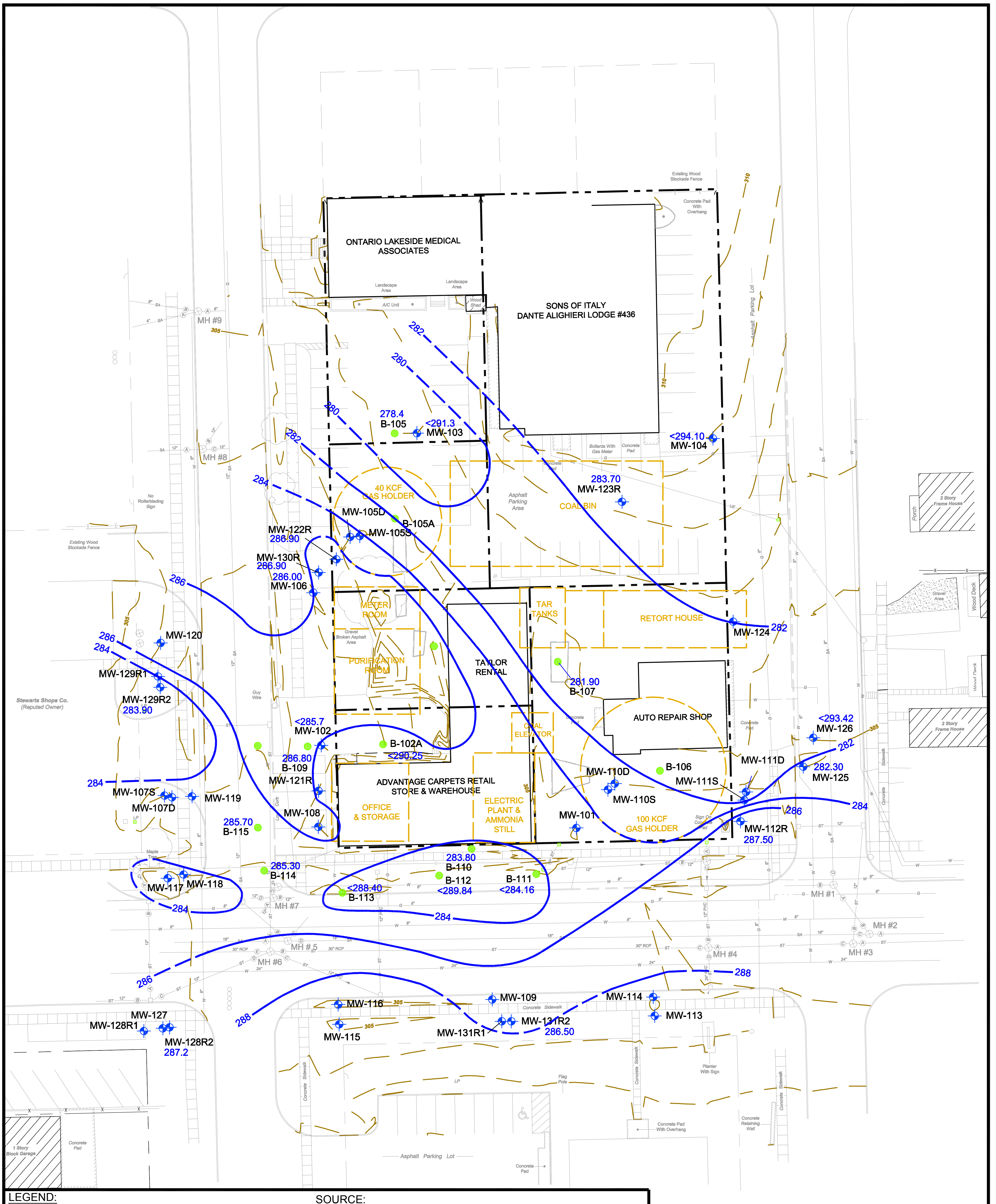
DATE	PROJECT NUMBER
1/12	141691

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\NATIONAL_GRID\OSWEGO\141691_OU1_ALTERNATIVES_ANALYSIS\CADD\2-SHEETS\C-CIVIL\141691-FIG-7-23-ALTERNATIVE-3_REV-1-30-12.DWG 01/30/2012 05:38:00PM By:rjames XREFS: 141691-BC-Basemap
141691-BC-Topo
141691-BC-Utilities

Figures

Appendix A: Figures from RI Report



LEGEND:

- SOIL BORING
- MONITORING WELL
- MANHOLE
- POWER POLE
- W — WATER LINE
- G — GAS LINE
- SA — SANITARY SEWER
- ST — SEWER LINE
- UE — UNDERGROUND ELECTRIC LINE
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR (FT., NGVD)
- 284 — TOP OF ROCK ELEVATION CONTOUR (FT., NGVD) DASHED WHERE INFERRED
- 288.4 — TOP OF BEDROCK ELEVATION (FT., NGVD)
- <294.10 — TOTAL DEPTH ELEVATION (FT., NGVD) FOR BORING WHERE BEDROCK WAS NOT ENCOUNTERED
- FORMER MGP STRUCTURE LOCATION. LOCATIONS ARE APPROXIMATE, BASED ON 1924 SANBORN FIRE INSURANCE MAP.

SOURCE:

BASE MAP DEVELOPED BASED ON DRAWING PREPARED BY SNYDER ENGINEERING & LAND SURVEYING, LLP (JANUARY 11, 2005: REVISED DECEMBER 10, 2010) REFER TO THIS DRAWING FOR SITE DETAILS.

FIGURE 3
TOP OF BEDROCK SURFACE CONTOUR MAP

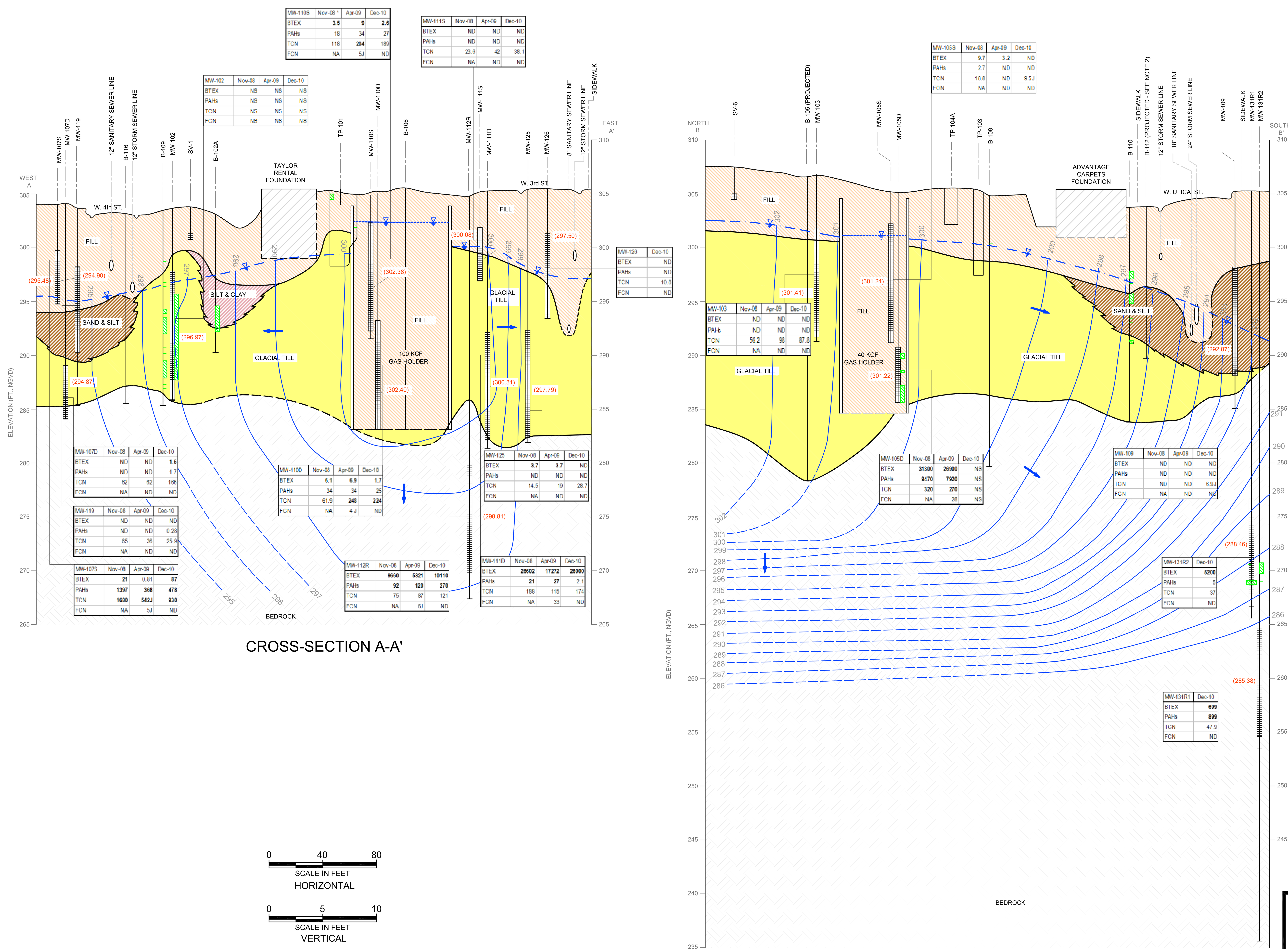
OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
4/11	139178.103

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\NIMO_OSWEGO\139178.103.002\FIGURE 3 (TOP_OF_BEDROCK_SURFACE).DWG 04/12/2011 10:25:28AM By:rjames XREFS: Basemap Layout: Layout1

P:\DRAFTING\NATIONAL_GRID\NIMO_OSWEGO\139178.103.002\FIGURE 4 (CROSS-SECTIONS A-A' & B-B').DWG 04/12/2011 10:09:38AM By:rjames XREFS: Layout: 34X22



CROSS-SECTION A-A'

MW-110S	Nov-08 *	Apr-09	Dec-10
BTEX	3.5	9	2.6
PAHs	18	34	27
TCN	118	204	189
FCN	NA	5J	ND

MW-111S	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	ND
TCN	23.6	42	38.1
FCN	NA	ND	ND

MW-102	Nov-08	Apr-09	Dec-10
BTEX	NS	NS	NS
PAHs	NS	NS	NS
TCN	NS	NS	NS
FCN	NS	NS	NS

MW-107D	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	1.5
PAHs	ND	ND	1.7
TCN	82	62	166
FCN	NA	ND	ND

MW-119	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	0.28
TCN	65	36	25.9
FCN	NA	ND	ND

MW-107S	Nov-08	Apr-09	Dec-10
BTEX	21	0.81	87
PAHs	1397	368	478
TCN	1680	542J	930
FCN	NA	5J	ND

MW-110D	Nov-08	Apr-09	Dec-10
BTEX	6.1	6.9	1.7
PAHs	34	34	25
TCN	61.9	248	224
FCN	NA	4 J	ND

MW-112R	Nov-08	Apr-09	Dec-10
BTEX	9660	5321	10110
PAHs	92	120	270
TCN	75	87	121
FCN	NA	6J	ND

MW-125	Nov-08	Apr-09	Dec-10
BTEX	3.7	3.7	ND
PAHs	ND	ND	ND
TCN	14.5	19	28.7
FCN	NA	ND	ND

MW-111D	Nov-08	Apr-09	Dec-10
BTEX	26602	17272	26000
PAHs	21	27	2.1
TCN	188	115	174
FCN	NA	33	ND

MW-126	Dec-10
BTEX	ND
PAHs	ND
TCN	10.8
FCN	ND

SCALE IN FEET HORIZONTAL: 0 40 80

SCALE IN FEET VERTICAL: 0 5 10

CROSS-SECTION B-B'

MW-103	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	ND
TCN	56.2	98	87.8
FCN	NA	ND	ND

MW-105D	Nov-08	Apr-09	Dec-10
BTEX	31300	26900	NS
PAHs	9470	7920	NS
TCN	320	270	NS
FCN	NA	28	NS

MW-105S	Nov-08	Apr-09	Dec-10
BTEX	9.7	3.2	ND
PAHs	2.7	ND	ND
TCN	18.8	ND	9.5J
FCN	NA	ND	ND

MW-109	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	ND
TCN	ND	ND	6.9J
FCN	NA	ND	ND

MW-131R2	Dec-10
BTEX	5200
PAHs	5
TCN	37
FCN	ND

MW-131R1	Dec-10
BTEX	699
PAHs	899
TCN	47.9
FCN	ND

NOTES:

1. CROSS-SECTIONS DO NOT DEPICT ALL IDENTIFIED SUBSURFACE UTILITIES. POSITIONS OF DEPICTED SEWERS ARE ESTIMATED AND APPROXIMATE.
2. WELL LOCATION PROJECTED INTO CROSS-SECTION. STRATIGRAPHIC INTERPRETATION BASED ON B-110 LOCATION.

LEGEND:

MW-111S — MONITORING WELL / SOIL BORING / TEST PIT IDENTIFICATION AND APPROXIMATE LOCATION

GENERALIZED GROUND SURFACE

WELL SCREEN INTERVAL

SUMP

TOTAL DEPTH OF BOREHOLE

NAPL OBSERVED WITHIN WELL CASING DURING DECEMBER 2010 GAUGING EVENTS

FILL

SILT & CLAY

SAND & SILT

GLACIAL TILL

BEDROCK

MW-111D	Nov-08	Apr-09	Dec-10
BTEX	26602	17272	26000
PAHs	21	27	2.1
TCN	188	115	174
FCN	NA	33	ND

GROUNDWATER QUALITY DATA. VALUES REPORTED IN MICROGRAMS PER LITER (ug/L). BOLD VALUE INDICATES THAT CONCENTRATION IS ABOVE CLASS GA CRITERIA, OR FOR BTEX AND PAHS, CONCENTRATIONS OF ONE OR MORE BTEX OR PAH COMPOUNDS ARE ABOVE CLASS GA CRITERIA.

WATER TABLE, 1/19/11 (DASHED WHERE INFERRED)

WATER LEVEL IN GAS HOLDER, 1/19/11

285 — EQUIPOTENTIAL LINE (DASHED WHERE INFERRED)

GENERALIZED DIRECTION OF GROUNDWATER FLOW OF (IN PLANE OF CROSS-SECTION)

(NM) — NOT MEASURED

(301.49) — GROUNDWATER ELEVATION, 1/19/11

NAPL OBSERVED IN SOIL SAMPLES OR TEST PIT

DISTINCT LAYER OF NAPL OBSERVED IN SOIL SAMPLES OR TEST PIT

ABBREVIATIONS:

- BTEX — BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE ISOMERS
- PAHs — POLYCYCLIC AROMATIC HYDROCARBONS
- TCN — TOTAL CYANIDE
- FN — FREE CYANIDE
- NS — NOT SAMPLED DUE TO NAPL PRESENCE
- ND — NOT DETECTED
- NA — NOT ANALYZED
- J — ESTIMATED CONCENTRATION
- * — TABLE LISTS HIGHEST CONCENTRATION FROM ORIGINAL AND DUPLICATE SAMPLE

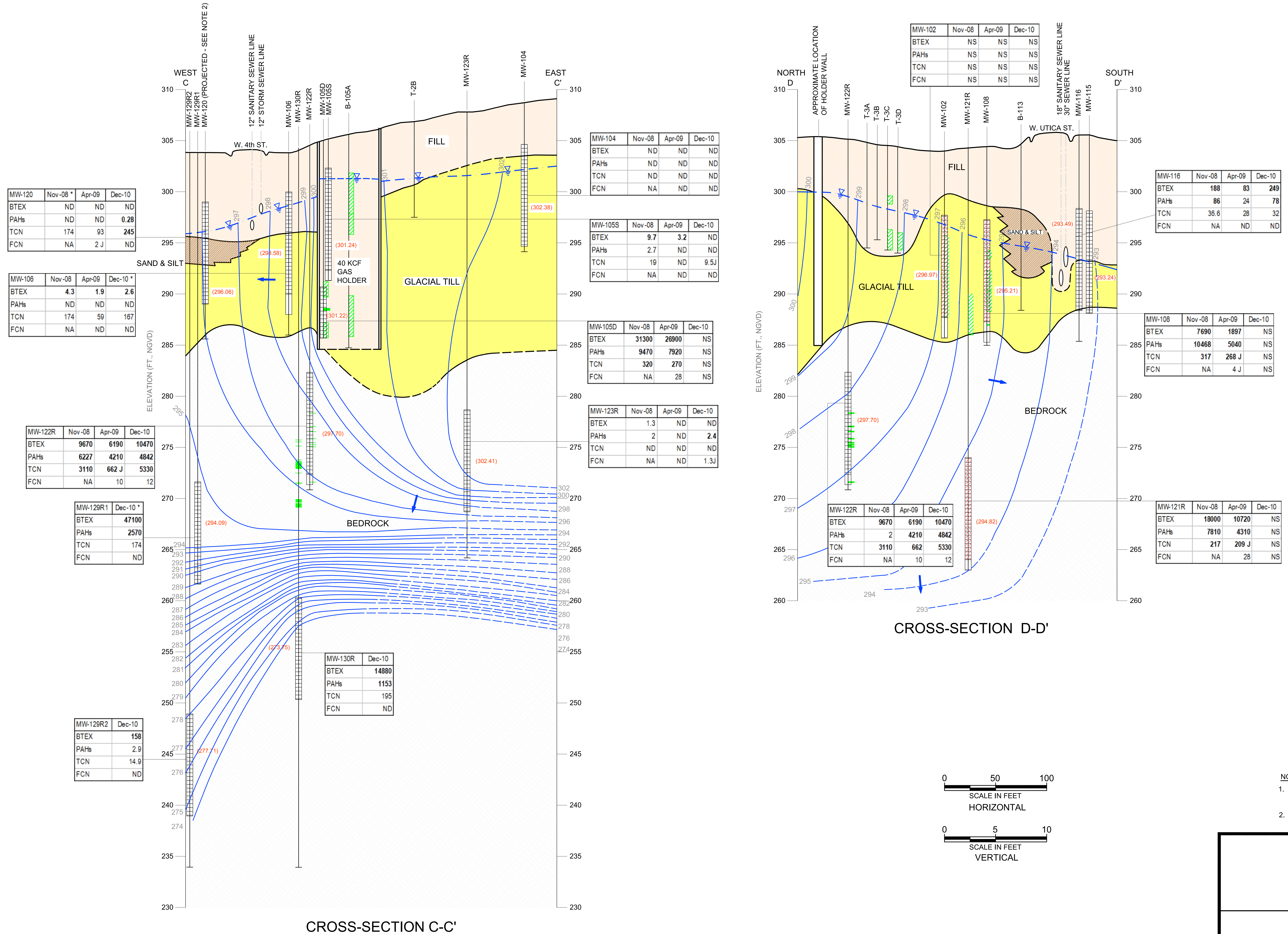
FIGURE 4
HYDROGEOLOGIC CROSS-SECTIONS A-A' & B-B'

NATIONAL GRID
OSWEGO (WEST UTICA STREET) FORMER MGP
OSWEGO, NEW YORK

DATE: 4/2011

PROJECT NUMBER: 139178.103

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY



MW-120	Nov-08 *	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	0.28
TCN	174	93	245
FCN	NA	2 J	ND

MW-106	Nov-08	Apr-09	Dec-10 *
BTEX	4.3	1.9	2.6
PAHs	ND	ND	ND
TCN	174	59	167
FCN	NA	ND	ND

MW-122R	Nov-08	Apr-09	Dec-10
BTEX	9670	6190	10470
PAHs	6227	4210	4842
TCN	3110	662 J	5330
FCN	NA	10	12

MW-129R1	Dec-10 *
BTEX	47100
PAHs	2570
TCN	174
FCN	ND

MW-129R2	Dec-10
BTEX	158
PAHs	2.9
TCN	14.9
FCN	ND

MW-130R	Dec-10
BTEX	14880
PAHs	1153
TCN	195
FCN	ND

MW-104	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	ND
TCN	ND	ND	ND
FCN	NA	ND	ND

MW-105S	Nov-08	Apr-09	Dec-10
BTEX	9.7	3.2	ND
PAHs	2.7	ND	ND
TCN	19	ND	9.5J
FCN	NA	ND	ND

MW-105D	Nov-08	Apr-09	Dec-10
BTEX	31300	26900	NS
PAHs	9470	7920	NS
TCN	320	270	NS
FCN	NA	28	NS

MW-123R	Nov-08	Apr-09	Dec-10
BTEX	1.3	ND	ND
PAHs	2	ND	2.4
TCN	ND	ND	ND
FCN	NA	ND	1.3J

MW-102	Nov-08	Apr-09	Dec-10
BTEX	NS	NS	NS
PAHs	NS	NS	NS
TCN	NS	NS	NS
FCN	NS	NS	NS

MW-122R	Nov-08	Apr-09	Dec-10
BTEX	9670	6190	10470
PAHs	2	4210	4842
TCN	3110	662	5330
FCN	NA	10	12

MW-116	Nov-08	Apr-09	Dec-10
BTEX	188	83	249
PAHs	86	24	78
TCN	36.6	28	32
FCN	NA	ND	ND

MW-108	Nov-08	Apr-09	Dec-10
BTEX	7690	1897	NS
PAHs	10468	5040	NS
TCN	317	268 J	NS
FCN	NA	4 J	NS

MW-121R	Nov-08	Apr-09	Dec-10
BTEX	18000	10720	NS
PAHs	7810	4310	NS
TCN	217	209 J	NS
FCN	NA	28	NS

LEGEND:

- MW-111S — MONITORING WELL / SOIL BORING / TEST PROBE IDENTIFICATION AND APPROXIMATE LOCATION
- GENERALIZED GROUND SURFACE
- WELL SCREEN INTERVAL
- SUMP
- TOTAL DEPTH OF BOREHOLE
- FILL
- SAND & SILT
- GLACIAL TILL
- BEDROCK
- GROUNDWATER QUALITY DATA. VALUES REPORTED IN MICROGRAMS PER LITER (ug/L). BOLD VALUE INDICATES THAT CONCENTRATION IS ABOVE CLASS GA CRITERIA, OR FOR BTEX AND PAHS, CONCENTRATIONS OF ONE OR MORE BTEX OR PAH COMPOUNDS ARE ABOVE CLASS GA CRITERIA.

MW-106	Nov-08	Apr-09	Dec-10 *
BTEX	4.3	1.9	2.6
PAHs	ND	ND	ND
TCN	174	59	167
FCN	NA	ND	1.5J

- WATER TABLE, 1/19011 (DASHED WHERE INFERRED)
- WATER LEVEL IN GAS HOLDER, 1/19/11
- 294 — EQUIPOTENTIAL LINE (DASHED WHERE INFERRED)
- GENERALIZED DIRECTION OF GROUNDWATER FLOW OF (IN PLANE OF CROSS-SECTION)
- (295.21) — GROUNDWATER ELEVATION, 1/19/11
- NAPL OBSERVED IN SOIL SAMPLES
- DISTINCT LAYER OF NAPL OBSERVED IN SOIL SAMPLES OR NAPL OBSERVED IN ROCK CORE ON ISOLATED FRACTURE SURFACE
- NAPL OBSERVED WITHIN WELL CASING DURING DECEMBER 2010 GAUGING EVENT

ABBREVIATIONS:

BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE ISOMERS
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
TCN	TOTAL CYANIDE
FCN	FREE CYANIDE
NS	NOT SAMPLED DUE TO NAPL PRESENCE
ND	NOT DETECTED
NA	NOT ANALYZED
J	ESTIMATED CONCENTRATION
*	TABLE LISTS HIGHEST CONCENTRATION FROM ORIGINAL AND DUPLICATE SAMPLE

NOTES:

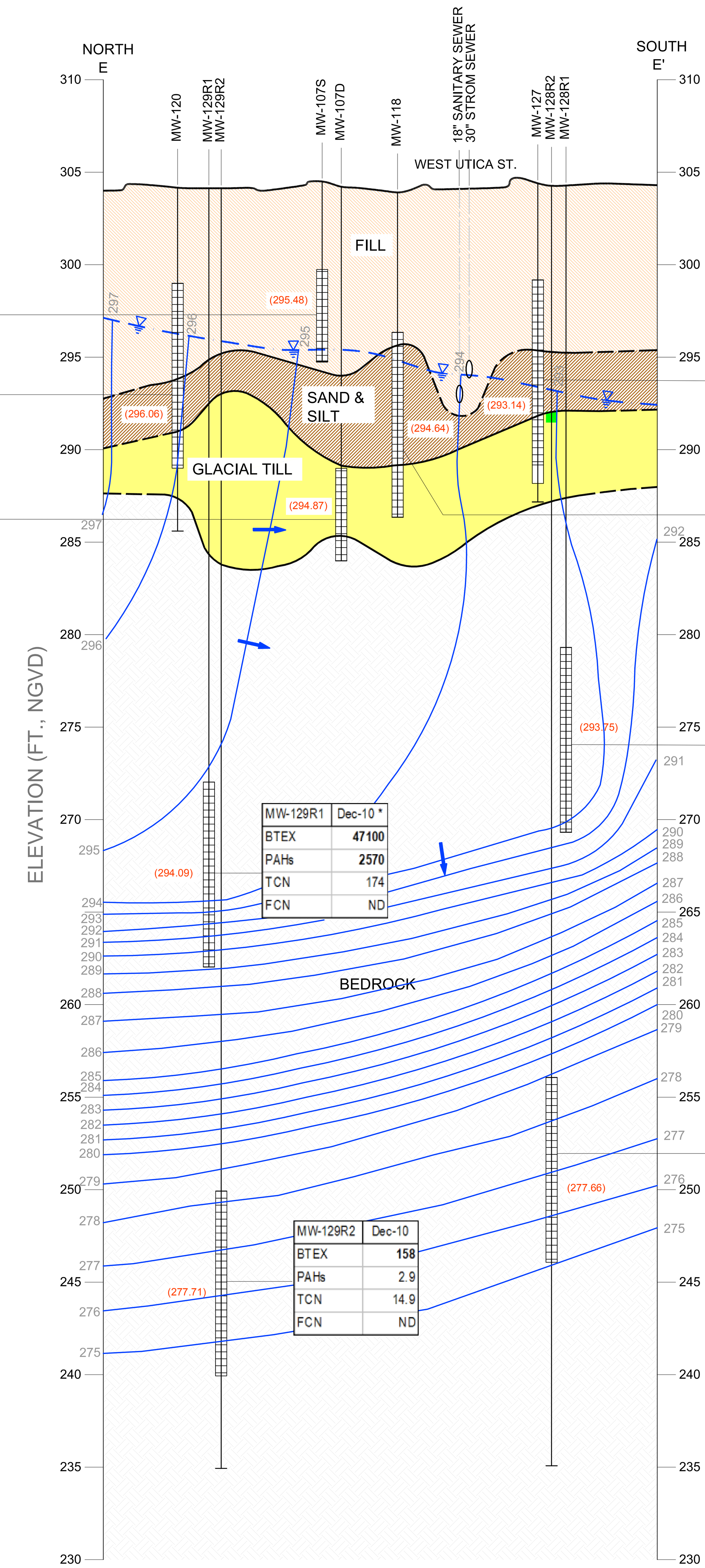
1. CROSS-SECTIONS DO NOT DEPICT ALL IDENTIFIED SUBSURFACE UTILITIES. POSITIONS OF DEPICTED SEWERS ARE ESTIMATED AND APPROXIMATE.
2. WELL LOCATION PROJECTED INTO CROSS-SECTION. STRATIGRAPHIC INTERPRETATION BASED ON MW-129R2 LOCATION.

FIGURE 5
HYDROGEOLOGIC CROSS-SECTIONS C-C'& D-D'

NATIONAL GRID
OSWEGO (WEST UTICA STREET) FORMER MGP
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
4/2011	139178.103

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY



CROSS-SECTION E-E'

MW-107S	Nov-08	Apr-09	Dec-10
BTEX	**21**	0.81	**87**
PAHs	**1397**	**368**	**478**
TCN	**1680**	**542J**	**930**
FCN	NA	5J	ND

MW-120	Nov-08 *	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	ND	ND	**0.28**
TCN	174	93	**245**
FCN	NA	2 J	ND

MW-107D	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	**1.5**
PAHs	ND	ND	1.7
TCN	62	62	166
FCN	NA	ND	ND

MW-129R1	Dec-10 *
BTEX	**47100**
PAHs	**2570**
TCN	174
FCN	ND

MW-129R2	Dec-10
BTEX	**158**
PAHs	2.9
TCN	14.9
FCN	ND

MW-127	Dec-10
BTEX	ND
PAHs	ND
TCN	4.8J
FCN	ND

MW-118	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	3	ND	0.28
TCN	172	**269**	183
FCN	NA	ND	ND

MW-128R1	Dec-10
BTEX	**22**
PAHs	ND
TCN	10.5
FCN	ND

MW-128R2	Dec-10
BTEX	**8138**
PAHs	7.4
TCN	5.7J
FCN	ND

SCALE IN FEET HORIZONTAL (0, 50, 100)

SCALE IN FEET VERTICAL (0, 5, 10)

LEGEND:

MW-118 — MONITORING WELL / SOIL BORING / TEST PROBE IDENTIFICATION AND APPROXIMATE LOCATION

GENERALIZED GROUND SURFACE

WELL SCREEN INTERVAL

SUMP

TOTAL DEPTH OF BOREHOLE

FILL

SAND & SILT

GLACIAL TILL

BEDROCK

MW-118	Nov-08	Apr-09	Dec-10
BTEX	ND	ND	ND
PAHs	3	ND	0.28
TCN	172	**269**	183
FCN	NA	ND	ND

GROUNDWATER QUALITY DATA. VALUES REPORTED IN MICROGRAMS PER LITER (ug/L). BOLD VALUE INDICATES THAT CONCENTRATION IS ABOVE CLASS GA CRITERIA, OR FOR BTEX AND PAHS, CONCENTRATIONS OF ONE OR MORE BTEX OR PAH COMPOUNDS ARE ABOVE CLASS GA CRITERIA.

WATER TABLE, 1/19011 (DASHED WHERE INFERRED)

WATER LEVEL IN GAS HOLDER, 1/19/11

275 — EQUIPOTENTIAL LINE

GENERALIZED DIRECTION OF GROUNDWATER FLOW OF (IN PLANE OF CROSS-SECTION)

(293.21) GROUNDWATER ELEVATION, 1/19/11

NAPL OBSERVED IN SOIL SAMPLES

ABBREVIATIONS:

- BTEX — BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE ISOMERS
- PAHs — POLYCYCLIC AROMATIC HYDROCARBONS
- TCN — TOTAL CYANIDE
- FCN — FREE CYANIDE
- NS — NOT SAMPLED DUE TO NAPL PRESENCE
- ND — NOT DETECTED
- NA — NOT ANALYZED
- J — ESTIMATED CONCENTRATION
- * — TABLE LISTS HIGHEST CONCENTRATION FROM ORIGINAL AND DUPLICATE SAMPLE

NOTE:

1. CROSS-SECTIONS DO NOT DEPICT ALL IDENTIFIED SUBSURFACE UTILITIES. POSITIONS OF DEPICTED SEWERS ARE ESTIMATED AND APPROXIMATE.

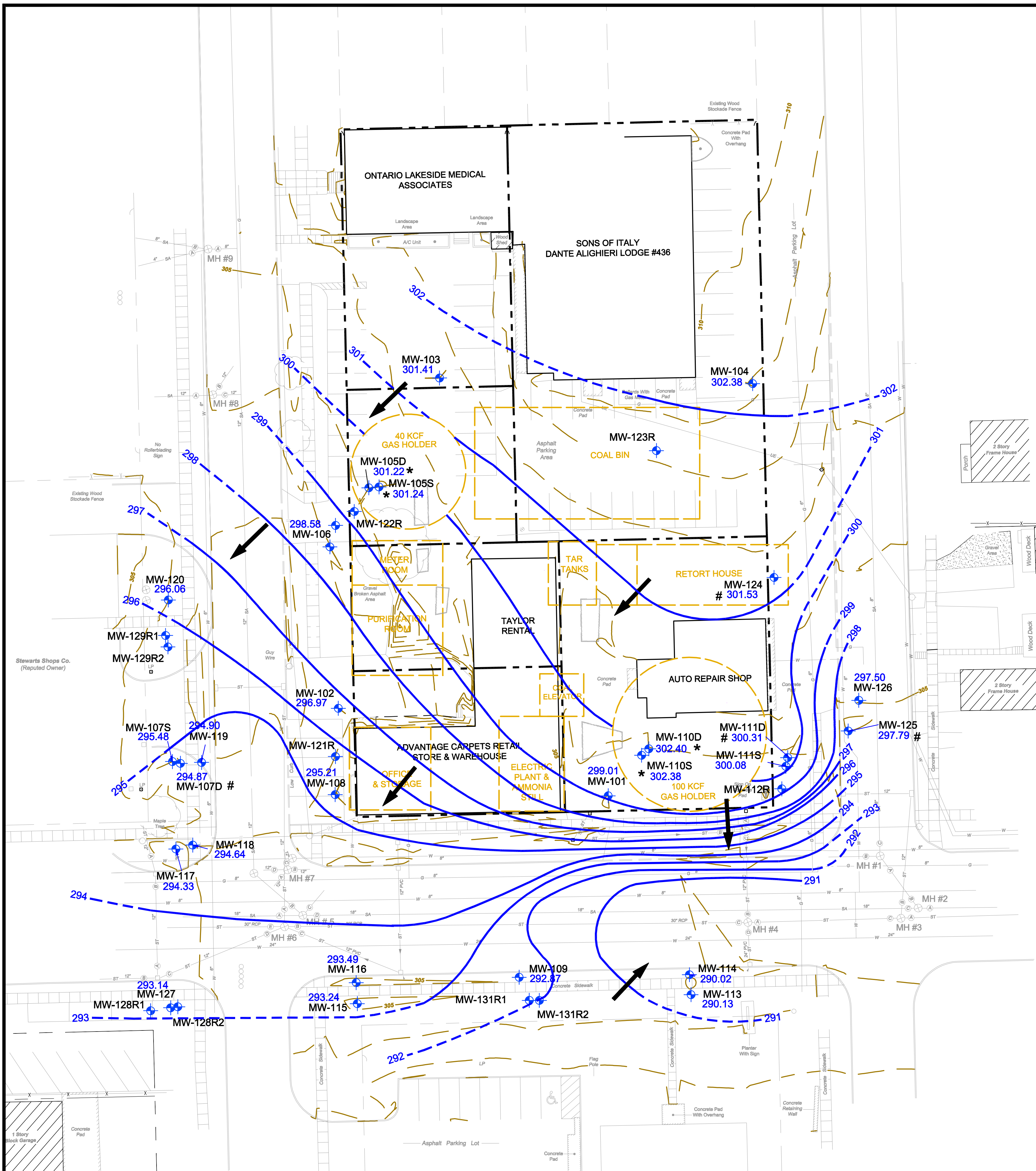
FIGURE 6
HYDROGEOLOGIC CROSS-SECTIONS E-E'

NATIONAL GRID
OSWEGO (WEST UTICA STREET) FORMER MGP
OSWEGO, NEW YORK

DATE: 4/2011

PROJECT NUMBER: 139178.103

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY



LEGEND:

- MONITORING WELL
- MANHOLE
- POWER POLE
- W — WATER LINE
- G — GAS LINE
- SA — SANITARY SEWER
- ST — SEWER LINE
- UE — UNDERGROUND ELECTRIC LINE
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR (FT., NGVD)
- 295 — WATER TABLE ELEVATION CONTOUR (FT., NGVD) DASHED WHERE INFERRED
- GENERALIZED DIRECTION OF GROUNDWATER FLOW
- 299.44 WATER TABLE ELEVATION (FT., NGVD)
- (NM) NOT MEASURED
- FORMER MGP STRUCTURE LOCATION LOCATION ARE APPROXIMATE, BASED ON 1924 SANBORN FIRE INSURANCE MAP.

WELL SCREEN POSITIONED SEVERAL FEET BELOW WATER TABLE. POSTED WATER ELEVATION ARE USED IN CONTOURING, OUT DATA MAY NOT BE REPRESENTATIVE OF WATER TABLE CONDITIONS.

* DATA FROM WELLS IN FORMER GAS HOLDER INDICATE THAT WATER IN HOLDERS HAS NO OR LIMITED HYDRAULIC CONNECTIVITY WITH SURROUNDING GROUNDWATER.

SOURCE:

BASE MAP DEVELOPED BASED ON DRAWING PREPARED BY SNYDER ENGINEERING & LAND SURVEYING, LLP (JANUARY 11, 2005: REVISED DECEMBER 10, 2010) REFER TO THIS DRAWING FOR SITE DETAILS.

0 50 100
SCALE IN FEET

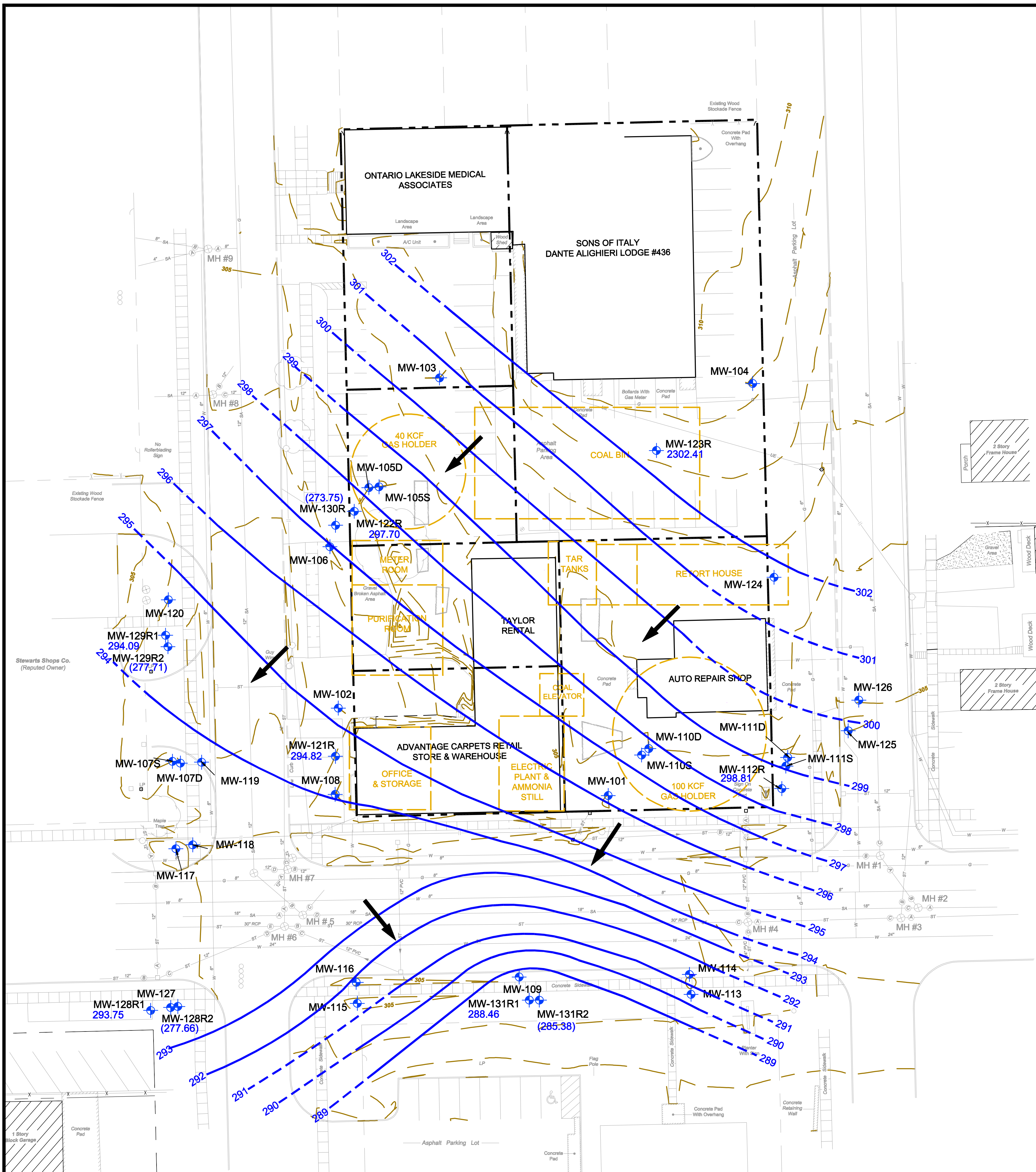
FIGURE 7
WATER TABLE CONTOUR MAP
JANUARY 19, 2011

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
4/11	139178.103

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\NIMO_OSWEGO\139178.103.002\FIGURE 7 (WATER_TABLE_CONTOUR_MAP_JAN 19 2011).DWG 04/12/2011 09:51:41AM By:rjames XREFS: Basemap Layout: Layout1



LEGEND:

- MONITORING WELL
- MANHOLE
- POWER POLE
- W — WATER LINE
- G — GAS LINE
- SA — SANITARY SEWER
- ST — SEWER LINE
- UE — UNDERGROUND ELECTRIC LINE
- PROPERTY LINE
- GROUND SURFACE ELEVATION CONTOUR (FT., NGVD)
- 292 — GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR (FT., NGVD) FOR SHALLOW BEDROCK DASHED WHERE INFERRED
- GENERALIZED DIRECTION OF GROUNDWATER FLOW
- 288.46 — GROUNDWATER POTENTIOMETRIC HEAD ELEVATION (FT., NGVD) - SHALLOW BEDROCK
- (273.75) — GROUNDWATER POTENTIOMETRIC HEAD ELEVATION (FT., NGVD) - DEEPER BEDROCK NOT USED FOR POTENTIOMETRIC SURFACE CONTOURS
- (NM) — NOT MEASURED
- FORMER MGP STRUCTURE LOCATION LOCATION ARE APPROXIMATE, BASED ON 1924 SANBORN FIRE INSURANCE MAP.

SOURCE:
BASE MAP DEVELOPED BASED ON DRAWING PREPARED BY SNYDER ENGINEERING & LAND SURVEYING, LLP (JANUARY 11, 2005: REVISED DECEMBER 10, 2010) REFER TO THIS DRAWING FOR SITE DETAILS.

0 50 100
SCALE IN FEET

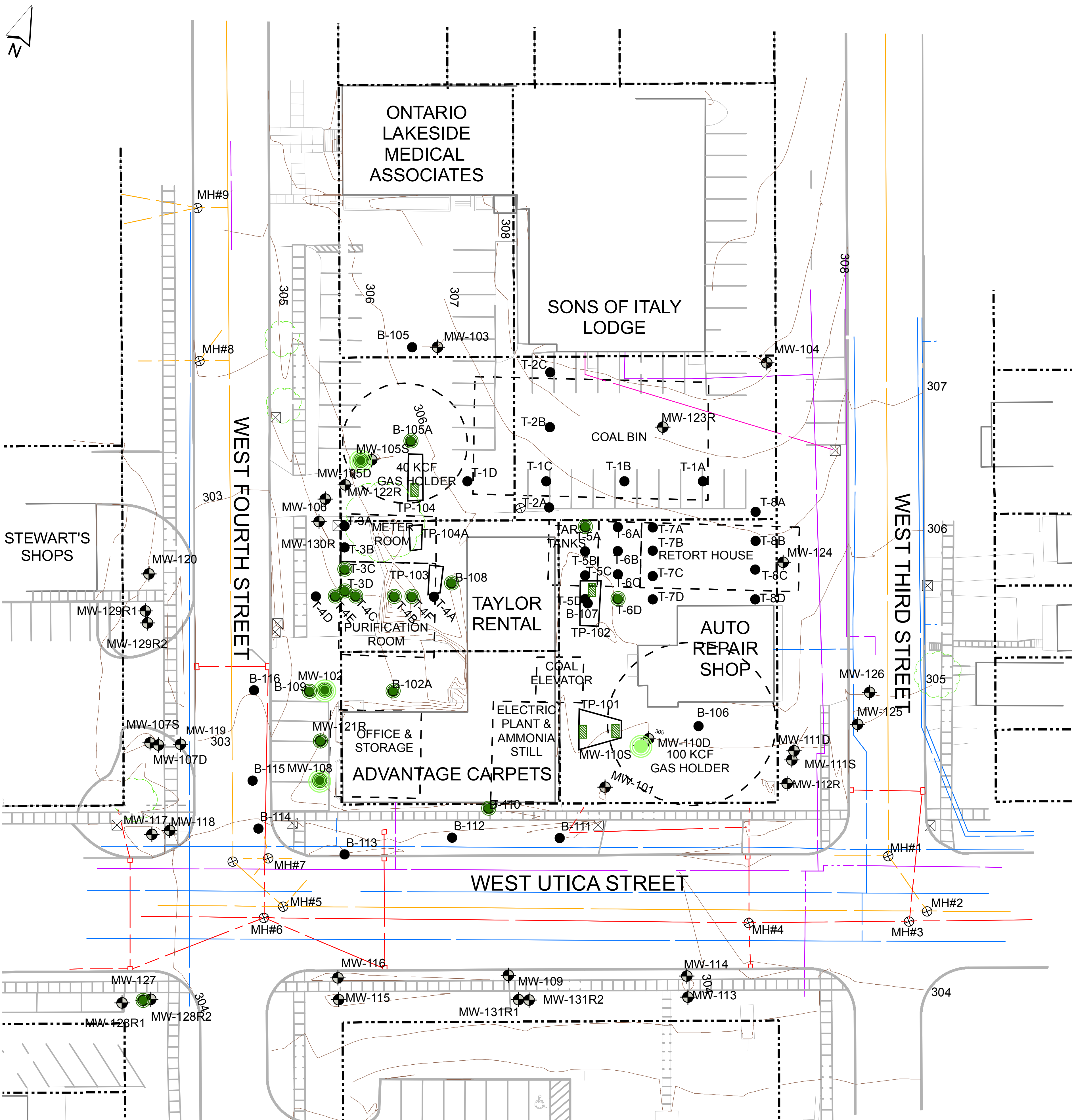
FIGURE 8
GENERALIZED SHALLOW BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE MAP
JANUARY 19, 2011

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
4/11	139178.103

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\NIMO_OSWEGO\139178.103.002\FIGURE 8 (PIEZOMETRIC SURFACE MAP JANUARY 19 2011).DWG 04/12/2011 09:50:04AM Byrjames XREFS: Basemap Layout: Layout1



Legend

- Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- NAPL/Tar Observed in Soil Boring or Test Pit
- NAPL/Tar Observed in Monitoring Well
- NAPL/Tar Observed in Soil Soil Boring and Monitoring Well
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Note: Refer to Table 5 for descriptions and depth intervals of NAPL/tar observations and to hydrogeologic cross-sections for vertical position of observations.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 9

NAPL/TAR OBSERVATIONS IN OVERBURDEN

OSWEGO (WEST UTICA ST.) FORMER MGP SITE OSWEGO, NEW YORK

DATE	PROJECT NUMBER
05/21/10	139178.103

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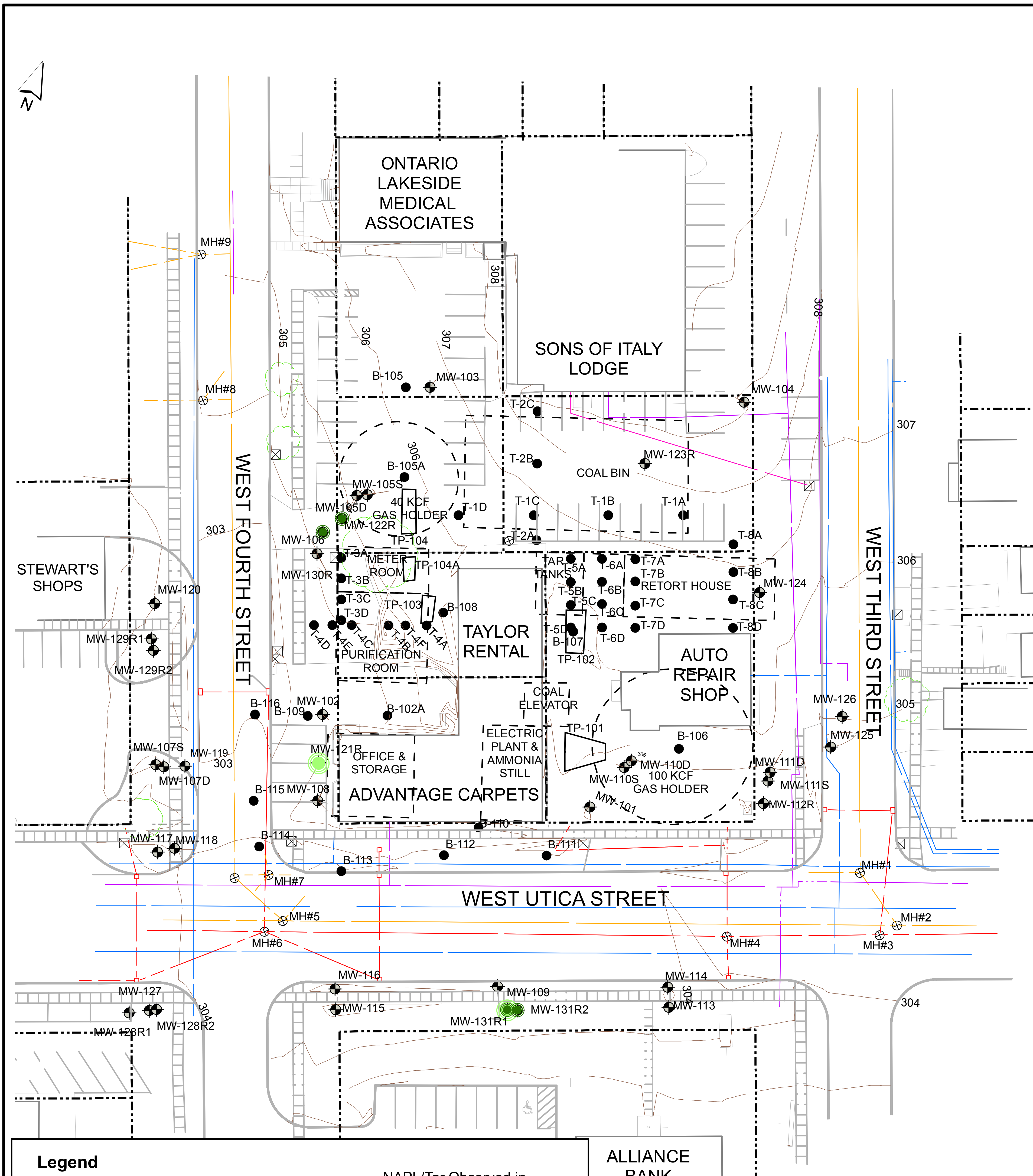
p:/GIS/National_Grid/Oswego/Oswego_NAPL_Tar_Observations_OB_soils.mxd



Legend

- Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- NAPL/Tar Observed in Rock Core Samples
- NAPL/Tar Observed in Monitoring Well
- NAPL/Tar Observed in Rock Core and Monitoring Well
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Note: Refer to Table 5 for descriptions and depth intervals of NAPL/tar observations and to hydrogeologic cross-sections for vertical position of observations.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 10

NAPL/TAR OBSERVATIONS IN BEDROCK

OSWEGO (WEST UTICA ST.) FORMER MGP SITE OSWEGO, NEW YORK

DATE	PROJECT NUMBER
05/21/10	139178.103

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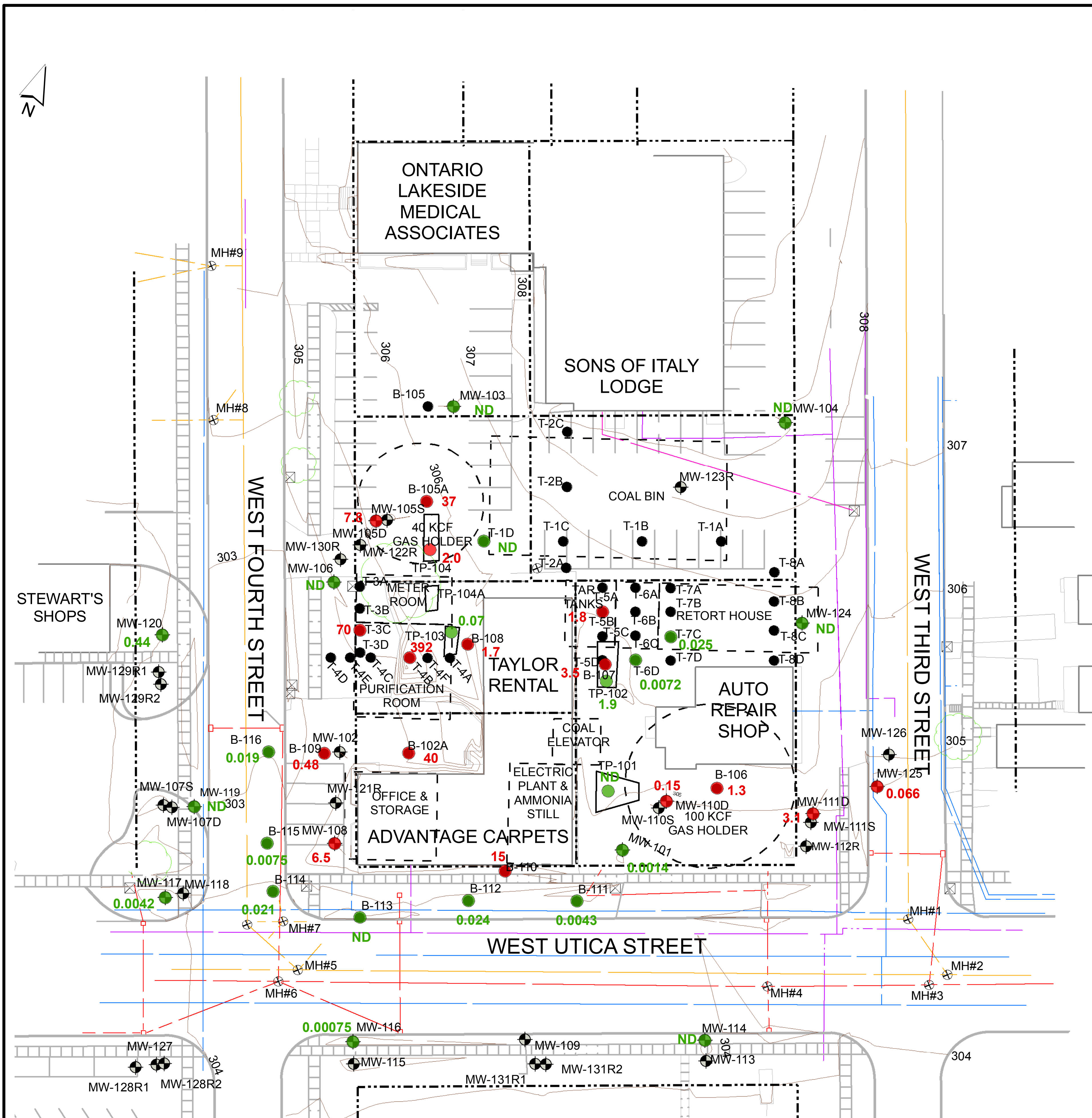
p:/GIS/National_Grid/Oswego/Oswego_NAPL_Tar_Observations_BR.mxd



Legend

- ● Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- BTEX concentrations below Part 375 SCOs (Commercial Use and/or Protection of Groundwater)
- Indicates one or more BTEX compounds are above Part 375 SCOs (Commercial Use and/or Protection of Groundwater)
- **70** Total BTEX Concentration (mg/kg)
- **ND** Not Detected
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Manhole
- Power Pole
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 11

BTEX IN SOIL

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
3/17/11	139178.103

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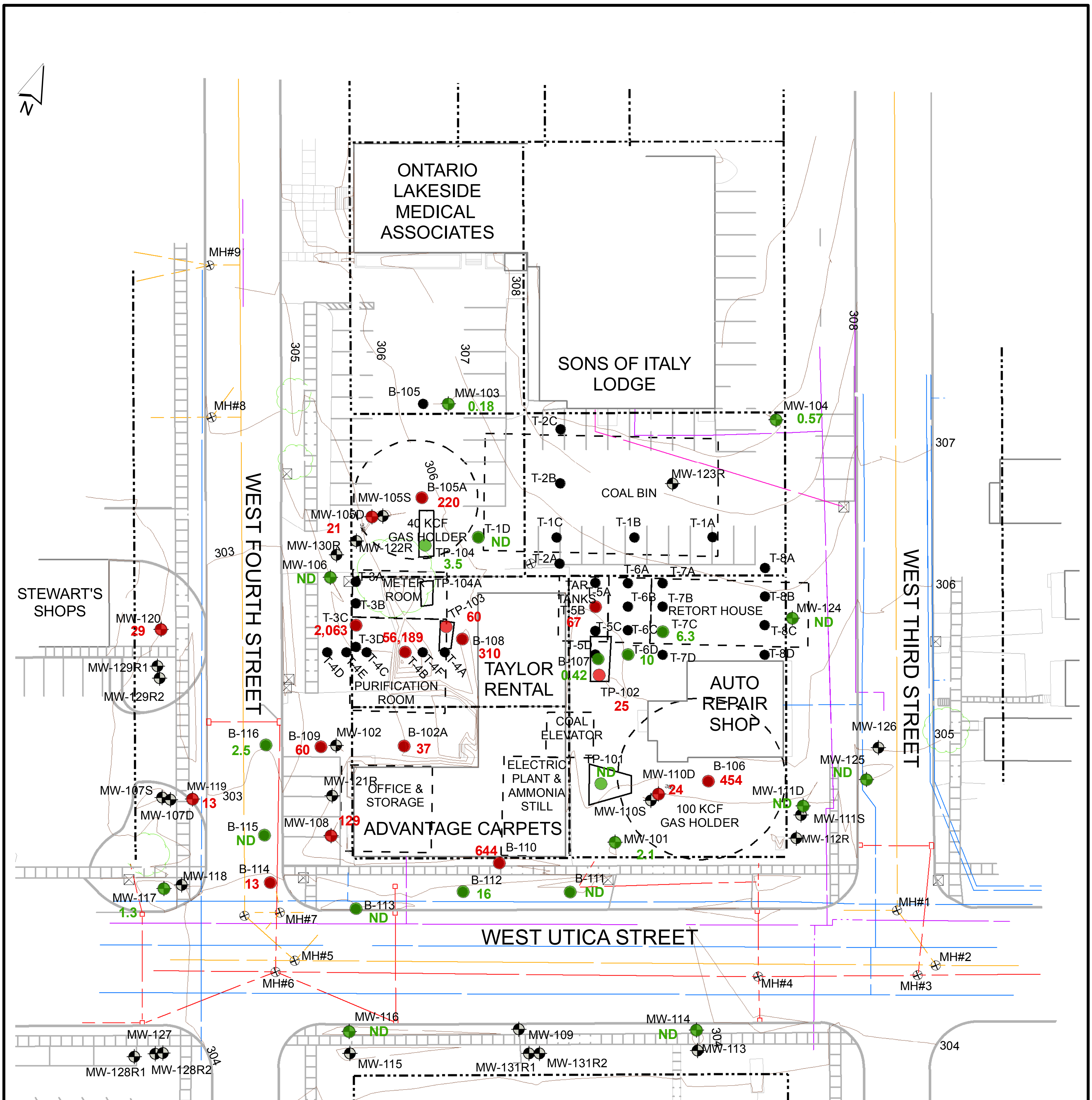
Associates

p:/GIS/National_Grid/Oswego/Oswego_Soil_BTEX_rpt.mxd



Legend

- Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- PAH concentrations below Part 375 SCOs (Commercial Use and/or Protection of Groundwater)
- Indicates one or more PAH compounds are above Part 375 SCOs (Commercial Use and/or Protection of Groundwater)
- 220 Total PAH Concentration (mg/kg)
- ND Not Detected
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Manhole
- Power Pole
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 12

PAHs IN SOIL

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
3/17/11	139178.103

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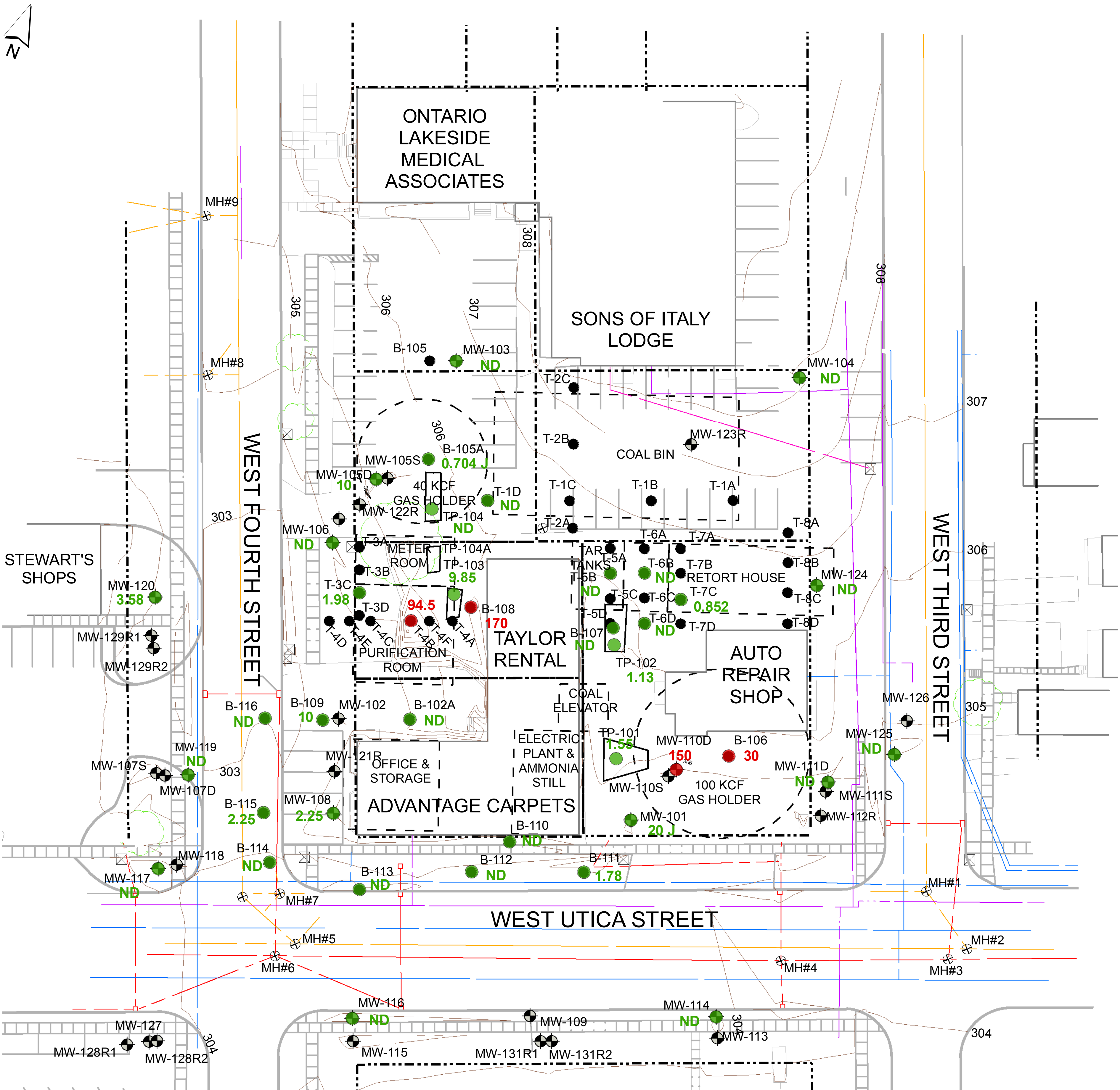

Legend

- ● Soil Boring/Transect Boring
- Monitoring Well
- Test Pit
- Total Cyanide concentration below Part 375 SCOs (Commercial Use and/or Protection of Groundwater)
- Indicates Total Cyanide concentration above Part 375 SCOs (Commercial Zoning and/or Protection of Groundwater)
- **10** Total Cyanide Concentration (mg/kg)
- **J** Estimated concentration
- **ND** Not Detected
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Manhole
- Power Pole
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2007). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 13

TOTAL CYANIDE IN SOIL

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE	PROJECT NUMBER
3/17/11	139178.103

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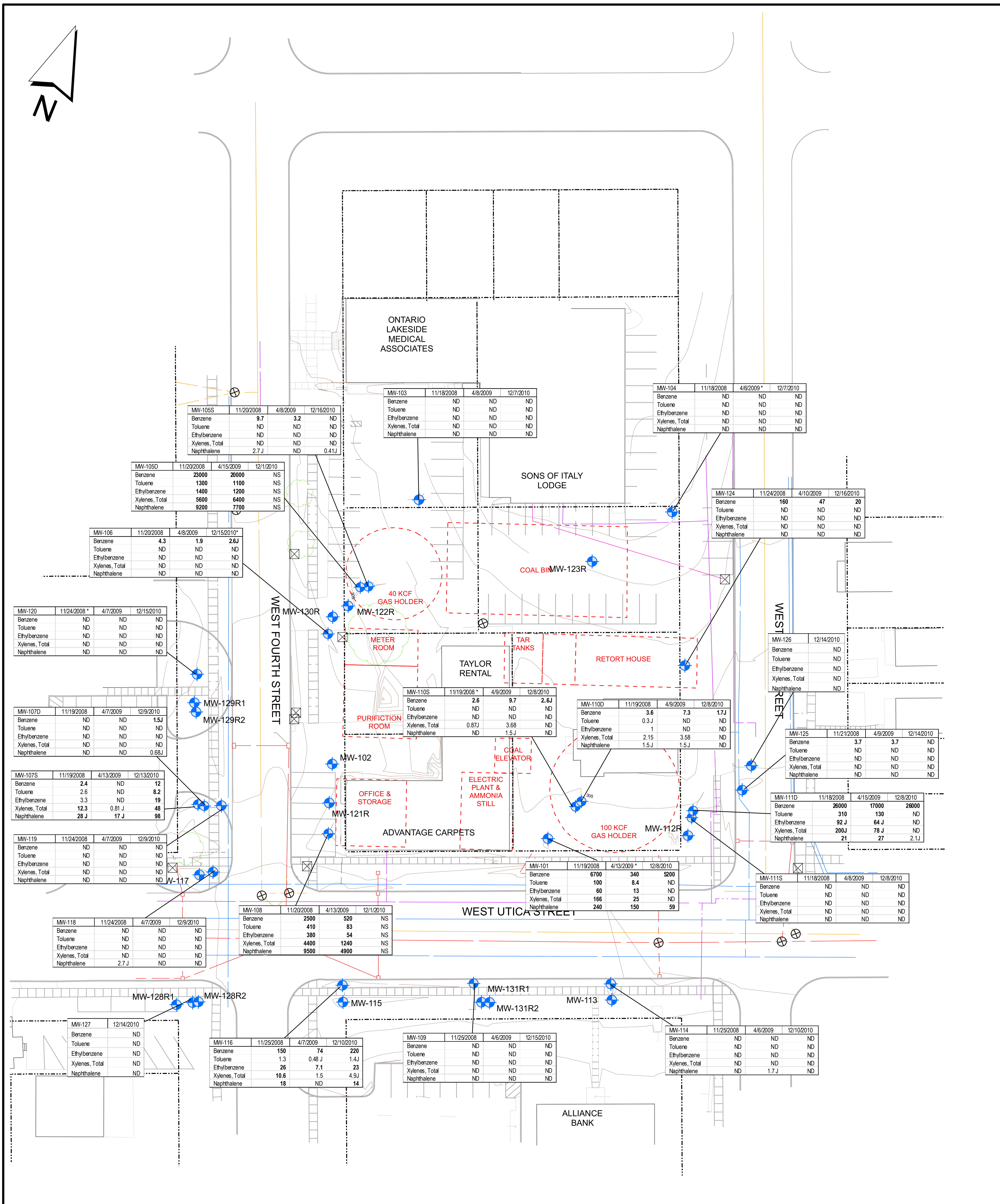
p:/GIS/National_Grid/Oswego/Oswego_Soil_Total_Cyanide_rpt.mxd



MW-105S	11/20/2008	4/8/2009	12/16/2010
Benzene	**9.7**	**3.2**	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	2.7 J	ND	0.41J

MW-103	11/18/2008	4/8/2009	12/7/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-104	11/18/2008	4/6/2009 *	12/7/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-105D	11/20/2008	4/15/2009	12/1/2010
Benzene	**23000**	**20000**	NS
Toluene	**1300**	**1100**	NS
Ethylbenzene	**1400**	**1200**	NS
Xylenes, Total	**5600**	**6400**	NS
Naphthalene	**9200**	**7700**	NS

MW-124	11/24/2008	4/10/2009	12/16/2010
Benzene	**160**	**47**	**20**
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-106	11/20/2008	4/8/2009	12/15/2010*
Benzene	**4.3**	**1.9**	**2.6J**
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-120	11/24/2008 *	4/7/2009	12/15/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-126	12/14/2010
Benzene	ND
Toluene	ND
Ethylbenzene	ND
Xylenes, Total	ND
Naphthalene	ND

MW-110S	11/19/2008 *	4/9/2009	12/8/2010
Benzene	**2.6**	**9.7**	**2.6J**
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	0.87J	3.68	ND
Naphthalene	ND	1.5 J	ND

MW-110D	11/19/2008	4/9/2009	12/8/2010
Benzene	**3.6**	**7.3**	**1.7J**
Toluene	0.3 J	ND	ND
Ethylbenzene	1	ND	ND
Xylenes, Total	2.15	3.58	ND
Naphthalene	1.5 J	1.5 J	ND

MW-107D	11/19/2008	4/7/2009	12/9/2010
Benzene	ND	ND	**1.5J**
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	0.68J

MW-125	11/21/2008	4/9/2009	12/14/2010
Benzene	**3.7**	**3.7**	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-107S	11/19/2008	4/13/2009	12/13/2010
Benzene	**2.4**	ND	**12**
Toluene	2.6	ND	**8.2**
Ethylbenzene	3.3	ND	**19**
Xylenes, Total	**12.3**	0.81 J	**48**
Naphthalene	**28 J**	**17 J**	**98**

MW-111D	11/18/2008	4/15/2009	12/8/2010
Benzene	**26000**	**17000**	**26000**
Toluene	**310**	**130**	ND
Ethylbenzene	**92 J**	**64 J**	ND
Xylenes, Total	**200J**	**78 J**	ND
Naphthalene	**21**	**27**	2.1J

MW-119	11/24/2008	4/7/2009	12/9/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-101	11/19/2008	4/13/2009 *	12/8/2010
Benzene	**6700**	**340**	**5200**
Toluene	**100**	**8.4**	ND
Ethylbenzene	**60**	**13**	ND
Xylenes, Total	**166**	**25**	ND
Naphthalene	**240**	**150**	**59**

MW-111S	11/18/2008	4/8/2009	12/8/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-108	11/20/2008	4/13/2009	12/1/2010
Benzene	**2500**	**520**	NS
Toluene	**410**	**83**	NS
Ethylbenzene	**380**	**54**	NS
Xylenes, Total	**4400**	**1240**	NS
Naphthalene	**9500**	**4900**	NS

MW-118	11/24/2008	4/7/2009	12/9/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	2.7 J	ND	ND

MW-127	12/14/2010
Benzene	ND
Toluene	ND
Ethylbenzene	ND
Xylenes, Total	ND
Naphthalene	ND

MW-116	11/25/2008	4/7/2009	12/10/2010
Benzene	**150**	**74**	**220**
Toluene	1.3	0.48 J	1.4J
Ethylbenzene	**26**	**7.1**	**23**
Xylenes, Total	**10.6**	1.5	4.9J
Naphthalene	**18**	ND	**14**

MW-109	11/25/2008	4/6/2009	12/15/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	ND	ND

MW-114	11/25/2008	4/6/2009	12/10/2010
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	ND	1.7 J	ND

Legend

- Monitoring Well
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line

Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Explanation of terms and abbreviations:
BTEX - Benzene, Toluene, Ethylbenzene, Xylenes
ND - Not Detected
NS - Not Sampled
J - Estimated concentration
Bold Value - Indicates constituent concentration above Class GA Criterion.

Results reported in micrograms per liter (µg/L)

* - Table lists the highest concentration from original and duplicate sample.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 30 60 90 120 Feet

FIGURE 14

BTEX AND NAPHTHALENE IN OVERBURDEN GROUNDWATER

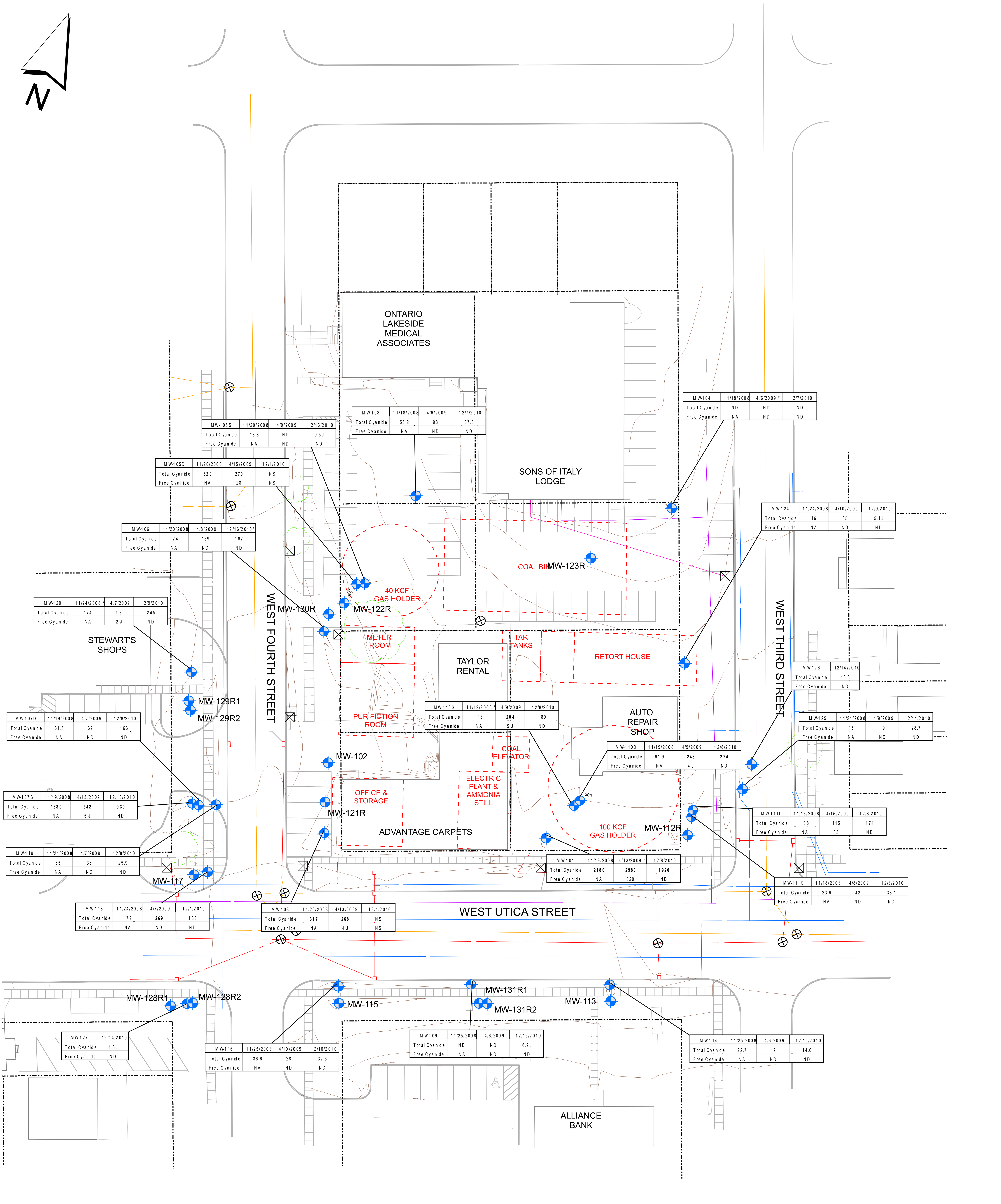
OSWEGO (WEST UTICA ST.) FORMER MGP SITE OSWEGO, NY

DATE 02/07/11

PROJECT NUMBER 139178.103

Brown AND Caldwell Associates

p:\GIS\National_Grid\Oswego\Oswego_BTEX_NAPH_OB_2x3.mxd



Legend

- Monitoring Well
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line

Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Explanation of terms and abbreviations:
ND - Not Detected
NA - Not Analyzed
NS - Not Sampled
J - Estimated concentration
Bold Value - Indicates concentration above Class GA Criterion.

Results reported in micrograms per liter (µg/L)

* - Table lists the highest concentration from original and duplicate sample.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 30 60 90 120 Feet

p:/GIS/National_Grid/Oswego/Oswego_Cyanide_OB_2x3.mxd

FIGURE 15

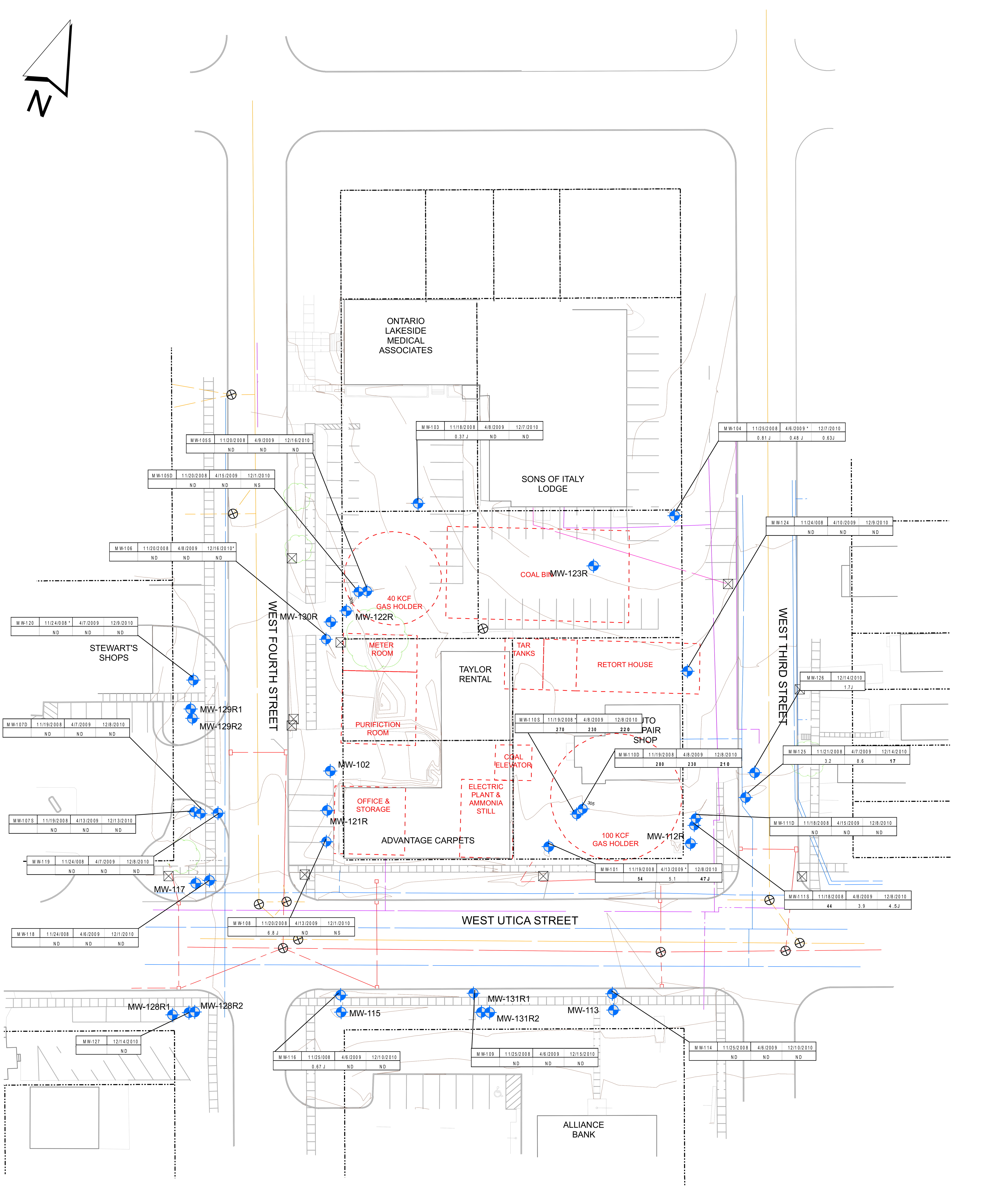
CYANIDE IN OVERBURDEN GROUNDWATER

OSWEGO (WEST UTICA ST.) FORMER MGP SITE OSWEGO, NY

DATE 02/07/11

PROJECT NUMBER 139178.103

Brown AND Caldwell Associates



Legend

- Monitoring Well
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line

Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Explanation of terms and abbreviations:
MTBE - Methyl tert-butyl ether
ND - Not Detected
NS - Not Sampled
J - Estimated concentration
Bold Value - Indicates concentration above Class GA Criterion.

Results reported in micrograms per liter (µg/L)

* - Table lists the highest concentration from original and duplicate sample.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 30 60 90 120
Feet

FIGURE 16

MTBE IN OVERBURDEN GROUNDWATER

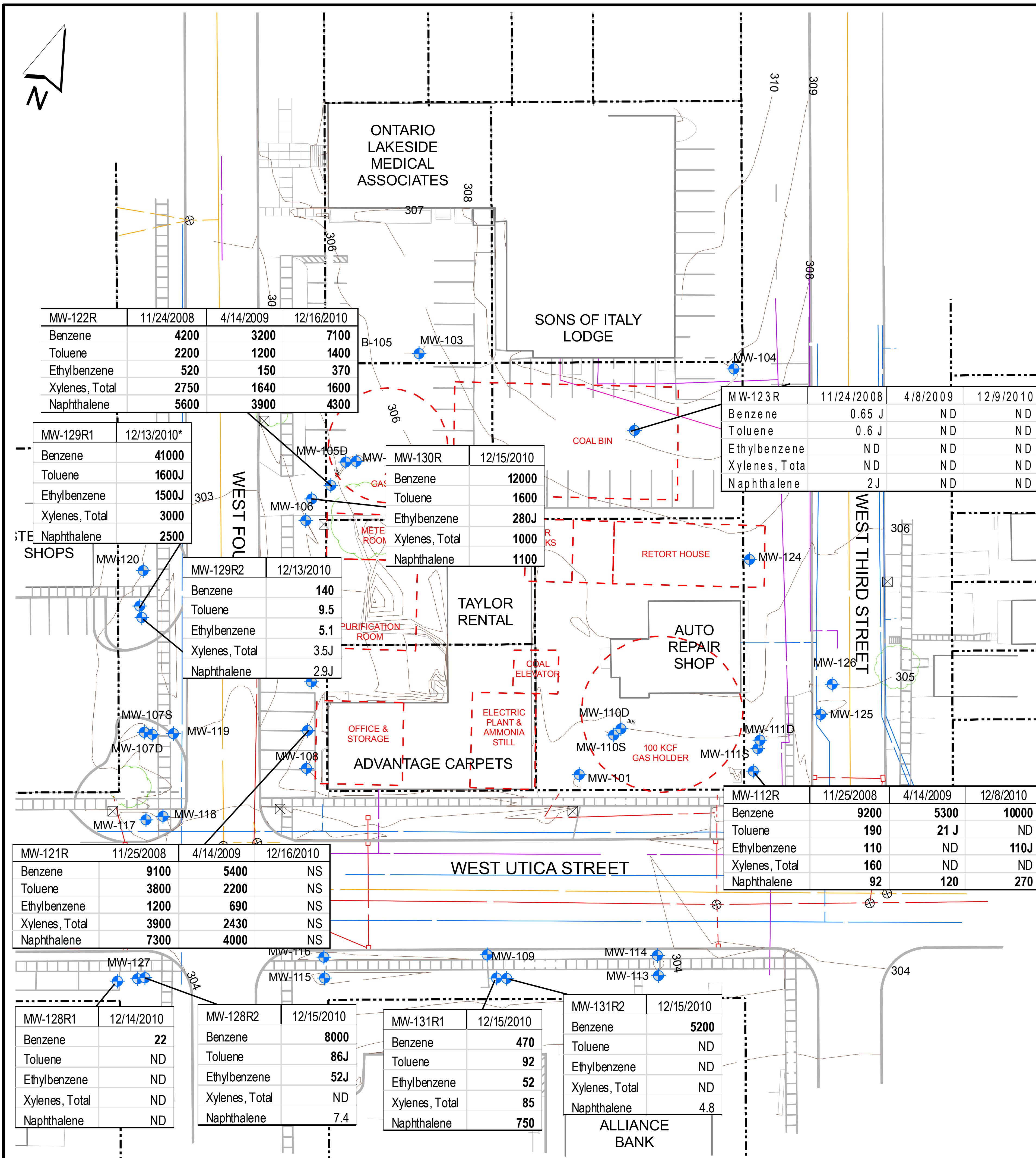
OSWEGO (WEST UTICA ST.) FORMER MGP SITE OSWEGO, NY

DATE 02/07/11

PROJECT NUMBER 139178.103

Brown AND Caldwell Associates

p:/GIS/National_Grid/Oswego/Oswego_MTBE_OB_2x3.mxd



MW-122R	11/24/2008	4/14/2009	12/16/2010
Benzene	**4200**	**3200**	**7100**
Toluene	**2200**	**1200**	**1400**
Ethylbenzene	**520**	**150**	**370**
Xylenes, Total	**2750**	**1640**	**1600**
Naphthalene	**5600**	**3900**	**4300**

MW-129R1	12/13/2010*
Benzene	**41000**
Toluene	**1600J**
Ethylbenzene	**1500J**
Xylenes, Total	**3000**
Naphthalene	**2500**

MW-130R	12/15/2010
Benzene	**12000**
Toluene	**1600**
Ethylbenzene	**280J**
Xylenes, Total	**1000**
Naphthalene	**1100**

MW-129R2	12/13/2010
Benzene	**140**
Toluene	**9.5**
Ethylbenzene	**5.1**
Xylenes, Total	3.5J
Naphthalene	2.9J

MW-123R	11/24/2008	4/8/2009	12/9/2010
Benzene	0.65 J	ND	ND
Toluene	0.6 J	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND
Naphthalene	2 J	ND	ND

MW-112R	11/25/2008	4/14/2009	12/8/2010
Benzene	**9200**	**5300**	**10000**
Toluene	**190**	**21 J**	ND
Ethylbenzene	**110**	ND	**110J**
Xylenes, Total	**160**	ND	ND
Naphthalene	**92**	**120**	**270**

MW-121R	11/25/2008	4/14/2009	12/16/2010
Benzene	**9100**	**5400**	NS
Toluene	**3800**	**2200**	NS
Ethylbenzene	**1200**	**690**	NS
Xylenes, Total	**3900**	**2430**	NS
Naphthalene	**7300**	**4000**	NS

MW-128R1	12/14/2010
Benzene	**22**
Toluene	ND
Ethylbenzene	ND
Xylenes, Total	ND
Naphthalene	ND

MW-128R2	12/15/2010
Benzene	**8000**
Toluene	**86J**
Ethylbenzene	**52J**
Xylenes, Total	ND
Naphthalene	7.4

MW-131R1	12/15/2010
Benzene	**470**
Toluene	**92**
Ethylbenzene	**52**
Xylenes, Total	**85**
Naphthalene	**750**

MW-131R2	12/15/2010
Benzene	**5200**
Toluene	ND
Ethylbenzene	ND
Xylenes, Total	ND
Naphthalene	4.8

Legend

- Monitoring Well
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Explanation of terms and abbreviations:
BTEX - Benzene, Toluene, Ethylbenzene, Xylenes
ND - Not Detected
NS - Not Sampled
J - Estimated concentration.
Bold Value - Indicates constituent concentration above Class GA Criterion.
* - Table lists highest concentration from original and duplicate sample.

Results reported in micrograms per liter (µg/L)

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 17
BTEX AND NAPHTHALENE
IN BEDROCK GROUNDWATER

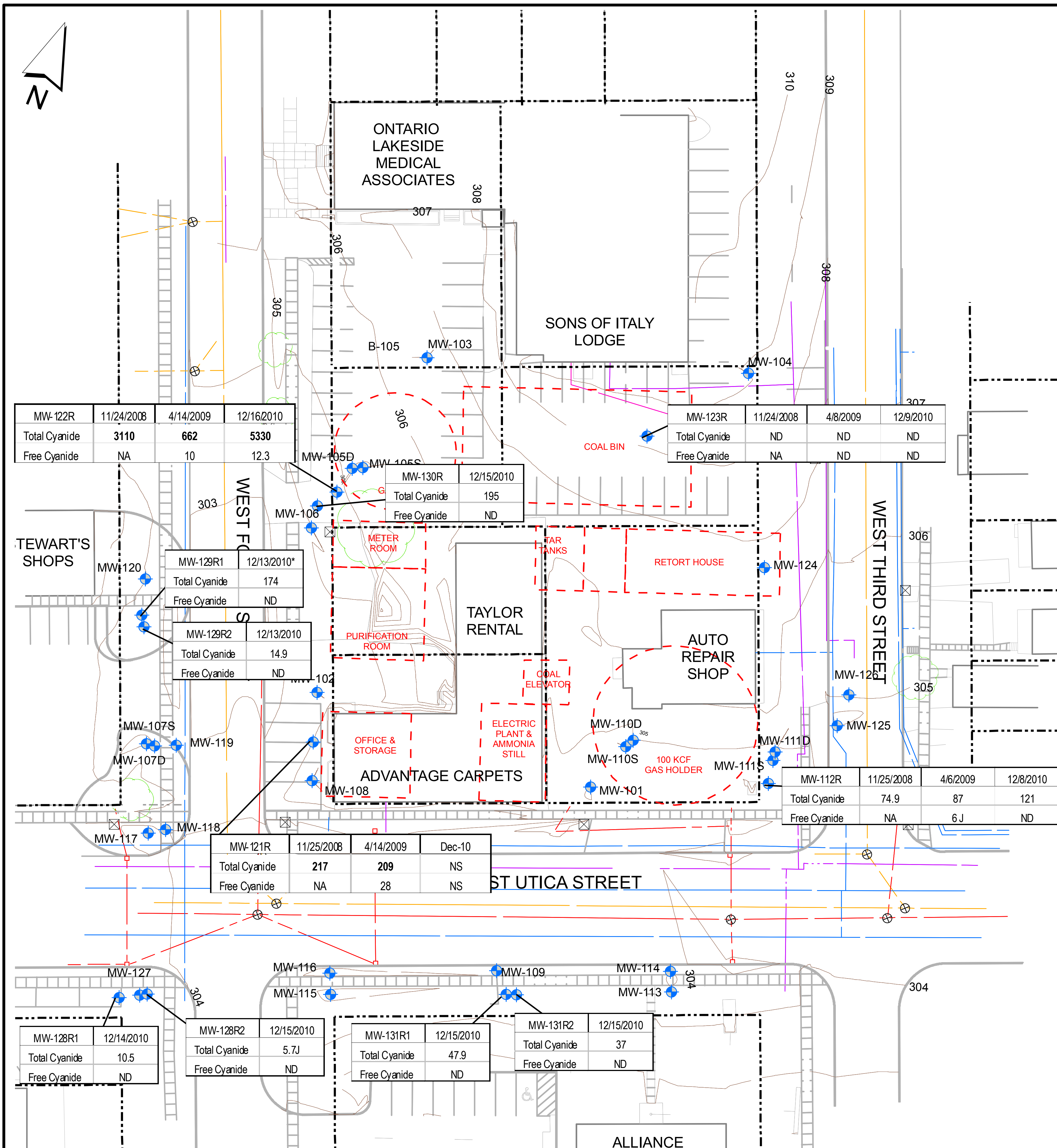
OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE 02/07/11

PROJECT NUMBER 139178.103

Brown AND Caldwell
Associates

p:/GIS/National_Grid/Oswego/Oswego_BTEX_NAPH_BR_(SRIdata)2.mxd



Legend

- Monitoring Well
- Manhole
- Power Pole
- Ground Surface Elevation Contour (ft, NGVD 29)
- Property Line
- Pavement Edge
- Vegetation
- Water Line
- Storm Sewer Line
- Sanitary Sewer Line
- Gas Line
- Former MGP Structure Location. Locations are approximate, based on 1924 Sanborn Fire Insurance Map.

Explanation of terms and abbreviations:
ND - Not Detected
NA - Not Analyzed
NS - Not Sampled
J - Estimated Concentration
Bold Value - Indicates consitituent concentration above Class GA Criterion.

Results reported in micrograms per liter (µg/L)

* - Table lists the highest concentration from the original and duplicate sample.

Source: Base map developed based on drawing prepared by Snyder Engineering & Land Surveying, LLP (January 11, 2005; Revised December 10, 2010). Refer to this drawing for site details.

0 25 50 100 Feet

FIGURE 18
CYANIDE IN BEDROCK GROUNDWATER

OSWEGO (WEST UTICA ST.)
FORMER MGP SITE
OSWEGO, NEW YORK

DATE 02/07/11

PROJECT NUMBER 139178.103

Brown AND Caldwell Associates

p:/GIS/National_Grid/Oswego/Oswego_TOTAL_CN_BR_(SRIdata).mxd

Appendix B: Remedial Alternative Cost Estimates

SUMMARY OF REMEDIAL ALTERNATIVES COST ESTIMATES

Oswego Former MGP Site – OU-1

Remedial Alternative	Capital Cost	Annual O&M Cost	NPW of O&M[3]	Total NPV
1 No Action	$0	$32,000	$628,000	$628,000
2 Removal of Accessible Source Materials, NAPL Extraction, Engineering and Institutional Controls, and Post-Remedial Monitoring Program	$5,970,000	$64,000	$1,255,000	$7,225,000
3 Restoration to Pre-Release Conditions	$14,400,000	$32,000	$147,000	$14,550,000

General Cost Estimate Notes

1) Cost estimates are based on Brown and Caldwell experience, vendor/contractor cost information, and Means Cost Estimating Guid es. Costs are in 2012 dollars.

2) Cost estimates are considered Class 4 Cost Estimates with an expected accuracy of -30% to +50%, which is consistent with USEPA's RI/FS Guidance (USEPA, 1988).

3) Present worth based on a 3% discount factor on a 2-yr operating period for Alternative 4 or 30-year operating period for Alternatives 1, 2 and 3. Per the EPA Guidance, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", July 2000 (EPA 540-R-00-002), for Federal facility sites being cleaned up using Superfund authority, it is generally appropriate to apply the real discount rates found in Appendix C of OMB Circular A-94. Per the Office of Management and Budget website (http://www.whitehouse.gov/omb/ circulars/a094/a094.html#8), the real discount rate as of January 2009 is 2.7% (approximately 3%).

COST ESTIMATE

ALTERNATIVE 1 - NO ACTION

Oswego Former MGP Site – OU-1

CAPITAL COSTS					
ITEM [a]	UNIT [c]	QUANTITY [a]	UNIT COST [d]	INSTALLED COST [e]	NOTES [b]
No Capital Costs					
			TOTAL CAPITAL COSTS	**$ -**	
OPERATIONS AND MAINTENANCE COSTS					
Groundwater Monitoring (Semi-Annual)	ANNUAL	1	$ 32,000	$ 32,000	1
			TOTAL ANNUAL O&M COSTS	**$ 32,000**	
			O&M NET PRESENT VALUE (30 yrs @ 3% discount rate)	**$628,000**	
			TOTAL NET PRESENT VALUE	**$ 628,000**	

Notes:

a: Items and quantities included in this estimate are based on preliminary pre-design information, and may change based on preparation of the final design, revisions to the delineation of treatment/excavation areas, and other revisions.

b: Notes are presented in the pages following the cost tables.

c: LS: Lump Sum, LF: Linear Foot, SY: Square Yard, CY: Cubic Yard, MSF: Thousand Square Feet.

d: Unit costs represent Year 2011 dollars and are estimated based on cost estimating guidance documents and Brown and Caldwell experience.

e: Installed costs are rounded to the nearest hundred, subtotals are rounded to the nearest thousand, and totals are rounded to the nearest ten thousand.

1. Includes semi-annual groundwater sampling of 10 monitoring wells. Cost based on existing project costs for groundwater sampling.

COST ESTIMATE
Alternative 2 - Removal of Accessible Source Materials, NAPL Extraction, Engineering and Institutional Controls, and Post-Remedial Monitoring Program

Oswego Former MGP Site – OU-1

CAPITAL COSTS					
ITEM [a]	UNIT [c]	QUANTITY [a]	UNIT COST [d]	INSTALLED COST [e]	NOTES [b]
Pre-Design Investigation	LS	1	$ 200,000	$ 200,000	1
Temporary Relocation of Businesses and Related Costs	LS	1	$ 800,000	$ 800,000	2
Mobilization and Demobilization	LS	1	$ 192,000	$ 192,000	3
Surveying	LS	1	$ 34,000	$ 34,000	4
Temporary Facilities and Controls	MONTH	5	$ 5,000	$ 25,000	5
Site Clearing and Preparation	LS	1	$ 22,000	$ 22,000	6
Site and Perimeter Air Monitoring	MONTH	5	$ 35,000	$ 175,000	7
Erosion and Sediment Control	LS	1	$ 8,000	$ 8,000	8
Well Decommissioning	EACH	6	$ 5,300	$ 32,000	9
Perimeter Utility Trenching					10
Underground Utility Survey and Mapping	LS	1	$ 3,000	$ 3,000	
Trench Excavation	CY	280	$ 25	$ 7,000	
Utility Capping	LS	1	$ 3,000	$ 3,000	
Excavation Support System	LS	1	$ 860,000	$ 860,000	11
Vibration and Settlement Monitoring	MONTH	4	$ 5,000	$ 20,000	12
Excavation Water Management					13
Dewatering Wells and Piping	LS	1	$ 130,000	$ 130,000	
Treatment System Mobilization & Demobilization	LS	1	$ 25,000	$ 25,000	
Treatment System Rental	MONTH	4	$ 10,000	$ 40,000	
Disposal Fee	GAL	1,800,000	$ 0.12	$ 216,000	
Excavation and Disposal					
Asphalt Removal & Recycling	LS	1	$ 13,000	$ 13,000	14
Soil Excavation	CY	7,000	$ 25	$ 175,000	15
Holder Removal and Material Processing	LS	1	$ 75,000	$ 75,000	16
Backfill Screening Sampling	SAMPLE	7	$ 200	$ 1,000	17
Waste Characterization Sampling	SAMPLE	14	$ 1,000	$ 14,000	18
Odor/Dust Suppressant	MONTH	4	$ 12,000	$ 48,000	19
Transportation and Disposal	TON	8,900	$ 90	$ 801,000	20
Site Restoration					
Reuse of Screened Excavated Soils	CY	1,800	$ 5	$ 9,000	21
Imported Clean Fill Material	CY	5,200	$ 30	$ 156,000	22
Asphalt Pavement (4")	SY	1,100	$ 25	$ 28,000	23
Monitoring Well Installation	EACH	5	$ 2,500	$ 13,000	24
NAPL Recovery Well Installation	EACH	3	$ 10,000	$ 30,000	25
			SUBTOTAL	$ 4,155,000	
Engineering Design & Construction Support		15%		$ 623,000	
			SUBTOTAL	$ 4,778,000	
Contingency		25%		$ 1,195,000	
			TOTAL CAPITAL COSTS	**$ 5,970,000**	
OPERATIONS AND MAINTENANCE COSTS					
Groundwater Monitoring (Semi-Annual)	ANNUAL	1	$ 32,000	$ 32,000	26
NAPL Recovery (Quarterly)	ANNUAL	1	$ 6,000	$ 6,000	27
Engineering and Institutional Controls					
Inspection and Maintenance	ANNUAL	1	$ 26,000	$ 26,000	28
			TOTAL O&M ANNUAL COST	**$ 64,000**	
			O&M NET PRESENT VALUE (30 yrs @ 3% discount rate)	**$ 1,255,000**	
			TOTAL NET PRESENT VALUE	**$ 7,225,000**	

COST ESTIMATE

Alternative 2 - Removal of Accessible Source Materials, NAPL Extraction, Engineering and Institutional Controls, and Post-Remedial Monitoring Program

Oswego Former MGP Site – OU-1

Notes:

a: Items and quantities included in this estimate are based on preliminary pre-design information, and may change based on preparation of the final design, revisions to the delineation of treatment/excavation areas, and other revisions.

b: Notes are presented in the pages following the cost tables.

c: LS: Lump Sum, LF: Linear Foot, SY: Square Yard, CY: Cubic Yard, GAL: Gallon.

d: Unit costs represent Year 2011 dollars and are estimated based on cost estimating guidance documents and Brown and Caldwell experience.

e: Installed costs are rounded to the nearest hundred, subtotals are rounded to the nearest thousand, and totals are rounded to the nearest ten

1. Cost based on previous project experience and includes delineation activities, geotechnical borings to support excavation design, and pumping tests to support dewatering estimates.

2. Cost provided by National Grid.

3. Lump sum based on previous project experience; 10% of capital construction costs (not including transportation and disposal and separate mobilization costs). Includes mobilization of contractor's equipment and personnel, submittals, and project administration.

4. Cost based on previous project experience. Includes general site surveying such as pre-existing conditions, post-excavation, and final

5. Cost based on previous project experience. Includes contractor temporary facilities and utilities such temporary support facilities, health and safety, electric, and water.

6. Cost based on Construction Means reference guides and previous project experience. Includes minor site brush and debris clearing, construction access roads, temporary fence installation, tree removal, miscellaneous site preparation activities.

7. Cost based on previous project experience. Includes site and perimeter air monitoring system with 4 stations and air sampling.

8. Cost includes silt fence installed along the perimeter of the excavation area. Assumes 25% of silt fence will require replacement during construction activities.

9. Includes 4 overburden and 2 bedrock wells within limits of excavation to be decommissioned. Cost based on previous project experience.

10. Trenching will be performed along the perimeter of the excavation area. Assumes excavated soils will be staged for off-site disposal. The estimated trench dimensions are 750 linear ft, 2 feet wide and 5 feet deep. Estimated volume of trench excavation = 280 cy.

11. Cost based on $50/vertical SF (previous project experience). Assumes excavation area will consist of five separate cells and internal bracing.

12. Cost include vibration and settlement monitoring for the duration of the construction activities. Cost based on previous project experience.

13. Assumes that dewatering will be required starting at 5 feet bgs. Includes installation of 20 dewatering wells and an on-site carbon treatment system. Assumes treated water can be discharged to the local POTW. Assumes treated water will be non-hazardous. Disposal fee is based on quote from local POTW. Estimated dewatering rate of 50 gpm for 8 hrs per day during excavation and backfilling. Dewatering system cost based on BC experience. On-site treatment system cost based on contractor quote and includes mobilization.

14. Assumes existing asphalt pavement thickness is 4 inches and removed asphalt would be sent off-site for recycling. Cost based on previous project experience.

15. Cost includes excavation and handling of soils. Cost based on previous project experience.

ALTERNATIVE 2 - Excavation Vol. Est.	Area (sf)	Depth (ft)	Volume (bcy)	Weight* (tons)
Area 1 - Gas Holder	4,150	22	3,400	5,800
Area 2 - Excavation to Bedrock (18 ft bgs)	2,500	18	1,700	2,900
Area 3 - Excavation to 15 ft bgs	3,410	15	1,900	3,200
Totals	**10,060**		**7,000**	**11,900**

* Soil weight assumes a soil density = 1.7 tons/cy.

16. Holder construction details are not known. A nominal cost of $75,000 was assumed for removal and material processing.

17. Cost includes laboratory analysis of visually screened soil for possible reuse as backfill. Assumes 1 sample per 500 cy will be submitted for analysis. Cost based on previous project experience.

18. Includes cost for laboratory analysis for waste characterization. Assumes 1 sample per 500 cy of excavated soil will be submitted for analysis. Cost based on previous project experience.

19. Includes odor foam suppressant system. Cost based on previous project experience. Cost includes sprayer rental ($3700/month), product ($350/drum) and one full time laborer. Assumes 1 drum/day during excavation activities.

20. Assumes 75% of excavated soils will be disposed off-site. Includes cost for transportation and disposal to a LTTD facility. Assumes a soil density = 1.7 tons/CY.

21. Assumes 25% of excavated soils can be reused as backfill. Cost includes backfilling from existing stockpiles. Cost based on previous project experience. Volumes estimates are shown in table below.

22. Cost includes certified clean imported fill material. Cost based on previous project experience. Volumes estimates are shown in table below.

Backfill	Volume (bcy)
Reuse 25% of excavated soils	1,800
Imported Clean Fill	5,200

23. Includes installation of 4 inches of asphalt pavement. Cost based on previous project experience.
24. Includes installation of 5 new monitoring wells (25 ft deep). Cost based on previous project experience.
25. Includes installation of 3 product recovery wells in the overburden. Cost based on previous project experience.
26. Includes semi-annual groundwater sampling of 10 monitoring wells for one year. Cost based on existing project costs.
27. Includes quarterly NAPL recovery events and assumes one 55-gallon drum of waste generated per event. Cost based on previous project experience.
28. Includes engineering and institutional controls inspection/documentation (assumed 2 inspections per year). Includes an allowance of $5,000 for miscellaneous O&M (e.g., asphalt repairs). Includes costs for preparation of an annual O&M report in accordance with the NYSDEC Guidance Document DER-10 entitled "Technical Guidance for Site Investigation and Remediation". The O&M report would also include the annual certification of institutional and engineering controls.

Construction Duration*	Volume	Days	Weeks
Site Preparation including asphalt removal	N/A	10	2
Soil Excavation	7,000	70	14
Backfill**	7,000	5	1
	TOTAL	**85**	**17**

*Assumes excavation rate of 500 cy/week and 500 cy/week for backfill.
**Assumes backfilling can be done concurrently with excavation with a 1 week lag.

COST ESTIMATE
Alternative 3 - Restoration to Pre-Release Conditions

Oswego Former MGP Site – OU-1

CAPITAL COSTS					
ITEM [a]	UNIT [c]	QUANTITY [a]	UNIT COST [d]	INSTALLED COST [e]	NOTES [b]
Pre-Design Investigation	LS	1	$ 300,000	$ 300,000	1
Mobilization and Demobilization	LS	1	$ 389,000	$ 389,000	2
Surveying	LS	1	$ 34,000	$ 34,000	3
Temporary Facilities and Controls	MONTH	11	$ 5,000	$ 55,000	4
Site Clearing and Preparation	LS	1	$ 23,000	$ 23,000	5
Site and Perimeter Air Monitoring	MONTH	11	$ 35,000	$ 385,000	6
Erosion and Sediment Control	LS	1	$ 9,000	$ 9,000	7
Well Decommissioning	EACH	6	$ 5,300	$ 32,000	8
Perimeter Utility Trenching					9
Underground Utility Survey and Mapping	LS	1	$ 5,000	$ 5,000	
Trench Excavation	CY	310	$ 25	$ 8,000	
Utility Capping	LS	1	$ 10,000	$ 10,000	
Building Demolition, Temporary Business Relocation and Related Costs	LS	1	$ 2,700,000	$ 2,700,000	10
Excavation Support System	LS	1	$ 1,673,000	$ 1,673,000	11
Vibration and Settlement Monitoring	MONTH	10	$ 5,000	$ 50,000	12
Excavation Water Management					13
Dewatering Wells and Piping	LS	1	$ 220,000	$ 220,000	
Treatment System Mobilization & Demobilization	LS	1	$ 25,000	$ 25,000	
Treatment System Rental	MONTH	10	$ 10,000	$ 100,000	
Disposal Fee	GAL	4,656,000	$ 0.12	$ 559,000	
Excavation and Disposal					
Asphalt Removal & Recycling	LS	1	$ 19,000	$ 19,000	14
Soil Excavation	CY	18,900	$ 25	$ 473,000	15
Holder Removal and Material Processing	LS	1	$ 75,000	$ 75,000	16
Backfill Screening Sampling	SAMPLE	19	$ 200	$ 4,000	17
Waste Characterization Sampling	SAMPLE	38	$ 1,000	$ 38,000	18
Odor/Dust Suppressant	MONTH	10	$ 12,000	$ 120,000	19
Transportation and Disposal	TON	24,200	$ 90	$ 2,178,000	20
Site Restoration					
Reuse of Screened Excavated Soils	CY	4,700	$ 5	$ 24,000	21
Imported Fill Material	CY	14,200	$ 30	$ 426,000	22
Asphalt Pavement (4")	SY	2,800	$ 25	$ 70,000	23
Monitoring Well Installation	EACH	5	$ 2,500	$ 13,000	24
			SUBTOTAL	$ 10,017,000	
Engineering Design & Construction Support		15%		$ 1,503,000	
			SUBTOTAL	$ 11,520,000	
Contingency		25%		$ 2,880,000	
			TOTAL CAPITAL COSTS	**$ 14,400,000**	
OPERATIONS AND MAINTENANCE COSTS					
Groundwater Monitoring (Semi-Annual)	ANNUAL	1	$ 32,000	$ 32,000	25
			TOTAL O&M ANNUAL COST	**$ 32,000**	
			O&M NET PRESENT VALUE (5 yrs @ 3% discount rate)	**$147,000**	
			TOTAL NET PRESENT VALUE	**$ 14,550,000**	

COST ESTIMATE
Alternative 3 - Restoration to Pre-Release Conditions

Oswego Former MGP Site – OU-1

Notes:

a: Items and quantities included in this estimate are based on preliminary pre-design information, and may change based on preparation of the final design, revisions to the delineation of treatment/excavation areas, and other revisions.

b: Notes are presented in the pages following the cost tables.

c: LS: Lump Sum, LF: Linear Foot, SY: Square Yard, CY: Cubic Yard, GAL: Gallon.

d: Unit costs represent Year 2011 dollars and are estimated based on cost estimating guidances and Brown and Caldwell experience.

e: Installed costs are rounded to the nearest hundred, subtotals are rounded to the nearest thousand, and totals are rounded to the nearest ten thousand.

1. Cost based on previous project experience and includes delineation activities, geotechnical borings to support excavation design, and pumping tests to support dewatering estimates, and pre-demolition building surveys (lead, asbestos, etc.).

2. Lump sum based on previous project experience; 10% of capital construction costs (not including building demolition and waste transportation and disposal). Includes mobilization of contractor's equipment and personnel, submittals, and project administration.

3. Cost based on previous project experience. Includes general site surveying such as pre-existing conditions, post-excavation, and final conditions survey. Also includes structural evaluation/survey of the building prior to the start of vibration and settlement monitoring.

4. Cost based on previous project experience. Includes contractor temporary facilities and utilities such temporary support facilities, decontamination pad and staging, health and safety, electric, and water.

5. Cost based on Construction Means reference guides and previous project experience. Includes minor site brush and debris clearing, construction access roads, temporary fence installation, tree removal, miscellaneous site preparation activities.

6. Cost based on previous project experience. Includes site and perimeter air monitoring system with 4 stations and air sampling.

7. Cost includes silt fence installed along the perimeter of the excavation area. Assumes 25% of silt fence will require replacement during construction activities.

8. Includes 4 overburden and 2 bedrock wells within limits of excavation that would need to be decommissioned.

9. Trenching will be performed along the perimeter excavation area. Assumes excavated soils will be staged for off-site disposal. The estimated trench dimensions are 850 linear ft, 2 ft wide and 5 ft deep. Estimated volume of trench excavation = 310 cy.

10. Demolition costs based on BC experience and cost estimating guidances. Demolition cost includes demolition of the buildings and foundation slabs and disposal of the demolition debris. Temporary businesses relocation and related costs provided by National Grid.

11. Cost based on $50/vertical SF (previous project experience). Assumes excavation area will consist of four separate cells and internal bracing.

12. Cost include vibration and settlement monitoring for the duration of the construction activities. Cost based on previous project experience.

13. Includes installation of 40 dewatering wells and an on-site carbon treatment system. Assumes treated water can be discharged to the local POTW. Estimated dewatering rate of 50 gpm for 8 hrs per day during excavation and backfilling. Assumes treated water will be non-hazardous. Disposal fee is based on quote from local POTW. Costs based on BC experience.

14. Assumes existing asphalt pavement thickness is 4 inches and removed asphalt will be sent off-site for recycling. Cost based on previous project experience.

15. Cost includes excavation and handling of soils. Cost based on previous project experience.

ALTERNATIVE 4 - Excavation Vol. Est.	Area (sf)	Depth (ft)	Volume (bcy)	Weight* (tons)
Soil Excavation	25,500	20	18,900	32,200

* Soil weight assumes a soil density = 1.7 tons/cy.

16. Holder construction details are not known. A nominal cost of $75,000 was assumed for removal and material processing.

17. Cost includes laboratory analysis of visually screened soil for possible reuse as backfill. Assumes 1 sample per 500 cy will be submitted for analysis. Cost based on previous project experience.

18. Includes cost for laboratory analysis for waste characterization. Assumes 1 sample per 500 cy of excavated soil will be submitted for analysis. Cost based on previous project experience.

19. Includes odor foam suppressant system. Cost based on previous project experience. Cost includes sprayer rental ($3700/month), product ($350/drum) and one full time laborer. Assumes 1 drum/day during excavation activities.

20. Assumes 75% of excavated soils will be disposed off-site. Includes cost for transportation and disposal to a LTTD facility. Assumes a soil density = 1.7 tons/CY.

21. Assumes 25% of excavated soils can be reused as backfill. Cost includes backfilling from existing stockpiles. Cost based on previous project experience. Volumes estimates are shown in table below.

22. Cost includes certified clean imported fill material. Cost based on previous project experience. Volumes estimates are shown in table below.

Site Restoration	Volume (CY)
Reuse 25% of excavated soils	4,700
Imported Clean Fill	14,200

COST ESTIMATE
Alternative 3 - Restoration to Pre-Release Conditions

Oswego Former MGP Site – OU-1

23. Includes installation of 4 inches of asphalt pavement. Cost based on previous project experience.
24. Includes installation of 5 new monitoring wells (25 ft deep). Cost based on previous project experience.
25. Includes semi-annual groundwater sampling of 10 monitoring wells for one year. Cost based on existing project costs.

Construction Duration*	Volume	Days	Weeks
Site Preparation, including asphalt removal	N/A	10	2
Soil Excavation	18,900	189	38
Backfill**		5	1
	TOTAL	**204**	**41**

*Assumes excavation rate of 500 cy/week and 500 cy/week for backfill.
**Assumes backfilling can be done concurrently with excavation with a 1 week lag.