NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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July 10, 2018

John J. Ruspantini, CHMM, PMP
Manager – Program/Projects
Projects/Environmental Remediation
New York State Electric & Gas (NYSEG)
P.O. Box 5224
Binghamton, NY 13902-5224

Re: Remedial Design Work Plan, June 2018
NYSEG-Elmira, Water Street MGP, Site #: 808025
Elmira, Chemung County

Dear Mr. Ruspantini:

The New York State Department of Environmental Conservation (Department) have reviewed the response letter and the revised Remedial Design Work plan (RDWP) dated June 4, 2018 prepared by GEI. The revised RDWP is hereby approved.

Please place the approved RDWP in the repositories established for the site. Please submit the final detailed schedule for implementation of the approved RDWP within 15 days of the date of this letter. If you have any questions, please contact Project Manager, Parag Amin at 518-402-9648 or at parag.amin@dec.ny.gov.

Sincerely,

David Crosby, P.E.
Section Chief
Remedial Bureau C
Division of Environmental Remediation

ecc: J. Edwards, GEI Consultant (
S. McLaughlin, NYSDOH
J. Deming, NYSDOH
P. Amin, DER

June 4, 2018

Mr. Parag Amin, P.E.
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway
Albany, NY 12233-7014

Consulting Engineers and Scientists

RE: Response to NYSDEC and NYSDOH Comments
NYSEG Elmira Water Street MGP Remedial Design Work Plan
NYSDEC Site # 808025
Index #: D0-0002-9309

Dear Mr. Amin:

On behalf of our client, NYSEG, GEI Consultants, Inc., P.C. (GEI) has prepared this letter to respond to the New York State Department of Environmental Conservation's (NYSDEC's) and the New York State Department of Health's (NYSDOH's) comments (dated May 14, 2018) on the Remedial Design Work Plan (RDWP) for the Elmira Water Street Manufactured Gas Plant (MGP) site (dated April 26, 2018). NYSDEC's and NYSDOH's comments are provided in italics, followed by our responses.

1. ***Comment:*** *Section 1.8.1: Please use the exact language of the RAOs from the approved March 2017 ROD.*

   Response: The text has been modified to reflect the exact language included in the ROD.

2. ***Comment****: Section 1.8.2: Note that any reduction to the groundwater monitoring program will require NYSDEC approval prior to implementation.*

   Response: The text has been added as requested.

3. ***Comment:*** *Section 1.8.2: Please add to the last paragraph, "_and requires compliance with the Department approved site management plan."*

   Response: The text has been added as requested.

4. ***Comment****: Section 3.3: Add bullet indicating that confirmatory samples will be collected in accordance with DER-10.*

   Response: A discussion of confirmatory sampling has been added to the RDWP as requested.

5. ***Comment****: Section 3.6: Please indicate who will be responsible for transmitting CAMP reports and exceedance information to NYSDEC and NYSDOH.*

   Response: Text has been added to indicate that the Engineer will transmit the reports and exceedance information to the agencies.

GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N, Ithaca, NY 14850
607.216.8955 fax: 607.274.7577

6. ***Comment**: Section 3.8: Please indicate that if an access agreement is determined to be required based on identified contamination or other factors, then one will be obtained from NYSDEC for this property.*

   Response: The text has been added as requested.

7. ***Comment**: Section 3.12, Traffic control: "Road closings, should they be necessary, will be conducted by obtaining the required permits from the City of Elmira, and then erecting the required NYSDOH barricades and notification signs at the NYSDOT-specified distances from the closed roadways." I do not believe this is a NYSDOH requirement. Please revise.*

   Response: The text has been changed to indicate that the barricades are a NYSDOT requirement.

8. ***Comment**: Section 3.1.2: 16. Note that truck/machinery idling should be managed/controlled as necessary, and should not be allowed for excessive periods of time on the site or nearby streets/roadways.*

   Response: The text has been added as requested.

9. ***Comment**: Section 3.1.7: Please provide this to the NYSDOH prior to or with the first CAMP submittal and state that the discussed background CAMP data will be collected prior to ground intrusive activities.*

   Response: The text has been added as requested to indicate submittal of the background data to the NYSDOH prior to the start of the intrusive activities.

10. ***Comment**: Section 3.1.7: Please refer to both categories as "action limits" as actions are needed at the lower level (alert limit) too. Additionally, this language implies the action limits are set at a level that would trigger health effects, which is misleading.*

    Response: The text has been modified to indicate that both categories are Action Limits.

11. ***Comment**: Section 3.1.7: "If the real-time perimeter Action Limits are exceeded or significant nuisance odors are noted, NYSEG, the Engineer, and the Remedial Contractor will consult to determine what type of emission control action is appropriate." Please remove the word "significant" and include that community complaints will also trigger these actions as olfactory sensitivity may be an issue.*

    Response: The text has been modified as requested.

12. ***Comment**: Section 3.1.7: Please ensure that odor suppressing products are on-site prior to activities commencing for immediate use if needed.*

    Response: Text indicating that the Remedial Contractor will provide chemical foam (Rusmar Foam®) was included in Section 3.18 of the RDWP. Text indicating the potential use of chemical foam has been added to the CAMP. The requirements for odor management will be included in the Technical Specifications, including the requirement to have the equipment present on the site during intrusive activities and soil management tasks.

13. ***Comment**: Section 3.32: Please indicate if a dewatering station will be in use or how wet soils will be addressed. This level of detail can be provided in the Remedial Design.*

Response: The text has been added as requested. Details will be provided in the Remedial Design.

14. ***Comment****: Section 3.34: Confirmatory excavation bottom and sidewall samples are recommended to be collected in accordance with DER-10. If the excavated material goes all the way to the excavation support system, however, and the system is well within the unimpacted zone then the proposal for no sidewall sample collection is supported. Note that sufficient data is required to verify that the remedial goals of the ROD are met.*

    Response: A discussion of confirmatory samples for the excavation sidewalls and bottom has been added as requested. As the NYSDEC has indicated, the approach for sidewall sample collection will need to be confirmed with the NYSDEC during implementation of the Remedial Action.

15. ***Comment****: Section 3.45.2: Please remove the statement in the first paragraph indicating that the CAMP is guidance and reference the site's approved CAMP in Appendix F and state that it will be followed.*

    Response: The text has been modified as requested.

Appendix F - Community Air Monitoring Plan:

1. ***Comment****: Section 2.1: Please indicate that both a data sheet and a figure/map will be provided showing CAMP data and station locations.*

    Response: The text has been added as requested. A figure will be provided showing data stations and locations.

2. ***Comment****: Section 2.1: "Where the work area is less than 20 feet from the nearest occupied building, the downwind air monitoring station will be positioned at the air intake for the building or..." Special requirements are not expected to be applicable here (no nearby buildings) unless there are other activities where people may be exposed to site contaminants (ex. if a flea market is set up on the pavement outside the site or picnic area nearby). If there are specific potential exposure scenarios, such as these, the CAMP should be modified with DOH acceptance to be protective of potentially exposed people.*

    Response: The text has been modified as requested. Buildings are not present at the site. If a potential exposure scenario is identified (such as the set-up of a flea or farmers market adjacent to the work area), the CAMP will be modified by the Engineer in consultation with the NYSDEC and the NYSDOH.

3. ***Comment****: Section 2.2: I recommend use of a wind sock or other visible indicator to facilitate accurate downwind direction detection.*

    Response: Text regarding the use of a wind sock or other visible indicator has been added to the CAMP.

4. ***Comment****: Section 2.3, Table 1: Remove special requirements language unless determined to be applicable.*

Response: Special requirement language has been removed as requested. Should special conditions be identified during implementation of the remedial action, modifications to the CAMP will be proposed to, and approved by the NYSDEC and the NYSDOH.

5. ***Comment****: Section 2.3, Table 1, Particulates: "Continue work if downwind PM-10 particulate levels are <150 µg/m3 above upwind levels and no visual dust leaving site." Please replace "Continue" with "Resume".*

   Response: The text has been modified as requested.

6. ***Comment****: Section 2.4: Note what criteria will be used to result in stopping work or implementing additional odor suppressing measures, etc. Also include what will happen if community complaints are received.*

   Response: Upon detection of odors at the site perimeter by the staff implementing the CAMP, the Construction Manager and Engineer will be notified. The Construction Manager will direct the Remedial Contractor to implement the odor controls identified in the Technical Specifications (the application of chemical foam or equivalent). The application will continue until the odors are reduced to acceptable levels. The application will continue for the excavation or soil management process until it is demonstrated that the odor control measures are effective.

   If community complaints are received, the Construction Manager will stop the excavation or soil management task. The complaint will be communicated to NYSEG, the Engineer and the NYSDEC and NYSDOH. The Construction Manager will then direct the Remedial Contractor to apply odor suppressant materials (chemical foam). The field activities will not resume until corrective measures have been demonstrated to be effective by the Construction Manager and Engineer with input from the CAMP monitoring staff. A summary of the complaint, and the measures implemented to address the complaint, will be included in the Daily Reports and distributed to the NYSDEC and the NYSDOH.

7. ***Comment****: Section 3.3: Note that Biosolve may not be effective (ex. Smith street MGP, Herkimer another product (foam) had to be used). Consider contingency odor control options that allow for continuation of work with active odor suppression.*

   Response: Text indicating that the Remedial Contractor will provide chemical foam (e.g., Rusmar Foam®) was included in the RDWP. The text has been added to the CAMP as requested. Based on GEI's and NYSEG's experience at other sites, it is agreed that chemical foam is the most effective control for mitigating odors at MGP sites during soil excavation and management tasks.

8. ***Comment****: Section 4: Please include a map with daily wind rose with CAMP submittals.*

   Response: A map with a daily wind rose will be included in the submittals.

9. ***Comment****: Attachment A: CAMP Data Sheet: I recommend including the start and end time of ground intrusive and potentially impacted material handling as well as action levels in the table.*

   Response: The data sheet has been modified to include the start and end time as requested.

Citizen Participation Plan:

1. ***Comment****: Section 4, Remedy Selection: "The NYSDEC prepared and issued a Proposed Remedial Action Plan (PRAP) and the public had the opportunity to ask questions and comment on the proposed site remedy. The NYSDEC has issued a Record of Decision (ROD) for the selected remedy for site cleanup." Please indicate that NYSDOH concurrence was provided as well.*

   Response: Text has been added to indicate NYSDOH concurrence for the ROD.

NYSDEC's Comments provided in email correspondence dated May 3, 2018.

1. ***Comment****: Samples collected for VOC analysis cannot be composited.*

   Response: The RDWP indicated that the samples collected for import soil characterization would include a composite sample, and also discrete grab samples for VOCs. It was the intent of the work plan to indicate that for the composite sample, the soil for VOCs would be collected from the aliquot collected for the composite sample for SVOCs, inorganics, PCBs, and pesticides before compositing. Then, additional non-composited grab samples would also be collected from the import soil source pile. The RDWP text has been revised to clarify that no VOC analyses will be performed for any of the composited soil for import soil characterization. Only discrete grab samples will be collected for VOC analyses.

2. ***Comment****: VOC samples should be collected using Method 5035A.*

   Response: The work plan text has been revised to indicate that for the import soil characterization task that the VOC analyses will be performed using Methods 5035A/8260C.

3. ***Comment****: It seems that one composite sample is proposed be collected from 0-30' for three borings to be installed outside the gas holder foot print but within the excavation support. That seems like excessive compositing.*

   Response: GEI has contacted the operators of the thermal treatment facility (ESMI) and the landfill facilities (Ontario and Seneca Meadows). Based on correspondence from the operators, the compositing of the representative soil material is required by the facilities to sufficiently characterize the soil for waste profiling and disposal purposes. Discrete grab samples are not accepted because the facility operators do not consider grab samples (even if composited together) to be sufficiently representative of the targeted soil material.

   It is GEI's opinion that one soil boring, and one sample which is inclusive of some soil from the entire 30 foot interval would be best representative of the material being characterized for disposal from the area between the holder and the excavation support. The composited soil would then be analyzed for the constituents specified by the receiving facility. Based on the data collected during the RI, impacted soil was not identified in the area between the wall and the support structure, and is not anticipated to be encountered in the remedial action. The compositing of soil from the borings is not considered to represent a concern for the proper characterization of the waste soil from this area.

4. ***Comment****: Though not mentioned in the work plan, 3-5 discrete samples from different depths should be homogenized to prepare a single composite.*

Response: It is GEI's understanding that collecting 3-5 samples from different depths is applicable for the characterization of import soil, or soil intended for reuse according to the specifications of DER10 Table 5.4 (e) 10.

However, for waste soil profiling and disposal, the collection of 3-5 samples from different depths is not applicable according to the information provided by the thermal treatment and landfill operators regarding their standard operating procedures (discussed above). Also, the methods proposed for the RDWP for waste soil profiling are consistent with GEI's and NYSEG's previous experience at other sites for implementing the profiling and disposal tasks.

A revised RDWP is attached for NYSDEC review and approval. Please feel free to contact me at (607) 216-8958 with any questions you may have regarding the information provided in this letter. Please direct the Department's official comments or response to John Ruspantini, NYSEG's Project Manager for the Elmira Water Street site.

Sincerely,

GEI CONSULTANTS, INC., P.C.

James Edwards, P.G.
Project Manager

Daniel Kopcow, P.E., PMP
Senior Engineer

Attachment: Revised RDWP

JHE:mlr

c: John Ruspantini, CHMM, PMP – NYSEG
Scarlett McLaughlin – NYSDOH
P.J. Snyder, P.E. – GEI

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GEI Consultants

Consulting
Engineers and
Scientists

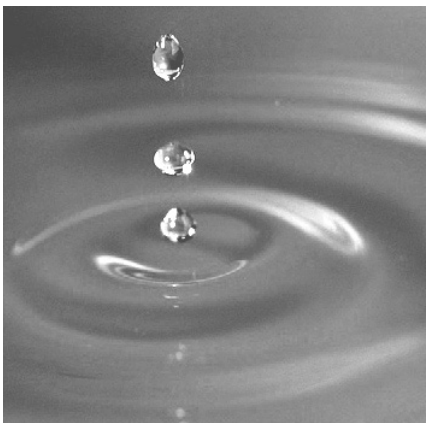
Remedial Design Work Plan
Elmira Water Street Manufactured Gas Plant Site
City of Elmira, New York

NYSDEC Site #808025
Index #: D0-0002-9309

Submitted to:
NYSEG
18 Link Drive
Binghamton, NY 13902-5224

Submitted by:
GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

June 4, 2018
Project # 1704633



PJ Snyder, P.E.
Senior Engineer

Reviewed by:

Daniel R. Kopcow, P.E., PMP
Senior Engineer

Engineer's Certification

In accordance with NYSDEC DER-10 Section 1.5 (b) 1, I, Daniel Kopcow, certify that I am currently a New York State registered professional engineer and that this Remedial Design Work Plan was prepared in accordance with all applicable statutes and regulations, and in substantial conformance with the New York State Department of Environmental Conservation, Division of Environmental Remediation DER10 / Technical Guidance for Site Investigation and Remediation.

6/4/2018

Engineer's Seal
GEI Consultants, Inc., P.C.

Date

It is a violation of New York State Education Law for any person, unless acting under the direction of a licensed professional engineer, to alter in any way plans, specifications, plates, and reports to which the seal of a professional engineer has been applied. If an item bearing the seal of an engineer or land surveyor is altered, the altering engineer shall seal the item and add the notation "altered by", sign and date such alteration, and provide a specific description of the alteration.

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Abbreviations and Acronyms

ACM	Asbestos Containing Material
AOC	Area of Concern
ASTM	ASTM International (formerly American Society for Testing and Materials)
AWQS	Ambient Water Quality Standards, Guidance Values, and Groundwater Effluent Limitations
ASTM	American Society Testing Materials
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BTU	British Thermal Unit
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulations
CM	Construction Manager
CMP	Corrugated Metal Pipe
CM	Construction Manager
COC	Constituent of Concern
CPP	Citizens Participation Plan
CP-51 Soil Cleanup Guidance	Soil Cleanup Guidance, NYSDEC Policy, October 21, 2010
CY	Cubic Yard
DER	Division of Environmental Remediation
DER10	NYSDEC DER10 Technical Guidance for Site Investigation and Remediation, May, 2010
DNAPL	Dense Non-Aqueous Phase Liquid
DOT	Federal Department of Transportation
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FER	Final Engineering Report
FPP	Flood Protection Project
FS	Feasibility Study
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc., P.C.
HASP	Health and Safety Plan
HDPE	High-density Polyethylene
IC/EC	Institutional Controls/Engineering Controls
ICP	Inductively Coupled Plasma
IRM	Interim Remedial Measure
LNAPL	Light Non-Aqueous Phase Liquid
LTTD	Low-Temperature Thermal Desorption
MGP	Manufactured Gas Plant
mg/kg	Milligrams per kilogram (equivalent to ppm)
MNA	Monitored Natural Attenuation

NAPL	Non-Aqueous Phase Liquid
NCP	National Contingency Plan. 40CFR1J Part 300 – National Oil and Hazardous Substances Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSDPW	New York State Department of Public Works
NYSOPRHP	New York State Office of Parks, Recreation and Historic Preservation
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PDI	Pre-Design Investigation
PLS	Professional Land Surveyor
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
ROD	Record of Decision
ROW	Right of Way
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SPT	Standard Penetration Testing
SVOC	Semi-Volatile Organic Compound
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
USACE	U.S. Army Corps of Engineers
VOC	Volatile Organic Compound

1. Introduction

This Remedial Design Work Plan (RDWP) describes remedial activities required for a site located between East Water Street and the Chemung River in the City of Elmira, New York. The site is the location of a former manufactured gas plant (MGP) which was constructed by the Elmira Gas Light Company, a predecessor company to NYSEG (New York State Electric and Gas Corporation). The location of the site is shown on Figure 1.

A Remedial Investigation (RI) for the site has been performed, and the New York State Department of Environmental Conservation (NYSDEC) has selected a remedy for site cleanup. NYSEG will implement the remedial action pursuant to a Multi-site Order on Consent between NYSEG and the NYSDEC, and the guidance provided in the document entitled "*NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation*" [DER10]. Activities identified in this RDWP will be performed under the approval and oversight of the NYSDEC DER, and the New York State Department of Health (NYSDOH).

1.1 Purpose

The elements for a remedial design required by NYSDEC DER are provided in Section 5.2 of the DER10 document [NYSDEC, 2010a]. Included are: 1) an introduction, 2) a summary of the design investigation, 3) a description of the design scope, 4) identification of required permits or authorizations, 5) a project schedule, and 6) a description of the post-construction plans. Therefore, this RDWP provides the preliminary engineering design approach for each component of the remedy, and also specific design and supporting technical information as appropriate. Following approval by the NYSDEC, this RDWP will support the preparation of the subsequent phases of design, bid, and ultimately the implementation of the remedy.

1.2 RDWP Organization

This document is divided into the following sections:

- **Section 1.0 – Introduction**. This section summarizes the nature and extent of the MGP-related residuals identified by the RI, and the selected remedy to be implemented by the Remedial Design (RD).
- **Section 2.0 – Design Investigation**. This section describes the tasks proposed for the Pre-Design Investigation (PDI).
- **Section 3.0 – Proposed Design Scope.** This section provides a description of the remedial action and the remedial technologies to be implemented for the identified Area of Concern (AOC) for the site.

- **Section 4.0 – Permits and Authorizations.** This section identifies the permits, exempted permits, or other authorizations required for the implementation of the remedy.
- **Section 5.0 – Schedule**. This section provides a schedule for the project.
- **Section 6.0 – Post-Construction Plans**. This section identifies the plans and the post-remedial requirements for the site.
- **Section 7.0 – References**. This section lists the project references.

Appendices for this report include:

- **Appendix A** – Test Pits Logs, Boring Logs, and Well Construction Logs
- **Appendix B** – PDI Work Plan
- **Appendix C** – NYSDEC ROD
- **Appendix D** – Field Sampling Plan (FSP)
- **Appendix E** – Quality Assurance Project Plan (QAPP)
- **Appendix F** – Community Air Monitoring Plan (CAMP)
- **Appendix G** – Health and Safety Plan (HASP)
- **Appendix H** – Citizens Participation Plan (CPP)

1.3 Site Description

The site is located in an urban area in the central business district of the City of Elmira (Figure 1). The address of the site is 510 East Water Street. The site is defined as the former parcel of land where the MGP operations were conducted. The site is approximately 1-acre and is centrally located within a larger parcel that is owned by NYSEG. The footprint of the site and the current NYSEG parcel is shown on Figure 2.

As shown on Figure 2, there are perpetual NYSDEC Flood Protection Project (FPP) easements in the southern area of the site. The easement areas were established in 1947 to implement the New York State Department of Public Works (NYSDPW) Elmira Flood Protection Project for the Chemung River. The flood control features in the southern area of the site, and the adjacent City of Elmira parcel to the south, consist of a man-made flood control structure which was constructed along the bank of the Chemung River between 1948 and 1949. The flood control structure includes a levee, concrete floodwall with a sheetpile cutoff (I-Wall) near the center of the levee, and an access road for NYSDEC maintenance of the levee area. An 84-inch-diameter, corrugated metal pipe (CMP) interceptor sewer is located in the southern area of the site (Figure 3). The interceptor sewer conveys storm water from the City of Elmira to an outfall in the riverbank east of the site.

Maintenance responsibilities for the flood control levee area on the site and the adjacent City of Elmira parcel began with the NYSDPW, were transferred to the New York State Department of Transportation (NYSDOT), and then transferred recently to the NYSDEC FPP Regional Sub-Office in Elmira. The easements are in place "to retain rights to construct, reconstruct, maintain and operate levees, walls, rip rap, work areas, access roads, pole lines, pipe lines, and to clear trees, brush, and debris in the easement areas".

1.4 Site History

The Elmira Water Street MGP was constructed in 1852 by the Elmira Gas Light Company. Based on the date of construction and the configuration of the plant, the MGP was constructed and operated as a coal carbonization plant using coal as a feedstock. The plant operated for 15 years until it was shut down in 1867. After plant closure, the Gas Holder at the site continued to be used to store gas manufactured at an off-site location (Madison Avenue MGP). According to property deed information, gas storage continued at the site until 1869. It is assumed that the above-grade portion of the Gas Holder was demolished sometime prior to 1898. The current and historical MGP features are shown on Figure 3.

Additional information regarding the configuration of the MGP, and the historic land uses is provided in the RI Report entitled "*Remedial Investigation Report, Elmira Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309,*" dated August 27, 2014. [GEI, 2014].

1.5 Previous Investigation

GEI Consultants, Inc., P.C. (GEI), on behalf of NYSEG, performed the RI to characterize the nature and extent of MGP residuals at the site. Where applicable for the RD, the RI data is discussed in the following sections. The RI test pit logs, soil boring logs and monitoring well construction logs are included in Appendix A.

1.6 Physical Setting

1.6.1 Land Use

The site is currently vacant. The ground surface is mostly covered by an asphalt parking lot, with a grass and weed-covered strip adjacent to the levee and I-Wall to the south.

1.6.2 Site Zoning

According to information provided by the City of Elmira Code Enforcement Department, the site is zoned for commercial land use (City of Elmira – Business G District Intent – Gateway Commercial).

1.6.3 Utilities and Infrastructure

The known utilities at the site and surrounding areas are shown on Figure 4. The utilities include:

- A sanitary sewer line for a former site building (not currently in use);
- Underground electric lines for light poles (not currently in use); and
- A storm sewer pipe which connects catch basins in Dewitt Avenue and East Water Street to the City of Elmira interceptor sewer.

The known utilities in the City of Elmira right of way (ROW) adjacent to East Water Street include:

- An underground electric line in the sidewalk area; and
- An underground communications line in the sidewalk area.

1.6.4 Topography

The ground surface of the site is relatively flat. The ground surface slopes from the concrete floodwall (855 feet NAVD88) towards East Water Street (850 feet NAVD88), with an overall change in elevation of 5 feet. The topography of the site is shown on Figure 5.

1.6.5 Site Geology

Information regarding the geology of the site was obtained from the RI test pit, soil boring, and well installation tasks. The stratigraphic units identified during the RI, shown on Figure 6, are described as follows:

- **Fill** - At the majority of the soil boring locations in and around the MGP process area, a layer of fill containing anthropogenic materials was observed. The fill was thickest (approximately 15 feet thick) near the Gas Holder foundation. The fill material was observed to consist mostly of sand and gravel, mixed with varying amounts of brick fragments, clinkers, ash, and coal.
- **Alluvium** - Underlying the fill is a thick deposit of alluvium comprised of a heterogeneous mix of silt, sand, and gravel. At the site, one soil boring was advanced down to the bedrock to observe the depth to bedrock and to observe deep soil conditions. The sampling performed at this location indicates that the alluvium is approximately 80 feet thick.
- **Lacustrine Clay** - Inter-bedded within the alluvium are lenses of lacustrine clay. The lenses of clay do not appear to be laterally continuous within the alluvium across the site. However, the clay may be continuous beneath the Gas Holder foundation as observed in the soil borings advanced in this area during the RI (Figure 6).

- **Bedrock** - Shale was encountered beneath the alluvium at a depth of about 80 feet in the former MGP process area.

1.6.6 Site Hydrogeology

Surface water in the parking lot area of the site, and in East Water Street, drains into a series of catch basins in these areas. The water then drains into a 60-inch-diameter corrugated pipe and then into "Manhole P" located in the footprint of the former Dewitt Street. Flow was historically diverted to the Chemung River from Manhole P. However, the outfall pipe from Manhole P was filled with concrete in 1947 when the flood control project was implemented.

Surface water at the site, and in the area-wide setting of the site in the City of Elmira to the east currently flows within the interceptor sewer to the north of the levee (Figure 4). The outfall to the Chemung River is approximately ½ mile to the east of the site.

To further understand the construction of the interceptor sewer, GEI contacted staff at the NYSDEC FPP office in Elmira, NY. The NYSDEC located a drawing in the Elmira FPP O&M Manual that indicates the interceptor sewer is a CMP. Based on information provided by the NYSDEC, the pipe is 84-inches in diameter from west of the Madison Avenue Bridge, eastward to the former Dewitt Avenue. East of Dewitt Avenue the pipe appears to be a 96-inch diameter CMP. It appears that the diameter change occurs near FPP Station 24+00, which is near the former Dewitt Avenue (when Dewitt was also on the southside of East Water Street). Therefore, the pipe section closest to the remedial area is an 84-inch diameter CMP.

Groundwater Flow and Gradient

Depth-to-water measurements were collected during the RI at the on-site wells, and temporary well points adjacent to the River. The depth to the water table was observed to range from between 6 feet at the flood control access road area adjacent to the Chemung River, and 16 feet at the site in the Gas Holder area. Based on the measurements obtained from the wells, and the measurement obtained for a surface water elevation reference point, the surface of the water table slopes from the north at the East Water Street area, towards the south towards the Chemung River.

1.7 Nature and Extent of MGP-Related Residuals

The primary MGP-related constituents of concern (COC) identified at the site are related to coal tar which contains many organic compounds which are regulated by the NYSDEC. These COC are primarily benzene, toluene, ethylbenzene, and xylenes (BTEX), and polycyclic aromatic hydrocarbons (PAHs) which are a sub-group of semi-volatile organic compounds (SVOCs). The NYSDEC has identified volatile organic compounds (VOCs) and SVOCs as the COCs for the site. The media impacted by MGP-related COC has been

identified to be subsurface soil. The extent of the MGP-impacts identified at the site is shown on Figure 7, and is described below.

1.7.1 Identified Area of Concern - Gas Holder

The Gas Holder foundation and associated impacted soil has been designated Area of Concern 1 (AOC1). The holder foundation location is shown on Figure 8. Figure 9 is a cross sectional view of the Gas Holder foundation, and the adjacent area to the south towards the Chemung River.

The Gas Holder foundation is constructed of brick. The foundation is circular with a diameter of 40 feet. The wall is 1.4 feet thick. The bottom of the holder floor is 17.5 feet deep. The footings for the foundation walls extend below the bottom of the holder floor. The depth of the wall footers is unknown; however, based on information obtained from the RI test pits, the footing is deeper than 23 feet. Photographs of the Gas Holder foundation are included in the test pit logs in Appendix A.

The holder has been backfilled with soil, fill and debris, including: silt, glass bottles, wood, metal debris, and brick fragments. Water was observed at a depth of about 10 feet inside the holder. The water level inside the holder was approximately 6 feet higher than the groundwater table outside the holder foundation (16 feet).

1.7.2 Subsurface Soil and Fill

Non-aqueous phase liquid (NAPL) coated or saturated soil was not observed in the soil borings advanced in the former gas production area, or in the adjacent areas sampled during the RI. No purifier residuals, such as blue-stained wood chips or soil, or lime-like materials, were observed during the RI.

Visible evidence of MGP-related impacts was limited to hydrocarbon-like staining and hydrocarbon sheen and blebs in the fill at the bottom of the Gas Holder foundation, and sheen (in soil) in a 7-foot interval just below the bottom of the Gas Holder foundation floor. To define the horizontal and vertical extent of the MGP-impacted fill and soil, borings were advanced radially from the Gas Holder foundation, and extended below the impacted interval identified beneath the holder floor.

1.7.3 Groundwater

Exceedances of the NYSDEC Groundwater Standards or Guidance Values were not identified for VOCs, SVOCs, or total cyanide in the groundwater samples collected from the monitoring wells and temporary well points adjacent to the Chemung River. Exceedances of several common metals were identified in groundwater; however, the metal exceedances can be attributed to concentrations naturally occurring in groundwater.

1.8 Summary of Remedial Action Objectives and Remedy

The data obtained during the RI was used to prepare a Feasibility Study (FS) of potential remedial alternatives. The alternatives were presented in the document entitled "*Feasibility Study Report, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309,*" dated November 2, 2015 [GEI, 2015].

The NYSDEC reviewed the FS and selected an alternative for site cleanup. The selected remedy identified is presented in the NYSDEC Record of Decision (ROD) document entitled "*Record of Decision - NYSEG – Elmira Water Street MGP State Superfund Project – Elmira, Chemung County, Site No. 808025,*" dated March 2017 [NYSDEC, 2017]. The NYSDEC ROD is included as Appendix C.

1.8.1 Remedial Action Objectives

The remedial action objectives (RAOs) are established as the overall goals for the site remediation to provide protection of human health and the environment. The RAOs for this site were developed based on the applicable standards, criteria, and guidance (SCGs), and the current and intended future land use (Commercial). The RAOs are site-specific goals that address the media of concern, specific COCs, and the exposure pathways for the site. Upon consideration of the SCGs, and the nature and extent of MGP-related residuals, as described in the RI, RAOs were developed in the FS, and identified in the ROD.

The remedial action objectives for this site are:

Groundwater

RAOs for Environmental Protection

- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Soil Vapor

RAOs for Public Health Protection

- Mitigate potential impacts to public health from existing, or the potential for, soil vapor intrusion into buildings at a site.

No buildings are currently present at the site, and sampling of the soil vapor intrusion pathway has not been required. The nearest buildings to the impacted area of the site are the buildings located to the north of East Water Street. The distance to these buildings is approximately 300 feet.

1.8.2 Selected Remedy

The sequential actions for the remedy are comprised of the following elements:

- A remedial design program as discussed in this work plan.
- A PDI, including an evaluation of the need to protect the NYSDEC Flood Control Easement area and features during remediation.
- Protection and/or relocation of utilities along East Water Street and on the site.
- Installation of excavation support at AOC1 around the Gas Holder foundation.
- Excavation and off-site disposal of the Gas Holder foundation and contents and soil below the holder to address grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u) [NYSDEC, 2006a]; soil containing visually impacted soils, visual coal tar or non-aqueous phase liquid; soil containing total PAHs exceeding 500 ppm, and soil that create a nuisance, as defined in Commissioner Policy CP-51 Section G [NYSDEC, 2010c].
- Backfill of the excavation area with material meeting NYSDEC criteria (6 NYCRR Part 375-6.7(d) [NYSDEC, 2006b].
- Site restoration, including repaving the area disturbed during the excavation.
- The site cover that currently exists outside of the excavation area will be maintained to allow for Commercial Use of the site. Any site redevelopment will maintain the existing site cover, which consists either of the structures such as buildings, pavement, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable SCOs for Commercial Use. Imported fill material will meet the requirements for the identified site use as set forth in 6 NYCRR part 375-6.7(d).
- Monitoring of groundwater for a period of 5 years following remediation to assess post-remedial conditions, followed by a re-evaluation of the need for any continued monitoring.

- Any reduction to the groundwater monitoring program will require NYSDEC approval prior to implementation.
- Institutional Controls/Engineering Controls (IC/ECs) implemented by a Site Management Plan (SMP) (site and groundwater use restrictions, and an environmental easement).
- Periodic Certification of IC/ECs in accordance with Part 375-1.8(h)(3).

The remedy for the site will include the implementation of an institutional control in the form of an environmental easement for the site which will require the submittal of a periodic certification of institutional and engineering controls to the NYSDEC in accordance with Part 375-1.8 (h)(3); will allow the use and development of the site for Commercial Use as defined by Part 375-1.8(h)(3); will restrict the use of groundwater as a source of potable or process water, and is required to be in compliance with the NYSDEC-approved Site Management Plan.

2. Design Investigation

A PDI will be performed to obtain additional data needed for the RD. A PDI Work Plan proposing the scope of work for the additional field activities that will be implemented for the design is included in Appendix B. The key elements of the PDI are summarized as follows:

- **Utility Clearance and Mapping -** utility locating work will be performed to mark the locations of utilities prior to the PDI activities, and to obtain additional information that will be used during the RD phase for utility protection or temporary relocation.
- **Geotechnical Soil Borings and Analyses -** Borings are proposed to obtain geotechnical data for the design of excavation support systems.
    - **Physical Characteristics -** At each boring, standard penetration testing (SPT) N-values of the overburden soils will be collected. The N-values will aid in the evaluation and selection of geotechnical soil properties that can be used for the design. Soil recovered from each sample interval will be visually characterized (for soil type, grain size, color, texture, and moisture content).
    - **Geotechnical Analyses -** Soil samples from each sample interval will be collected during drilling and each soil strata observed during the drilling program (fill, silt, and silty sand) will have a minimum of three bulk samples collected and submitted to a geotechnical laboratory. These tests will help to confirm the field soil classification, and will also assist in the estimation of soil parameters that may be used in the design of engineered excavation support.
    - **Bedrock Core -** A bedrock core will be obtained to evaluate bedrock quality with the information to be used for the design on the excavation support structure.
- **Hydrology Characterization -** The hydrology characterization will be performed to aid in the prediction of lateral seepage into the excavation areas during soil removal.
- **Soil Pre-Characterization -** Soil borings will be advanced to obtain samples that will be analyzed for disposal parameters to obtain information to aid with the development of a Soil Management Plan for remediation.
- **PDI Exploration Locations -** A survey of the PDI exploration locations, existing utilities, and important site features not surveyed during the RI will be performed at the end of the field activities.

- **Levee and I-Wall Condition Assessment -** An assessment will be performed to observe and document the current condition of the levee and I-Wall. The location of settlement, deflections, rotations, cracks, etc. in the wall will be recorded, as well as other structural details that may be relevant to the RD.
- **Interceptor Sewer Condition Assessment -** An assessment will be performed to observe and document the condition of the CMP interceptor sewer. The assessment will be performed in consultation with the City of Elmira Department of Public Works.
- **Vibration Monitoring -** A vibration monitoring program will be established to collect baseline information on the typical level of vibrations experienced by the existing flood control structures near the proposed work area. This information will be used to evaluate the effects of potential construction methods based on the expected level of vibrations that would be generated during the remedial action.

Several companion documents will be utilized to implement the PDI. These include: the Field Sampling Plan (FSP) included as Appendix D; the Quality Assurance Project Plan (QAPP) included as Appendix E, the Community Air Monitoring Plan (CAMP) included as Appendix F, and the Health and Safety Plan (HASP) included as Appendix G.

3. Proposed Design Scope

This section provides a detailed description of the remedial action and the remedial technologies to be implemented during the remedy for AOC1.

3.1 General Extent of Impacts

The extent of MGP-related impacts at the site was determined during the RI, and summarized in the ROD [NYSDEC, 2017]. The areal and vertical extent of soil impacts in AOC1 that are attributable to the former MGP operations are shown on Figures 6 and 7. Removal of the Gas Holder contents and foundation, and soil to about 30-feet-deep will effectively manage: grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u), soil containing visually impacted soils, soil containing total PAHs exceeding 500 ppm, and soil that will create a nuisance condition, as defined in Commissioner Policy CP51 Section G.

Impacted groundwater was not identified at the site or the off-site areas during the RI, and other than post-remedial monitoring, action to address this media is not required by the NYSDEC.

3.2 Horizontal Limits of Soil Excavation

Observations of visible MGP-related residuals, and the results of laboratory analyses of subsurface soils from the RI provided the basis for determining the horizontal limits of excavation (Figure 7). The horizontal limits of impact were determined by the following exploration locations:

- **Impacted Conditions** - observed at TP2, SB4, SB5, and SB7 within the footprint of the Gas Holder foundation.
- **Non-impacted Conditions** - observed outside of the foundation for the Gas Holder at TP1, TP3, SB1, SB3, SB8, SB10, MW1, MW2, and MW3.

As required by the NYSDEC, the material within the Gas Holder foundation, the foundation walls and the soil between the foundation wall and the excavation support will be removed and managed according to the provisions of the Contract Documents.

3.3 Vertical Limits of Excavation Area

Observations of soil conditions, and the results of laboratory analyses of subsurface soils from the RI provided the primary basis for determining the vertical limits of excavation (Figure 8). The vertical limits of impact were determined by the following explorations locations:

- **Impacted Conditions** - observed at SB4, SB5, and SB7 inside the holder foundation and below the holder foundation floor to a depth of 30 feet.
- **Non-impacted Deeper Soil Conditions** - observed at SB4, SB5, and SB7 from a depth of 18 feet to a depth of 50 feet, the approximate total depth of each of these borings. None of the six deeper samples below the holder floor had TPAH17 concentrations greater than 500 mg/Kg. Visual impacts were not observed deeper than 7 feet below the holder floor (or 30 feet below existing grade). Excavating soil to a depth of 30 feet below existing grade will address impacted soil with concentrations of TPAH17 greater than 500 mg/Kg (not identified to be present) and soils that may create a nuisance, as defined in Commissioner Policy CP51 Section G, by the removal of visually impacted soil exhibiting sheen.
- **Confirmatory Samples** - will be collected in accordance with the specifications of DER10.

3.4 Volume Estimates

The volumes of impacted soil present at the site were estimated for use in the design tasks. The following table provides a summary of the volumes identified for the remedial action.

Estimated Volumes of Impacted Media

Medium	Estimated Volume
AOC1:	
1. Gas Holder Foundation – Fill and Debris • Area of holder: 1,280 square feet • Assumed depth of holder: 18 feet	900 CY
2. Soil Volume Between Holder Wall and Engineering Support (targeted for excavation) – Subsurface Soil • Area of soil between holder exterior and centerline of support: 1,050 square feet • Assumed depth of excavation material: 18 feet	700 CY
3. Subsurface Soil Below Holder Foundation Floor, including soil within Excavation Support Structure • Area of soil excavation: 2,400 square feet • Assumed depth of excavation: 15 feet	1,400 CY
4. Estimated Total Volume of Materials Within Supported Excavation to Remove Foundation and Deeper MGP-Impacted Soil (rounded total)	3,000 CY

Notes:
CY – cubic yards

Additional volume will be generated during installation of the selected excavation support system.

3.5 General Remedial Approach

Following approval of the RD by the NYSDEC, NYSEG will solicit bids and select a Remedial Contractor who will be responsible for executing the designed remedy. The design of the excavation support system will be stamped by a Professional Engineer, licensed to practice in New York State. The work will be conducted in general accordance with the procedures described in this RDWP and the Contract Documents (drawings and technical specifications) developed during the design process.

3.6 Remedial Project Organization

The management and field activities will be coordinated between NYSEG and several contractors and stakeholders as follows:

NYSEG Responsibilities:

- Secure access agreements and coordinate with the representatives of the City of Elmira regarding access to City right of way areas, coordination of the remedial activities, and the restoration of the disturbed City areas.
- Coordinate with the Remedial Contractor, Engineer to implement the items identified in this RDWP.
- Prepare and send a Notice and Fact Sheet consistent with the NYSDEC "*Program Policy DER23, Citizens Participation Handbook for Remedial Programs*" [NYSDEC, 2010b] to the site contact list prior to the start of the remedial activities.
- Contract with the identified Remedial Contractor.
- Contract with a firm which will serve as the Engineer.
- Issue any contract addenda and any modifications as needed based on input from the Engineer.
- Contact the Engineer to document pre- and post-remedial structural conditions of the flood control easement area surrounding the remedial excavation area.
- Act as the generator for the media that will be generated as a result of the remedial activities for profiling, and off-site treatment or disposal of waste.
- Manage bills of lading and manifests for the off-site shipment of waste materials from the site. The documents may be managed by the Engineer as agent, under an agreement with NYSEG.
- Notify and coordinate with the NYSDEC and the NYSDOH for all environmental-related site activities.

NYSDEC / NYSDOH Responsibilities:

- The agencies will provide regulatory oversight for the implementation of the remedy and will periodically observe the remedial work activities.

Engineer Responsibilities:

- NYSEG will select an Engineer to provide services prior to and during the implementation of the site remedy.
- The Engineer will observe and document each of the remedial activities and may serve as Construction Manager (CM).
- Conduct pre-remedial sampling of media described in this RDWP.
- Oversee the decommissioning of the monitoring well in the remedial excavation area.
- Provide assistance to NYSEG with the preparation of waste profiling documents necessary to manage waste at treatment or disposal facilities.
- Provide review of Remedial Contractor submittals.
- Provide project management and oversight to observe and monitor the implementation of the remedy.
- Maintain records for all remedial tasks, including daily field reports and photographs.
- Document that the remedial tasks are performed in accordance with the project documents.
- As directed by NYSEG, the Engineer may provide staff to perform the required CAMP monitoring.
- Monitor the Remedial Contractor's survey control as applicable.
- Prepare, review, sign as Agent waste manifests and shipping documents.
- Prepare an inventory of wastes transported or discharged from the site in accordance with NYSEG's requirements.
- Assist NYSEG in the review and approval of invoices prepared by the Remedial Contractor or other subcontractors.
- Coordinate project meetings before, during and after the remedial work.
- Prepare daily field reports as CM.
- Transmit CAMP reports and exceedance information to the NYSDEC and NYSDOH.
- Prepare and certify the Final Engineering Report (FER), Record Drawings, and Site Management Plan (SMP).

Remedial Contractor Responsibilities:

- NYSEG will select a Remedial Contractor to implement the remedial activities.
- The Remedial Contractor responsibilities will be identified in the Contract Documents.
- Provide all necessary equipment, materials and staff to implement the site remedy as described in this RDWP.
- Coordinate with the vendors for import materials and the transportation and off-site disposal of waste material.

- Contract a company to provide (third party) noise monitoring during implementation of the remedy.
- Contract a company to provide (third party) health and safety observations during implementation of the remedy (as required by NYSEG).
- Contract a company to conduct vibration monitoring during implementation of the remedy. As directed by NYSEG, the Engineer may perform these services.

CAMP Monitoring Contractor Responsibilities:

- NYSEG will select a CAMP Monitoring Contractor to implement the CAMP.
- The CAMP monitoring services may be provided by the Engineer, as directed by NYSEG.
- Provide daily reports, exceedance information, and other pertinent data to the project team for review and distribution to the NYSDEC and NYSDOH.

3.7 Citizen Participation Plan

Following approval of this RDWP, the NYSDEC will require that the Citizens Participation Plan (CPP) be updated and implemented. The CPP for the site, developed for the RI, is included in Appendix H. The plan will need to be updated and distributed prior to mobilization to ensure that the most current Site Contact information and Distribution List are included. The CPP will describe the citizen participation activities that have, and will be performed for the implementation of the remedy. The CPP will be consistent with the specifications provided in the document entitled "*DER Program Policy DER23, Citizens Participation Handbook for Remedial Programs*" [NYSDEC, 2010b].

Prior to the start of the remedial field activities, a NYSDEC Notice and NYSDEC Fact Sheet will be sent to the Site Contact list. This list typically contains the residents and business owners within a specified distance from the site. Also included are additional local community and political staff, as appropriate, and as approved by NYSEG. A preliminary contact list was developed for the RI. Following approval of this RDWP, the list will be updated for distribution.

The CPP will also be included as an appendix to the FER. It will also be placed in the document repository established for this project, and updated as needed.

3.8 Access Agreement

NYSEG will obtain an access agreement with the City of Elmira to perform the remedial activities in the City ROW along East Water Street. NYSEG owns the site, so no additional access agreements will be necessary to implement the remedy. Additionally, remedial activities or staging are not expected to occur on the NYSDEC Flood Prevention Project

easement areas, therefore, an access agreement will not be necessary with the NYSDEC. However, if work is required to occur within the Flood Prevention Project area, then an access agreement will be obtained from the NYSDEC.

3.9 Remedial Contractor Submittals

Prior to mobilization, the Remedial Contractor will prepare and submit the required documents that will be identified in a set of Contract Documents for review and approval by NYSEG, the Engineer, and the NYSDEC. The Engineer will review Remedial Contractor submittals to check for conformance with NYSEG requirements. The submittals will include a Remedial Contractor HASP, in accordance with 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926. The HASP will be certified by a Certified Industrial Hygienist. The Remedial Contractor will also submit a Construction Quality Assurance Plan, a Schedule and comprehensive Sequencing Plan for implementation of the remedy.

3.10 Pre-Characterization

The Engineer and the Remedial Contractor will perform the pre-characterization tasks identified below. It is assumed that the pre-characterization program will be completed prior to Remedial Contractor mobilization.

3.10.1 Off-Site Pre-Characterization of Granular Fill Materials

The Remedial Contractor will identify proposed sources of imported material, and will be responsible for demonstrating that the imported material meets the requirements for imported fill or soil and is appropriate for use as backfill for the remedial excavation area.

The sampling will be consistent with the requirements of Table 5.4(e)10 of the NYSDEC DER10. Included in Appendix B of the NYSDEC document, is a table from DER10 entitled "*Allowable Constituent Levels for Imported Fill or Soil Subdivision 5.4(e)*" [NYSDEC, 2010a]. The results of the backfill analyses will be compared to the allowable constituent levels by the Engineer. All COC identified by the NYSDEC DER10 document will be analyzed for. The results of the sampling will be provided to the NYSDEC for approval prior to importing the materials to the site. The facilities targeted by the Remedial Contractor will meet NYSEG requirements. The numbers of samples required will be proposed to, and confirmed with the NYSDEC. The analytical requirements for the granular fill soils are summarized as follows:

- **Granular Fill Soil Composite** – A composite sample of the materials will be analyzed for:
    - SVOC TCL – EPA Method 8270D;
    - Herbicides – EPA Method 8151A;
    - Pesticides – EPA Method 8081A;

  - Polychlorinated Biphenyls (PCBs) – EPA Method 8082;
  - Metals – EPA 6000-7000 Series (arsenic, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, silver, selenium, and zinc); and
  - Total Cyanide – EPA Method 9014A.

- **Granular Fill Soil - Discrete 1** – A grab sample of the structural soil/fill will be analyzed for VOC TCL – EPA Method 5035A/8260C.
- **Granular Fill Soil - Discrete 2** – A second grab sample of the structural soil/fill will be analyzed for VOC TCL – EPA Method 5035A/8260C.
- **Granular Fill Soil - Discrete 3** – A third grab sample of the structural soil/fill will be analyzed for VOC TCL – EPA Method 5035A/8260C.
- **Granular Fill Soil - Discrete 4** – A fourth grab sample of the structural soil/fill will be analyzed for VOC TCL – EPA Method 5035A/8260C.

No compositing of the soil for the VOC analyses will be allowed. The samples will be analyzed by a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. The chain-of-custody record for the sampling and the laboratory data packages, and the Data Usability Summary Reports (DUSRs) will be submitted to the NYSDEC for review prior to the import of the fill soil. The results will also be included in the FER.

Ordinary fill will conform to general requirements for material designation 733-10 in the September 4, 2014 Standard Specification prepared by the NYSDOT: the fill will have a pH greater than 5, and less than 10. Ordinary Fill will be comprised of hard, durable sand and gravel, free of clay, organic matter, surface coatings, trash, debris, and other deleterious materials. Soil finer than the No. 200 sieve (the “fines”) should be non-plastic. Ordinary fill shall meet the following gradation requirements:

U.S. Standard Sieve	**Percent Finer by Dry Weight**
2 inch	100
0.25 inch	30 to 65
No. 40	5 to 40
No. 200	0 to 10

3.10.2 Other Imported Backfill Material

It is assumed that Ordinary Fill will be used to backfill the majority of the remedial excavation area. However, to provide a suitable subbase for the pavement restoration, other fill materials (e.g., structural fill, gravel sub-base, etc.) may be used. If proposed, the specifications for this material will be developed during final design.

3.10.3 On-Site Soil Pre-Characterization for Disposal

The PDI scope of work includes a pre-characterization task to evaluate and profile materials for disposal (Appendix B). However, this RDWP also includes methods and procedures for profiling and characterization for disposal should additional characterization be required in advance, or during implementation of the remedy. If excavated materials are encountered that do not appear consistent with the materials pre-characterized, of are not believed to align with the waste disposal profiles, then additional samples may be collected from the excavation or stockpiled materials.

The current methods and requirements are included in this RDWP. However, to ensure that the most current requirements of the targeted disposal facilities are met prior to mobilization, the plan will need to be updated and confirmed with the facilities prior to the sample collection task. The samples will be collected by the Engineer or Remedial Contractor as directed by NYSEG.

Low-Temperature Thermal Desorption Facilities

The waste characterization profile for low-temperature thermal desorption (LTTD) facilities is based on the results of the facility acceptance analyses listed below for LTTD at ESMI's Fort Edward, New York facility. This facility is a NYSEG-approved facility. The characterization required by ESMI is summarized below.

Coal Tar / MGP Soils:

- Total Petroleum Hydrocarbons (TPH) – Method 8015 GRO/DRO
- Total VOCs – Method 5035A/8260C
- Total SVOCs – Method 8270D
- Total PCBs – Method 8080
- Total Metals – Method 6010B
- Total Cyanide – Method 9014A
- Total Sulfide – Method 9030B/9034
- Percent Sulfur – ASTM Method D129-64
- British Thermal Unit (BTU) – ASTM Method D240-87

The number of borings and the number of samples to be collected from each boring will be determined based on the requirements of ESMI for waste characterization. ESMI currently requires three samples for the first 500 cubic yards, and one sample for each 500 cubic yards thereafter. The final number and types of analyses will be confirmed by the Remedial Contractor or the Engineer prior to site mobilization.

Should LTTD be identified for soil management, the facility permits for treating non-hazardous waste will be reviewed by the Engineer and provided to the NYSDEC just prior to mobilization, to demonstrate that the facility operating permits are current.

Landfill Facilities

Excavated materials that may be disposed of as non-hazardous material at a landfill facility will also be pre-characterized. Three NYSEG-approved facilities are discussed below. However, the final list of potential facilities will need to be confirmed prior to remediation by the Remedial Contractor. The target facilities currently considered for landfill disposal include:

- **Ontario County Landfill**, Stanley, New York
- **Seneca Meadows Landfill**, Waterloo, New York
- **High Acres Landfill - Waste Management**, Fairport, New York

Each of these facilities currently has permits in place to accept non-hazardous fill / soil. The selected facility will provide current permit information to the Engineer and the NYSDEC before mobilization, to demonstrate that the current facility permits are in place.

To meet the sample requirements of these facilities, the pre-characterization samples will be analyzed for the following:

- Toxicity Characteristic Leaching Procedure (TCLP) ZHE Extraction – EPA Method 1311;
- TCLP VOC – Method 1311/8260B;
- TCLP SVOC – Method 1311/8270C;
- TCLP Inductively Coupled Plasma (ICP) Metals – Method 6010B;
- TCLP Herbicides – Method 1311/8151A;
- TCLP Pesticides – Method 1311/8081A;
- TPH – 8015 GRO/DRO;
- VOCs TCL – Method 5035A/8260C;
- SVOCs TCL – Method 8270D;
- Total Cyanide – Method 9014A;
- PCBs – Method 8082;
- Reactive Sulfide – Method 7.3.4.1;
- Reactive Cyanide – Method 7.3.3.2;
- Ignitability – Method 1010/Flashpoint;
- Corrosivity / pH – Method 9045;

- Total Residue/Percent Solids – ASTM D-2216-90; and
- TAL Metals – 6000-7000 Method Series.

The number of samples required for pre-characterization and profiling will be confirmed with the facilities prior to mobilization. Landfill facilities typically require one sample per 500 tons of soil scheduled to be disposed.

For the sample analysis, a NYSDOH ELAP certified laboratory will be utilized. Level 2 Reports will be prepared for the sample delivery groups. A Level 4 report package prepared in accordance with the NYSDEC ASP Category B deliverables is not required for the waste profiling task. The chain-of-custody record and the laboratory Form I Report sheets for the analyses will be provided by the Engineer to the Remedial Contractor and the target disposal facilities. The analytical results will also be included in the FER.

3.10.4 On-Site Soil Pre-Characterization for Reuse

Based on the results of the RI, the holder contains fill and debris. The soil that will be excavated from below the holder floor exhibits visible evidence of hydrocarbon sheen. Therefore, it does not appear to be feasible to reuse the excavated materials for backfill purposes. A provision for characterization for on-site reuse is not included in this RDWP.

3.11 Flood Control Easement Area Access

The Remedial Contractor will maintain access for NYSDEC Elmira FPP employees or their contractors who access the flood control features for routine operations, monitoring, or inspections during implementation of the remedy. Access will be maintained at the eastern boundary of the NYSEG property at all times. The FPP access roadway at the eastern end of the NYSEG parcel at Melville Avenue will not be blocked by remedial construction activities.

3.12 Traffic Control

Traffic will be controlled during the remedial work to minimize the disruption to the areas adjacent to the site, and to provide for safe access to and from the site. The access route(s) for project traffic, the expected traffic flow for each remedial task, and the anticipated impact to the public in the areas adjacent to the site during implementation of the remedy are described below.

Traffic Control Strategy

The Engineer and the Remedial Contractor will implement the traffic control strategy to identify points of access and departure from the designated remedial work area.

Access Routes

The proposed trucking route is shown on Figure 11. Impacted materials and debris will be loaded on the site. It will be the responsibility of the Remedial Contractor to regularly check trucks to ensure that soil or sediment is not tracked off of the site by the truck traffic. Trucks will leave the site by pulling out onto East Water Street. The trucks will then follow East Water Street southwest until the interchange for Interstate 86. Backfill and materials / supplies will be transported into the site by the same route. Generally, the plan indicates the traffic routes to and from the site for:

- Trucking soil and bulky waste / debris off site.
- Importing clean fill and topsoil to the site.
- Liquid waste hauler off-loading dewatered liquids (if necessary).
- Remedial Contractor access and parking.
- Equipment access and storage.

The exact routes and other traffic control specific guidelines will be developed during the design process and will be detailed in the Contract Documents.

Truck Staging

During mobilization the Remedial Contractor will identify a staging location for trucks that are waiting to load or unload. The staging area will be set-up in an area that will not block traffic on the adjacent public roadway (East Water Street). Trucks and machinery idling will be controlled as necessary, and will not be allowed for excessive periods of time on the site or nearby streets or roadways.

Traffic Control

The Remedial Contractor will conduct the following:

- Utilize flagman as necessary to assist with traffic control.
- Guide trucks that are turning around or backing up.
- Signs noting “Construction Area” or similar verbiage will be erected at the access and exit locations.
- The traffic control signs will meet the requirements of the NYSDOT, with signs erected which indicate **“Trucks Exiting”** and **“Trucks Entering”.**
- Hazard barrels or equivalent will be placed at the entrance of the work area to identify the beginning of the remedial work area.

- Road closings, should they be necessary, will be conducted by obtaining the required permits from the City of Elmira, and then erecting the required NYSDOT barricades and notification signs at the NYSDOT-specified distances from the closed roadways.

Pedestrian Traffic

Pedestrian traffic will be re-routed from the remedial work areas in the City ROW by signage and barricades placed on East Water Street, if needed. The Remedial Contractor will erect the signs and barricades and routinely check their condition to ensure that the public is safely directed around the remedial work areas.

Protection of Public Roadways

The Engineer and the Remedial Contractor will monitor and oversee the loading of trucks carrying soil or water in a manner that minimizes that spillage or other discharge of impacted media during loading or transport. All vehicles will be covered before leaving the site. The trucking company will be responsible for containing loads until the trucks arrive at the disposal or treatment facilities.

Estimated Traffic Flow

Traffic for the implementation of the remedy will include the import of soil, and structural fill, and the off-site transportation of debris, soil and water. Based on the estimated quantities of these media, and assuming 25 tons per truck for the soil, a preliminary estimate of these media includes:

- **Import of backfill soil** – approximately 254 trucks
- **Import of structural fill soil** – approximately 5 trucks
- **Off-site transportation of debris and soil** – approximately 259 trucks

3.13 Baseline Noise Monitoring

The Engineer (if directed by NYSEG) or a third-party firm employed by the Remedial Contractor will perform baseline noise monitoring prior to the mobilization of the Remedial Contractor. The data obtained will provide baseline data for use during remedial construction. The monitoring will be performed at the boundaries of the remedial work areas, and between the work areas and the occupied buildings of the neighborhood. If required, the noise monitoring baseline data will be provided to the NYSDEC and the NYSDOH for review.

3.14 Site Security

Site security controls will be implemented to prevent the vandalism or damage to construction equipment, and to prevent public access and minimize the associated health and safety concerns.

Perimeter Security

A temporary fence will be erected around the perimeter of the remedial work area. The fence will be 8-foot high (minimum), and equipped with a privacy screen. A variance will be established with the City of Elmira by the Remedial Contractor, if necessary, for installation of the temporary fencing to this height. The fence will extend around the limit of work and include the excavation area, and waste handling and storage areas. The fence will have a minimum of two gates that will have the ability to be locked at the end of each working day. If necessary (considering the site may be otherwise lighted by building floodlights, municipal streetlights, etc.), the Remedial Contractor will provide temporary lighting at the gate.

The remedial excavation is anticipated to be 30 foot deep. When this deep excavation is being performed, the Remedial Contractor will take additional measures to isolate the excavation area with temporary fall protection and signage according to the specifications of the Remedial Contractor's HASP.

Equipment Security

Vehicles and/or equipment left in the work area will be secured at the end of each working day. In addition, vehicles and equipment must remain inside the perimeter fence, or at a remote secured area if left on site overnight or during non-work days. No vehicles or equipment may be left overnight in an unsecured location. It is the responsibility of the Remedial Contractor to ensure that all non-essential equipment is de-energized when left on site and not in use to prevent electrical/fire/explosive hazards.

3.15 Implementation of Safe Work Procedures

Following construction of the security fence, Safe Work Procedures will be implemented in the work areas. The Safe Work Procedures will be implemented by the Engineer and the Remedial Contractor, and be consistent with all NYSEG requirements for the management of impacted sites.

- **Health and Safety Kick-off Meetings** - HASP procedures will be reviewed on a daily basis by staff assigned to the site.
- **Sign In and Out Sheets** - sheets will be maintained by the Remedial Contractor in a job trailer. All site workers and other site personnel will be required to sign in and out each work day.

- **Signage** - signage around the constructed perimeter fence will be maintained by the Remedial Contractor including open excavation areas.
- **Equipment** - equipment will be parked in a designated area and all keys removed.

The Remedial Contractor will maintain an organized work area and properly organize and store equipment and tools.

3.16 Work Zones

Work zones will be established within the site boundaries in accordance with the Remedial Contractor's site-specific HASP that define: the initial Exclusion Zones, the Decontamination Zones, and the Support Zone. These zones will change as the work progresses in order to maintain safety and allow for efficient completion of the remedial work. The project will be designated as "**No Smoking**".

3.17 Community Air Monitoring Program (CAMP)

CAMP Background Monitoring

The CAMP equipment and labor necessary to implement the CAMP will be mobilized and set up at the site prior to any invasive field activities. The CAMP Contractor will collect baseline CAMP data for a period of 5 days prior to invasive field activities. The background data will be submitted to the Engineer, and the Engineer will submit this data to the NYSDEC and the NYSDOH prior to any ground intrusive activities.

CAMP Monitoring

Excavation activities at remediation sites typically generate airborne dust and odors that have the potential to migrate off site. In recognition of this potential hazard, the NYSDOH has promulgated a CAMP that establishes action levels of respirable dust and VOCs that are protective of the surrounding community. The requirements of the CAMP are contained in Appendix 1A of the DER10 Document [NYSDEC, 2010a]. The CAMP is intended to supplement, but be discrete from the localized air-monitoring program implemented by the Remedial Contractor for purposes of evaluating worker health and safety.

A site-specific CAMP is included in Appendix F. It is designed to provide monitoring procedures, Action Limits, and contingency measures if Action Limits are approached as the invasive work is completed.

- **Action Limit – Lower Level**: An Action Limit is a constituent concentration or odor intensity that triggers contingent measures. The lower-level Action Limit is an Alert Limit, and does not suggest the existence of a health hazard, but serves instead as a

screening tool to trigger contingent measures, if necessary, to assist in minimizing off-site transport of COC and odors during remedial activities.

- **Action Limit – Upper Level**: The Action Limit is a constituent concentration or odor intensity that triggers work stoppage.

If the real-time perimeter Action Limits are exceeded or nuisance odors are reported by the staff implementing the CAMP monitoring, the staff will notify the Construction Manager. The Construction Manager will notify NYSEG and the Engineer. The Construction Manager will direct the Remedial Contractor to implement the appropriate control measures. Community complaints will also trigger response actions as olfactory sensitivity may be an issue. Actions that may be taken to reduce emissions include the following:

- Spraying water on exposed soil surfaces and/or roadways to suppress windblown dust.
- Covering working areas of exposed impacted soils, trucks loaded with impacted soils, or stockpiles of impacted soils with tarps, vapor suppressing foam, or other vapor control agent(s).
- Temporarily relocating work to an area with potentially lower emission levels.
- Reducing the production rate or changing the sequence of work activities.
- Changing the work methods or equipment to alternatives that minimize air emissions.

In practice, these actions will typically be employed proactively to prevent action levels from being reached at the exclusion zone perimeter in the first instance. The anticipated locations of the air monitoring stations are noted; however, they will be subject to change according to the Remedial Contractor's methods for construction. The Remedial Contractor will have suppressing products on site prior to commencing the intrusive activities for immediate use as needed.

During times of ground intrusive activities, fence line perimeter air monitoring will be conducted using a combination of real-time (continuous and almost instantaneous) air monitoring at fixed locations and walk-around supplemental monitoring using hand-held instruments on an as-needed basis. Odor monitoring will also be performed at the work zone perimeter.

3.18 Odor and Fugitive Dust Control

Volatile emissions and dust and odors will be controlled from the soil excavation and drilling activities to limit the potential for off-site impacts. The Remedial Contractor will provide odor suppressant system consisting of chemical foam (e.g., Rusmar Foam ®) or other approved method. The Remedial Contractor will have the materials on site for immediate use prior to the remedial action, and will keep sufficient odor suppressant on site to manage

the odors generated from the excavated materials, including, but not limited to open excavations, limited stockpiles, or materials loaded into trucks for transportation and disposal. The odor suppressant system will be stored near the excavation and will be easily mobile. Open excavations containing MGP-related source material will be backfilled or covered at the end of each working day to suppress odors.

3.19 Construction Noise Control

Measures will be implemented by the Remedial Contractor to control noise during construction. The methods and procedures will adhere to applicable codes. The site is located in the downtown area of the City of Elmira, and is adjacent to some commercial and residential buildings. The City of Elmira has established ordinances with limits for work hours and acceptable decibel levels (dBA) during the day and evening hours. It is the responsibility of the Remedial Contractor retained by NYSEG to abide by all applicable local noise control ordinances during the performance of the work and to obtain any required permits or variances. The Remedial Contractor will be responsible for making changes to the means and methods of the work, and/or employing noise mitigating equipment to comply with the applicable codes, and for any fines or other punishment incurred from non-compliance with applicable noise ordinances.

The following acts will be considered to be "loud, disturbing, unnecessary, and unreasonable noises" in violation of the specifications of the RDWP. Specific to the performance of the remedial construction, which for the purposes of the code qualifies as "construction" as defined by the City code:

- The operation of any tools, machinery or equipment used in construction, except in case of emergency in the interest of public safety, other than between the hours of:
  - 8:00 a.m. and 6:00 p.m. on Mondays through Fridays, and
  - 9:00 a.m. to 6:00 p.m. on Saturdays, Sundays and legal holidays.
  - The noise threshold standards for the site, and measurement locations, are described below and reported in dBA:
  - Except as otherwise permitted, any source of sound in excess of the sound level limits identified in this RDWP will be considered a violation. For purposes of measuring sound levels from any source, sound level measurements will be made at a point on the receiving property nearest where the sound source at issue generates the highest sound level.
  - For all sources of sound measured from any property:
    - Nighttime hours (from 10:00 p.m. to 7:00 a.m.): 75 dBA.
    - Daytime hours (from 7:00 a.m. to 10:00 p.m.): 90 dBA.

In accordance with local ordinances, and in the absence of any variances or special permits, the Remedial Contractor will not conduct work outside of the permitted working hours, Monday through Friday 7:00 am to 6:00 pm, and no heavy machinery operation will be permitted prior to 8:00 am. In addition, there will be no work on Federal holidays or over weekends, without advanced approval from NYSEG or the Engineer. Measurements of sound levels will be made from the receiving property line by the Remedial Contractor, in accordance with the City of Elmira code.

Means and Methods

The Remedial Contractor will equip vehicles and motorized equipment with appropriate noise control devices to maintain noise levels that conform to current OSHA standards and State and local regulations. Construction equipment will be operated in the manner that it was intended so as not to create an excessive amount of noise and vibration. All equipment that is required to operate beyond standard work hours will be, to the maximum extent possible, equipped to meet the required sound levels. The Remedial Contractor will properly maintain all mufflers and noise control devices, and replace them as necessary.

The Remedial Contractor will make modifications to their selected means and methods for the remedial construction, and/or employ noise mitigation equipment, if needed to comply with noise control requirements. The Remedial Contractor will take immediate steps to correct any deficiencies identified by the Engineer or NYSEG.

Noise Level Enforcement

NYSEG will have final responsibility and authority for all aspects of the remedy. Should NYSEG receive complaints from the property owner or adjacent residents or businesses, NYSEG or the Engineer will direct the Remedial Contractor to adjust their means and methods accordingly. If changes to the means and methods of construction do not reduce the noise level to a level where it complies with the City code, then NYSEG will discuss the use of noise mitigation equipment (e.g., noise barriers) with the Remedial Contractor to further reduce the noise levels at adjacent identified areas.

3.20 Pre-Construction Meeting

The Engineer will conduct a pre-construction site meeting with the Remedial Contractor, NYSEG, the NYSDEC DER, the local Flood Control staff, the City of Elmira Engineer, and the NYSDOH prior to the commencement of remedial field activities. The meeting will be held to review specified construction requirements and schedules, as well as to review the responsibilities of the Engineer, the Remedial Contractor, and NYSEG with respect to the implementation of the remedial action.

3.21 PLS Survey

The Remedial Contractor will retain a professional land surveyor (PLS) licensed to perform work in New York State to provide survey control, layout, progress surveys, and a final as-built survey during the work. Preliminary locations for the holder foundation and the excavation support structure are provided in Table 1. The Remedial Contractor will use this initial survey to confirm and maintain horizontal and vertical limits as the work proceeds. The surveyor will return, as needed, to provide services required in the Contract Documents, which may include, documenting excavation progress, collecting measurements for unit cost bid items, and to completing an as-built survey of the finished work.

The perimeter boundary of the NYSDEC FPP easements will be staked-out by the PLS. The Remedial Contractor will erect temporary fencing around the perimeter of the work area, and no staging or work will be permitted in the NYSDEC FPP easement areas.

Initial, progress, and as-built surveys will be reviewed by the Engineer and NYSEG.

The grid and benchmarks will be established in English Units (feet) in the following datum:

- **Horizontal**: New York State Plane (Central Zone) as represented by North American Datum of 1983 (NAD1983); and
- **Vertical**: North American Vertical Datum of 1988 (NAVD88).

The surveyors will return as needed to establish other reference points, layout work, and survey record information such as the locations of documentation/confirmation samples and the limits of the excavations. Other site personnel may perform additional data collection or layout as needed.

3.22 Erosion and Storm Water Control

Erosion and storm water controls will be installed by the Remedial Contractor prior to disturbing the site. The erosion and sediment controls will be maintained throughout the duration of the work according to NYS requirements. The erosion control measures will be installed to:

- Minimize the potential for erosion of site soil within, and adjacent to the remedial work areas.
- Minimize the potential for the migration of water containing sediments beyond the active work areas.
- Minimize surface water run-on from adjacent areas.
- Minimize the accumulation of water in the active work areas.
- Reduce the potential for off-site tracking of site soils.

Storm water runoff from outside of the excavation area will be managed by the Remedial Contractor. Storm water runoff will be collected, routed, and discharged into the local drainage structures prior to contact with any impacted materials provided the water is determined to be sediment free. The erosion and sediment control measures will be constructed and maintained in general accordance with the project requirements and the NYSDEC document entitled "*New York State Standards and Specifications for Erosion and Sediment Control,"* dated November 2016 [NYSDEC, 2016].

3.23 Utility Preservation Outside Remedial Areas

Prior to any intrusive work, the Remedial Contractor will be responsible for identifying and protecting existing utilities on the site, and within the City ROW. This task will begin by contacting Dig Safely New York. Protection of existing utilities will be maintained by the Remedial Contractor throughout the remedial construction period.

To accomplish this task, the Remedial Contractor will contact and cooperate with utility companies to locate all utilities (including pipelines, cables, power poles, guy wires, and other structures) on the site prior to beginning the remedial work. The Remedial Contractor will comply with the requirements of specific utility protection Laws or Regulations, including NYSEG's specific requirements for environmental site management.

3.24 Utility Decommissioning and Temporary Relocation – Remedial Excavation Areas

There are several subsurface utilities near the footprint of the remedial excavation area (Figure 6). These utilities may need to be decommissioned and/or relocated for the duration of the work. However, the Engineer will need to discuss the utilities with the City of Elmira for a final utilities management plan. The Remedial Contractor will be responsible for the temporary utility protection, relocation, and restoration. The utilities that will need to be addressed include, but are not limited to, the following:

- Overhead electric and communication lines may require protection and /or rerouting along East Water Street.
- A subsurface fiber optic television line is present in the sidewalk adjacent to East Water Street, it may require decommissioning and rerouting due to engineering control installation.
- A subsurface electric supply line present in the City ROW area along East Water Street may need to be protected or rerouted during remedial excavation support installation.
- The storm and sanitary sewer (not used) on the site will need to be protected and rerouted, as necessary.

If an unknown utility is encountered prior to or during the work, the Remedial Contractor will notify NYSEG and the Engineer immediately. The Engineer will review the updated information and evaluate if additional work (e.g., relocation or protection) will be required.

3.25 Demolition of Site Features

The Remedial Contractor will demolish the existing features present at the site to prepare for the excavation activities. These will include:

- Pavement around the excavation area.
- Light poles and underground electrical conduit (if necessary).
- Storm sewer line, may be rerouted.

The Remedial Contractor will isolate the NYSDEC FPP easement areas by erecting temporary fencing on the site, near the northern boundary of the easement, and will preserve and protect the adjacent NYSDEC flood control features. No staging or work of any kind will be performed on the NYSDEC easement area parcels.

3.26 Monitoring Well Decommissioning

One monitoring well, MW2, is located in the remedial excavation area. It will need to be decommissioned prior to the excavation activities. The decommissioning will be performed by a NYS licensed driller, contracted by the Remedial Contractor or the Engineer. The decommissioning activities will be observed and documented by the Engineer. The location of the well to be decommissioned is shown on Figure 6, and a boring and well construction log for MW2 is included in Appendix A.

The well will be decommissioned using methods specified in the document entitled "*NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy*," dated November 3, 2009. A NYSDEC Monitoring Well Decommissioning Form will be completed for the well. The well will be over-drilled, and the well materials removed according to the methods described in NYSDEC CP-43. The boreholes will be grouted using a tremie pipe with a cement-bentonite grout. Waste generated during the decommissioning tasks will be managed with the waste generated during site remediation. The completed Monitoring Well Decommissioning Form and record will be included in the FER.

3.27 Protection of Monitoring Wells Outside of the Excavation Area

The Remedial Contractor will make all reasonable efforts to protect monitoring wells at the site that are outside of the remedial excavation area. These wells include: MW1, MW3, MW4, MW5, MW6, MW7, and MW8. The wells are required to be protected and preserved because monitoring of the wells will be required by the NYSDEC after the excavation and

restoration tasks are complete (Post-Remedial Monitoring Plan). If these wells are damaged during the work, they will be replaced to match the existing well configurations.

3.28 Monitoring Existing Structures

Monitoring will be performed on the interceptor sewer and flood wall prior to and during the remedial action. Additional details of the monitoring methods are provided below. Action and alert levels for the various types of monitoring will be provided in the technical specifications.

3.28.1 Pre-Construction Survey

Prior to mobilization, a pre-construction survey will be performed to document the condition of the existing structures, look for cracks or other structural defects that may be problematic during construction, and to collect a series of baseline measurements. Video and photographic documentation will be collected during the survey and submitted to NYSEG and the Engineer for review prior to commencing intrusive work.

The pre-construction survey will be performed in two areas. The on-site area will include the flood control features in the southern area of the site. The off-site area will include the area to the north of East Water Street. The survey in the off-site area will document pre-construction conditions at the Chemung Vital Statistics / Aladin Management Building. This building is approximately 200 feet to the north of AOC1.

3.28.2 Monitoring Methods

The 84-inch-diameter interceptor sewer, levee embankment and floodwall are approximately 70 feet from southern edge of the remedial excavation area (Figure 6). The Chemung Vital Statistics / Aladin Management Building is approximately 200 feet north of AOC1, in the off-site area. The Remedial Contractor will be responsible for maintaining acceptable clearances from the existing interceptor sewer for equipment and controls, and also to provide appropriate protective measures as required by the City of Elmira and the NYSDEC. Monitoring of these structures will be performed by the Engineer during invasive remedial activities including: installation of excavation support system, demolition, excavation, and backfilling.

Vibration Monitoring

Vibration monitoring will be performed using portable seismographs at up to three (3) locations to monitor vibrations during intrusive activities.

Lateral Movement Monitoring

Lateral movement monitoring will be performed at up to two (2) locations in the on-site area. Lateral movement monitoring will be observed using vertical inclinometers that will be read

on a regular basis during the work. The inclinometers will be installed before the ground intrusive activity begins to establish baseline readings.

Optical Monitoring

Optical monitoring will be performed at up to eight (8) locations along the existing flood wall and off-site building area to monitor movement during the work. Optical monitoring will be conducted by installing reflective survey targets at selected locations along the flood wall. The monitoring will be performed before, and during the ground intrusive activities.

Crack Monitoring

If cracks are observed during the pre-construction survey, then crack monitors may be installed. Crack monitors will be read on a regular basis, and crack monitoring observations will be discussed, as necessary, during the work, and the results will be summarized in the FER.

The Remedial Contractor will be responsible for protecting the interceptor sewer, levee, and floodwall, and the adjacent off-site building. The Remedial Contractor will repair damage to these features that occurs during the remedial work.

3.29 Excavation Support

Due to the depth of excavation (30 feet), the design and installation of an excavation support system will be required. The design of the support system will be further detailed in the design package prepared by a NYS licensed Professional Engineer. The Remedial Contractor will be responsible for installing the excavation support system and performing the excavation and backfill.

3.29.1 Excavation Support – Purpose

The remedy requires the removal of soil, fill, and debris from inside, below and around the Gas Holder. To safely achieve this, an excavation support system is required. A rigid, circular excavation support system is preferred to minimize deflections and the amount of excavated material. A circular shaft constructed of cast-in-place secant piles or diaphragm wall panels is proposed to implement the remedy. This type of excavation support system provides several benefits over other, more conventional support systems (such as sheet piling). The objectives, and potential benefits for implementation and constructability for the proposed excavation support system include:

- To provide adequate excavation support for the holder foundation and soil removal.
- To allow for the installation of a support feature keyed into the bedrock for groundwater cutoff and basal stability.

- To install an excavation support system to minimize groundwater infiltration during excavation. A rock-socketed excavation support system will reduce the amount of groundwater that will need to be managed during excavation and backfill.
- To minimize deflections felt by adjacent site features, such as the flood control system to the south, and the public roadway to the north.
- To provide an open excavation (i.e., no lateral bracing), which will allow the excavation and backfill operation to be more efficient.

3.29.2 Excavation Support – Conceptual Design

The conceptual design elements for a rigid, circular excavation support system are discussed below. Additional information and details of the selected excavation support system will be provided in the subsequent design phases.

A guide wall will be constructed around the holder at the existing grade to provide horizontal and vertical alignment and layout control. The elements are installed using a primary-primary-secondary (i.e., skip spacing) technique, which allows adjacent elements to overlap, improve water-tightness, and load transfer. The elements will be keyed into bedrock to provide groundwater cutoff to improve basal stability and reduce the overall volume of water management required during excavation and backfill. Elements are typically installed using temporary casing or slurry to support the sidewalls of the localized excavation for element installation. After the local excavation has been completed, the element is then filled with concrete, typically using tremie methods. Concrete placement continues until laitance and diluted concrete is expelled from the pour and good-quality concrete is observed at the top of the element.

A circular layout of the excavation support system is currently planned, as it conforms to the geometry of the Gas Holder and will help to minimize the amount of excavation and backfill required. A circular geometry is also advantageous because it is quite rigid and allows the elements to act as a compression ring. This configuration typically minimizes the need for heavily-reinforced elements or internal bracing and also minimizes deflection and the associated movement seen by adjacent structures.

The excavation support system is proposed to remain in place after excavation and backfill is complete. However, the tops of the elements can be demolished below grade to allow for the appropriate site cover to be installed during the final restoration phase.

3.30 Excavation Dewatering and Water Management

Excavation below the groundwater table will be required during the work. Therefore, a dewatering system will be installed by the Remedial Contractor, and be ready for use prior to excavating below the groundwater table. Performance requirements for the dewatering

system will be provided in the Remedial Design, and final design will be performed by a Professional Engineer employed or subcontracted by the Remedial Contractor. Included will be a discussion of the procedures to be used for wet soil management. The system will be used for initial dewatering (un-watering) of the holder foundation and bulk excavation, and to keep groundwater levels sufficiently low during excavation and backfilling. Observations during the RI indicated that the groundwater table is present at a depth of about 16 feet in the remedial area. Water is present inside the holder at a depth of 8 feet. This is likely because the holder foundation appears competent and is preventing water exfiltration. The conceptual excavation support system should minimize the amount of groundwater infiltration during the work, so it is anticipated that the bulk of the water will be removed in the initial phase of dewatering, and dewatering during excavation or backfill is anticipated to be limited.

The Remedial Contractor will install a dewatering system in accordance with their means and methods and anticipated excavation sequencing. A filtered collection system will be required to protect against the movement of fines, and the water will be pumped directly from the excavation.

3.30.1 Treatment of Dewatering Effluent

A water treatment system capable of treating the anticipated flows and volumes of water generated during construction will be designed and supplied by the Remedial Contractor. The Remedial Contractor will be responsible for obtaining the necessary permits and testing the water to demonstrate that the treated effluent meets the appropriate discharge requirements. The specifications will require that the system can meet the following performance requirements:

1. Provide flow metering and sufficient storage capacity to meet the daily volume limits of the applicable Wastewater Treatment Facility.
2. Provide flow metering and sufficient storage capacity to meet the daily volume limits of the applicable off-site disposal facility.
3. Provide flow metering and sufficient storage capacity to meet the daily volume limits for discharge to the Chemung River via a State Pollutant Discharge Elimination System (SPDES) permit equivalent request.
4. Separation and recovery of light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) products recovered with the water (not anticipated at this site).
5. Removal of suspended solids.
6. For discharge to the sanitary sewer; removal of the COC and limits identified by the Chemung County Sewer District. For disposal at an off-site facility; testing for the COC identified and the associated limits for off-site transportation and disposal. For

disposal to the Chemung River; testing for the COC identified by the SPDES permit. The system will include sampling ports for collecting samples in accordance with the requirements of the discharge permit.

The appropriate disposal method will be selected during the design development phase. Regardless of which management method is identified for treated water disposal, the characterization and disposal tasks will be performed in conformance with all applicable NYSEG and NYSDEC regulations.

Water treatment and disposal records will be managed by the Remedial Contractor, provided to the Engineer, and included in the FER.

3.31 Archeological Monitoring

If required for the remedial action, a qualified archeologist will monitor the initial phases of the excavation work according to an Archeological Monitoring Plan prepared by the Engineer. The New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) will approve the Archeological Monitoring Plan prior to site mobilization. The Engineer will coordinate any required monitoring with the archeologist. The results of the archeological monitoring will be provided to the Engineer, and summarized in the FER.

3.32 Excavated Materials

The excavation will be performed using standard construction equipment. The Remedial Contractor will be required to remove fill and debris in the holder foundation along with the water contained in the foundation. The brick holder foundation and floor will then be demolished and removed. The impacted soil below the holder floor will then be excavated to approximately 30 feet deep. The target excavation depth could be exceeded if the NYSDEC determines that the excavation criteria identified in the ROD is not met.

Excavated material will likely be loaded directly into trucks for off-site transportation and disposal. If stockpiles are generated, the appropriate containment, dust, and odor control measures will be followed. Excavated materials will be amended, as necessary, in accordance with NYSDEC and disposal facility requirements, to reduce the water content to acceptable levels. A de-watering station will be constructed by the Remedial Contractor. Details regarding de-watering procedures will be provided in the remedial design.

Recyclable Materials

If recyclable materials are encountered during excavation, they will not be mixed with any soil, segregated and stockpiled separately for recycling. A NYSEG-approved facility will be used for the recycling. The Remedial Contractor will identify the facility targeted for the recycling, and submit the facility information to the Engineer and NYSEG for approval. Recyclable materials will be decontaminated prior to transport.

3.33 Historical Utilities or Lines Encountered during Excavation

Although not anticipated, historical utilities or lines from the MGP process area may be encountered in the remedial excavation area. These lines will be removed and disposed of by the Remedial Contractor. Depending on the types of materials encountered, NYSEG may need to coordinate the characterization and disposal of the materials at an appropriate disposal facility. The Remedial Contractor will be responsible for assessing the construction materials and past uses of the lines (if possible), draining any materials including coal tar NAPL from the lines, cutting and capping the lines as the excavation work progresses. If asbestos containing material (ACM) such as pipe wrap is encountered, the Remedial Contractor will implement measures to manage the ACM according to the applicable rules and regulations. If historical lines are encountered, the lines will be photographed, and the locations surveyed. The information will be included in the figures in the FER.

3.34 Confirmation Sampling

Sidewall and excavation bottom confirmation sampling is discussed below. The NYSDEC may add additional confirmation sampling if the NYSDEC determines that the conditions have changed from those described in the NYSDEC ROD.

Sidewall Sampling

Sidewall samples for confirmation are not proposed as it is anticipated that the excavation will remove all soil up to the engineering support.

Based on the density of the borings and test pits completed during the RI, impacted soil is not anticipated in this area. Thirteen samples were collected from the test pits and soil borings around the holder foundation. These include: TP1(12-13), TP3(19-20), SB3(15-16), SB3(48-49), MW2(15-16), MW2(29-30), MW2(46-47), SB1(16-17), SB1(48-49), SB8(27-28), SB8(49-50), SB10(9), SB10(26-27), and SB10(75-76).

- None of the samples contained TPAH17 concentrations above the Guidance Value of 500 mg/Kg.
- None of the samples contained BTEX in concentrations above Commercial Use SCOs.
- None of the samples exhibited visible evidence of hydrocarbon impacts in soil.

The excavation support system will remain in place and will not allow for the sidewall sampling to be performed. The Engineer will consult with the NYSDEC on-site representative or project manager regarding the need for sidewall sampling as the remedial action is performed and soil conditions at the excavation perimeter can be observed to ensure that the remedial goals of the ROD are met.

Excavation Bottom Sampling

Based on the density of the soil borings performed beneath the Gas Holder foundation during the RI, and the associated laboratory results, the excavation bottom confirmation sampling targeted for the remedial action is anticipated to demonstrate that the excavation will verify that the remedial goals of the ROD are met.

- Six samples were collected from three borings during the RI. These include: SB4(23-24), SB4(29-30); SB5(18.2-18.6), SB5(24-25); and SB7(30-31), SB7(49-50).
- Samples were analyzed from the most impacted intervals observed, and also from below the impacted soil intervals.
- None of the samples contained TPAH17 concentrations above the guidance value of 500 mg/Kg. None of the samples contained BTEX in concentrations above Commercial Use SCOs.
- Removal of the visually impacted soil to a depth of about 30 feet will meet the criteria established in the ROD of removing soil that creates a nuisance, as defined in Commissioner Policy (CP) 51 Section G.

Excavation bottom confirmation samples will be collected in accordance with the specifications of DER10 for the COC identified in the ROD. Additional details will be provided in the remedial design.

3.35 Backfill

Clean fill meeting the requirements of DER10, Appendix 5 will be imported for backfill of the excavation. Beneath the parking lot and sidewalk areas, NYSDOT-approved backfill material may be used as discussed in Section 3.10.1. This backfill material will be placed and compacted to allow for restoration of the parking lot surfaces.

3.36 Site Restoration

Following the completion of the remedial excavation activities, the site will be restored to its current use as a parking lot. The restoration plan will be developed in consultation with NYSEG. The following tasks will be performed by the Remedial Contractor:

- **Final Grading** – The ground surface elevation of will be regraded to promote positive surface drainage and restored to be approximately the same as the grade prior to the work.
- **Storm Sewer Replacement** – If necessary, the storm sewer line removed during excavation will be replaced to match the existing conditions.
- **Parking Lot Restoration** – The existing area of the parking lot will be restored following remediation. Pavement restoration details will be developed to match and

be compatible with the existing pavement. Excavated areas and damaged areas of asphalt will be restored to provide a consistent surface.

- **Concrete Sidewalk** – New concrete sidewalks will be installed to match pre-excavations conditions. Entrances, curbs, and other existing site features will be re-constructed, if needed.

If substantial completion occurs during the winter months, final restoration will not be completed until spring. This will prevent restoration work during winter conditions, and will allow paving and concrete work to be completed when temperatures allow. Temporary erosion and sedimentation controls will remain in place until final restoration is complete.

3.37 Groundwater Monitoring Well Installation

One up-gradient well, MW2R, will be installed to replace the well decommissioned during construction to allow for the excavation support to be installed. The well installation will be performed by a NYS-licensed well driller contracted by the Remedial Contractor or the Engineer. The monitoring well will be constructed with 2-inch Schedule 40 PVC and 0.020-inch slotted PVC screen and will be similar to the construction of MW2. The well will be developed and allowed to stabilize prior to groundwater sampling.

3.38 As-Built Survey

The Remedial Contractor will contract a NYS licensed surveyor to perform an as-built survey when the work is complete. The survey information will be used to document the final site conditions. The new replacement well will be surveyed. The results of the survey will be provided to the Engineer and included in the FER.

3.39 Post-Construction Survey

A post-remedial condition survey will be performed after the remedial work is complete. The survey will include:

- Comparisons of the observations of the pre- and post-remedial construction survey.
- Observations regarding the post-remedial condition of the levee and flood wall. The results of the observations and photographs of the wall conditions will be provided in the FER.
- A final (post-remedial) check of crack gauges installed on any identified pre-remedial cracks in the FPP embankment wall.
- Final set of readings for the inclinometers installed at the site.
- Observations regarding the post-remedial condition of the City of Elmira 84-inch CMP interceptor sewer. The reconnaissance will be coordinated with staff from the

City of Elmira DPW or City Engineer. The results of the observations and photographs of the sewer conditions will be provided in the FER.

- Observations regarding the post-remedial condition of the Chemung Vital Statistics / Aladin Management Building located in the off-site area to the north of the site.

3.40 Decontamination

Personnel and equipment decontamination procedures will be developed to reduce the potential for residuals to migrate from the excavation area (exclusion zone) to other site work areas (support zone) or to public areas (i.e., highways, roads, support trailer, vehicles, etc.). Additional procedures for decontamination will be identified and implemented as described in the HASP (Appendix G), and the Remedial Contractor's HASP and Narrative Work Plan (provided upon award of contract). Decontamination procedures implemented by the Remedial Contractor will likely include:

- **Personnel Decontamination Station** - A personnel decontamination station where workers can drop equipment and remove personal protective equipment (PPE) will be set up within the work zone. It will be equipped with basins for water and detergent, and trash bags or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves as a secondary means of personal hygiene (e.g., hands, face, etc.).
- **Equipment Decontamination Station** - Heavy equipment decontamination will be performed within the limits of the on-site decontamination pads. If necessary, at the decontamination/anti-tracking pad, heavy equipment will be pressure-washed before leaving the site. Upon exiting the excavation area, the contractor will stage the trucks on the equipment decontamination/anti-tracking pad. Trucks will then be visually inspected (i.e., box sidewalls, box tailgate, and tires, etc.), cleaned with brushes/brooms and will be decontaminated with pressure sprayers, if necessary, prior to being allowed to leave the site.
- **Decontamination/anti-tracking pads** - Will be located where vehicular or equipment traffic leaves the site. The decontamination pad(s) will be sufficiently sized to ensure that the largest piece of contractor equipment can be adequately decontaminated. If wash stations are used, provisions will be made to capture wash water and control overspray.

3.41 Management of Waste

On-site storage will take place in accordance with the applicable laws and regulations dealing with the type of waste being stored. Liquid wastes will be stored in appropriate tanks or drums. Other solid waste materials (i.e., non-soil) will be directly loaded into haul trucks, or be stored in roll-off containers or within the excavation. In order to consolidate large

amounts of waste material for bulk transport, or because of construction sequencing and off-site disposal facility scheduling issues, it will likely be necessary to stage impacted waste material on site within the excavation prior to shipment.

If stockpiles are generated, the appropriate containment, dust, and odor control measures will be followed. Waste materials will be amended, as necessary, in accordance with NYSDEC and disposal facility requirements, to reduce the water content to acceptable levels.

Debris generated during demolition and excavation may require decontamination and/or downsizing to meet facility acceptance requirements. Material generated during decontamination operations will be collected and managed with other impacted material. Decontamination water will be collected for off-site disposal or treatment. Breaking down large stones, concrete, etc. will be accomplished using an excavator mounted hoe ram or other acceptable means.

Trucks will be loaded in such a way as to avoid contamination of their exteriors, including tires. Trucks will be checked for loose soil or other materials and odors before leaving the site. Loose soil or other materials will be removed to prevent unwanted discharge. Street sweeping will be provided by the Remedial Contractor at the frequency required in the specifications or based on field observations by the Engineer, NYSEG, or the NYSDEC.

3.42 Off-Site Transportation and Disposal

The Remedial Contractor will coordinate the loading and transportation of the excavated material with the designated receiving facilities for off-site disposal. Truck traffic will generally follow the identified transportation route (Figure 11).

Excavated materials will be transported by a NYS permitted waste hauler to the receiving facilities in gasket sealed tailgate dump trucks or dump trailers. Trucks transporting excavated material to the disposal facility will be lined before loading occurs and will use solid, sealable covers during transport. The use of mesh roll-top covers will not be permitted. The truck will then exit the site via an anti-tracking pad or other feature to help remove soil from the tires, and will proceed directly to the designated off-site disposal facility.

If necessary, liquids will be transported in tanker trucks for disposal at an appropriate off-site disposal facility.

It is not anticipated that hazardous waste will be generated. However, hazardous waste shipments (if generated) will be documented using standard hazardous waste manifests as required by applicable NYSDEC and Federal Department of Transportation (DOT) waste regulations.

Other waste materials (i.e., non-hazardous wastes) that have no specific documentation requirements will be documented using waste tracking forms, bills of lading, and receipts. All shipments of waste will be documented, describing the type and amount of waste and the receiving facility. All wastes shipped off site will be pursuant to a signed waste manifest (either a hazardous or non-hazardous waste manifest). NYSEG or NYSEG's designated representative will sign the transportation manifests.

Transportation of impacted materials will be performed in accordance with the applicable NYSDEC and NYSDOT requirements for hazardous and non-hazardous materials.

3.43 Transportation Permit Requirements

The DOT has developed requirements which regulate the transportation of hazardous materials by road and rail. Among the hazardous materials identified in these regulations are coal tar distillates. In addition, as discussed above, hazardous waste regulations specify that shipments of hazardous wastes must meet certain requirements presented in the federal and applicable state regulations. Specific requirements for hazardous material shipments include the following:

- All truckers must have valid NYSDEC Part 364 Waste Transporter Permits, with a copy of the issued permit in each vehicle.
- Shipping papers must include a description of hazardous materials included in the shipment along with the DOT designated identification number and hazard class. Hazardous wastes may not be shipped without a manifest (49 CFR 172.200). All vehicles transporting waste materials for off-site treatment or disposal will use a manifest (either for hazardous waste or non-hazardous waste).
- Each container, package, or vehicle containing a hazardous material must be marked or labeled with the DOT shipping name, technical name, identification number, and hazard class (49 CFR 172.300 and 49 CFR 17 .400).
- Each vehicle or container containing a hazardous material must be appropriately placarded (49 CFR 172.500).
- When hazardous materials are transported, emergency response information must be available at the point of loading, unloading, and during transport. Trucks coming to and from the site will comply with the Truck Route.

3.44 Remedial Contractor Demobilization

Following the completion of the restoration activities and other closeout procedures, the Remedial Contractor will dismantle the temporary facilities, staging areas, decontamination area, and remove all equipment and materials from the site.

3.45 Supporting Plans

The following supporting plans are site-specific documents that ensure the activities are performed in general accordance with the applicable laws and regulations and will achieve the project objectives.

3.45.1 Health and Safety Plan

Site-specific HASPs will be prepared by the Engineer for their staff for the PDI and the remedial action oversight (Appendix G). A HASP will be prepared by the drilling company for the PDI. A HASP will be prepared by the Remedial Contractor for their staff and subcontractors for implementation of the remedy. HASPs typically contain information regarding emergency contacts, the route to the nearest hospital, and site-specific hazards for this excavation project. Based on previous experience with the site investigation, the field activities will be performed with modified level D PPE. Level C may be required for personnel working for long periods and in close proximity to excavation areas which contain hydrocarbon-impacted soil. GEI's current HASP is provided in Appendix G as an example, and will be modified as needed prior to mobilization.

3.45.2 Community Air Monitoring Plan and Odor Management Plan

Perimeter and work zone air monitoring will be performed in accordance with the CAMP provided in Appendix F which includes an Odor Management Plan that provides measures to protect the nearby community from MGP-related nuisance odors during the remedial activities. The CAMP will be followed during the remedial action activities discussed above.

3.45.3 Citizens Participation Plan

A CPP will be in place prior to the start of the remedial activities. The CPP will describe the methods to be used to update the public regarding the scope and schedule for the remedial activities. A draft version of the CPP is included in Appendix H. It will need to be updated prior to mobilization to ensure that the most current contact information is included.

3.46 Reporting

Project reporting will be completed in accordance with NYSDEC DER10 and the ROD.

3.46.1 Daily Reports

A daily report will be prepared to document the remedial activities. The report will include the following:

- A list of personnel and equipment present on the site.
- A summary of the accomplishments, observations, and any non-conforming activities.

- A summary of odor control activities, CAMP exceedances, and engineering controls used to mitigate odors and improve air quality.

Copies of the individual daily reports will be provided in the FER.

3.46.2 Final Engineering Report

A Final Engineering Report (FER) will be prepared by the Engineer at the conclusion of the field activities in accordance with DER10, Section 5.8. The following items will be included:

- Background and Site Description
- Remedial Action Objectives
- Description of Remedial Actions performed, with accompanying documentation
- Governing Documents
- Remedial Program Elements
- Impacted Materials Removal
- Remedial Performance/Documentation Sampling
- Imported Backfill
- Impacted Media Remaining at the site
- Soil Cover System
- Engineering Controls
- Institutional Controls
- Deviations from the RDWP
- Tables
- Figures
- Record drawings, specifications, addenda, actual volumes of excavated material and treated / discharged wastewater
- Approval and Closure documents from NYSDEC
- Approved permits
- Shipping manifests and bills of lading (contaminated soil, clean fill, and construction dewatering liquids)
- Summary of Air Monitoring Data collected during the remedial activities
- Certification that material transported off site was disposed of at a properly licensed NYSEG-approved disposal facility or Treatment Storage and / or Disposal Facility

4. Permits and Approvals

Copies of all permits obtained for this project will be provided to the NYSDEC.

4.1 Local Building Permits

Local building permits may be required for various aspects of this project. The Remedial Contractor will be responsible for obtaining the necessary permits for the remedial work. The permits may include, but not be limited to, a local fire hydrant usage permit, the excavation and site restoration work, demolition work, storm water pollution prevention, road closures, and the construction of a temporary parking area, air emissions, noise, etc. Specifically, a local permit may be required if adjacent roadways (such as East Water Street Street) are temporarily closed during the remedial activities. The requirements for the local permits will be confirmed prior to mobilization, and copies of the permits provided to the NYSDEC.

4.2 Temporary Wastewater Discharge Permit and Approval

Two options for the management of wastewater may be utilized by the Remedial Contractor.

Chemung County Sewer District Wastewater Treatment Facility

One option for water management includes on-site treatment for suspended solids, and VOCs/SVOCs, and discharge to the sanitary sewer system. The water will pass through a certified meter and then to the discharge point at the sanitary sewer system in East Water Street. An approval letter / permit will be required from the City of Elmira Treatment Plant for this discharge. The permit request will describe the requirements for operating any wastewater treatment system on site (to remove COC related to the MGP site), and the testing required, and the specifics of the discharge of pre-treated wastewater to the sanitary sewer system, including discharge volume restrictions. The Remedial Contractor will confirm these requirements by contacting the City prior to mobilization to obtain the permit, and then provide the required information to the City as required.

Treatment and Off-Site Disposal

A second option for water management is off-site treatment and disposal at a NYSEG-approved facility. The Remedial Contractor will be required to obtain approval from a properly licensed, NYSEG-approved disposal facility for all transported materials. Volume limitations, if any, for the identified facilities, should be evaluated by the Remedial Contractor.

4.3 NYSDEC Flood Protection Project Permit Requirements

GEI contacted the NYSDEC FPP office in Elmira, New York to evaluate if a NYSDEC FPP permit was required for the remedial action. Based on GEI's current conceptual design and our discussions with the NYSDEC staff, a NYSDEC Article 16 Flood Control Land Use Permit will not be required. This permit is not required because the remedial work will not occur on flood control lands or adversely affect the Elmira Flood Protection Project. A definition of regulated activities on flood control lands is presented in NYCRR Part 501 Use of Flood Control Lands. GEI will continue to communicate with the NYSDEC FPP office in Elmira during the design process.

4.4 USACE Permit Requirements

The NYSDEC Elmira FPP staff has indicated that they have contacted the U.S. Army Corps of Engineers (USACE) regarding the remedial work required for the site. The Department has indicated that a review of the proposed work by the USACE with respect to the Elmira FPP will not be required based on the location of the proposed work.

4.5 Archeological Monitoring

The New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) will be contacted to determine if an Archeological Monitoring Plan will be required for the remedial project. If a plan is required, the Engineer will update NYSEG and the NYSDEC. The Engineer will prepare a plan for NYSOPRHP review and approval. The plan will be prepared in accordance with DER10 5.1(g), a Phase IA Report of archeological and cultural resources. The Engineer will then coordinate the monitoring with the archeologist during the initial stages of the remedial excavation within the Gas Holder foundation. The results of the archeological monitoring will be provided to the Engineer, and summarized in the FER. The Phase 1A Report will be consistent with the requirements of Section 14.09 of the State Historic Preservation Act.

4.6 Transportation Permit Requirements

The Federal Department of Transportation (DOT) has developed requirements which regulate the transportation of hazardous materials by road and rail. Among the hazardous materials identified in these regulations are coal tar distillates. In addition, as discussed above, hazardous waste regulations specify that shipments of hazardous wastes must meet certain requirements presented in the federal and applicable state regulations. Specific requirements for hazardous material shipments include the following:

- All truckers must have valid NYSDEC Part 364 Waste Transporter Permits, with a copy of the issued permit in each vehicle.

- Shipping papers must include a description of hazardous materials included in the shipment along with the DOT designated identification number and hazard class. Hazardous wastes may not be shipped without a manifest (49 CFR 172.200). All vehicles transporting waste materials for off-site treatment or disposal will use a manifest (either for hazardous waste or non-hazardous waste).
- Each container, package, or vehicle containing a hazardous material must be marked or labeled with the DOT shipping name, technical name, identification number, and hazard class (49 CFR 172.300 and 49 CFR 17 .400).
- Each vehicle or container containing a hazardous material must be appropriately placarded (49 CFR 172.500).
- When hazardous materials are transported, emergency response information must be available at the point of loading, unloading, and during transport. Trucks coming to and from the Elmira Water MGP Site will comply with the Truck Route illustrated on Figure 11.

5. Schedule

This section presents a preliminary project schedule for the completion of the Remedial Design and the implementation of the remedy.

Preliminary Project Schedule

Schedule Component	Target Date
RDWP Submittal	Second Quarter 2018
Pre-Design Investigation	Second or Third Quarter 2018
Remedial Design Finalization	Second Quarter 2019
Remedial Construction Phase	Second and Third Quarter 2021

The final schedule for implementation of the remedy will be developed in consultation with the NYSDEC. The final schedule for the start of the remedial activities will depend on obtaining the necessary access agreements, and the approval of the project plans by the NYSDEC.

6. Post-Remedial Controls and Plans

The post-remedial requirements and activities identified in the NYSDEC ROD are summarized in the following sections.

6.1 Institutional Controls

The remedy includes the imposition of an Institutional Controls (ICs) in the form of an Environmental Easement for the site. It will include the areas covered by the flood control easements located in the southern area of the site. The ICs:

- Requires the remedial party or site owner to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- Allows the use and development of the controlled property for Commercial or Industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or Chemung County DOH; and,
- Requires compliance with the NYSDEC-approved SMP.

6.2 Engineering Controls

A site cover currently exists at the site outside of the identified remedial area. Following remediation, the site cover will be maintained to allow for Commercial or Industrial Use of the site. Potential redevelopment of the site will be required to maintain the applicable cover system which consists of buildings, pavement, sidewalks or soil where the upper 1 foot of exposed soil meets the applicable NYSDEC SCOs for Commercial Use. Imported fill material will meet the requirements for the identified site use as set forth in 6 NYCRR Part 375-6.7(d).

6.3 Site Management Plan

As specified in the ROD, a Site Management Plan (SMP) will be required for the site following implementation of the remedy. The SMP will include the following:

- an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements

necessary to ensure the following institutional and/or engineering controls remain in place and effective:

- Institutional Controls: The Environmental Easement discussed above.
- Engineering Controls: The soil cover system discussed above.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations on-site;
- a provision for further investigation and remediation should large scale redevelopment occur, such as maintenance, reconstruction, replacement of the flood control structure, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible.

The nature and extent of MGP-related impacts in areas where access was previously limited or unavailable during the RI, including the area within the NYSDEC FPP easements which was not investigated due to the setback limits stipulated in the permit issued by the NYSDEC, will be immediately and thoroughly investigated pursuant to the investigation work plan approved by the NYSDEC DER. All necessary approvals for the construction within the flood control easement will be obtained. Citizen Participation Plan (CPP) activities will continue through this process. Any necessary remediation will be completed prior to, or in association with, redevelopment:

- descriptions of the provisions of the environmental easement including any land use, and/or groundwater;
- a provision for evaluation of the potential for soil vapor intrusion for any future buildings that are developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification;
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls;
- a schedule of monitoring and frequency of submittals to the Department; and
- monitoring for vapor intrusion for future buildings that are developed on the site as may be required by the Institutional and Engineering Control Plan discussed above.

6.4 Post-Remediation Groundwater Monitoring Plan

The Post-Remediation Groundwater Monitoring Plan will specify the frequency of sampling, sampling locations, laboratory analyses, and duration and program evaluation. The objective

of the Post-Remediation Groundwater Monitoring Plan is to continue to document the non-impacted conditions for groundwater (Class GA groundwater standards and guidance) at the site following the remedial action. The plan is anticipated to be maintained for a period of at least five (5) years. Any changes or reductions to the plan will be proposed to, and approved by the NYSDEC. The locations of the wells that will remain at the site following the remedial action are shown on Figure 10.

7. References

GEI, 2013. Remedial Investigation Work Plan, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309, dated February 18, 2013.

GEI, 2014. Remedial Investigation Report, Elmira Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309, August 27, 2014.

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NYSDEC, 2006a. NYSDEC Rules and Regulation, 6 NYCRR Subpart 375-1: General Remedial Program Requirements, December 14, 2006.

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NYSDEC, 2010a. DER10 – Technical Guidance for Site Investigation and Remediation, May 2010.

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NYSDEC, 2010d. DER31 – Green Remediation, August 2010. Revised January 2011.

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NYSDOH, 2006. NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006.

NYSDEC, 2016. New York State Standards and Specifications for Erosion and Sediment Control, NYSDEC, November 2016.

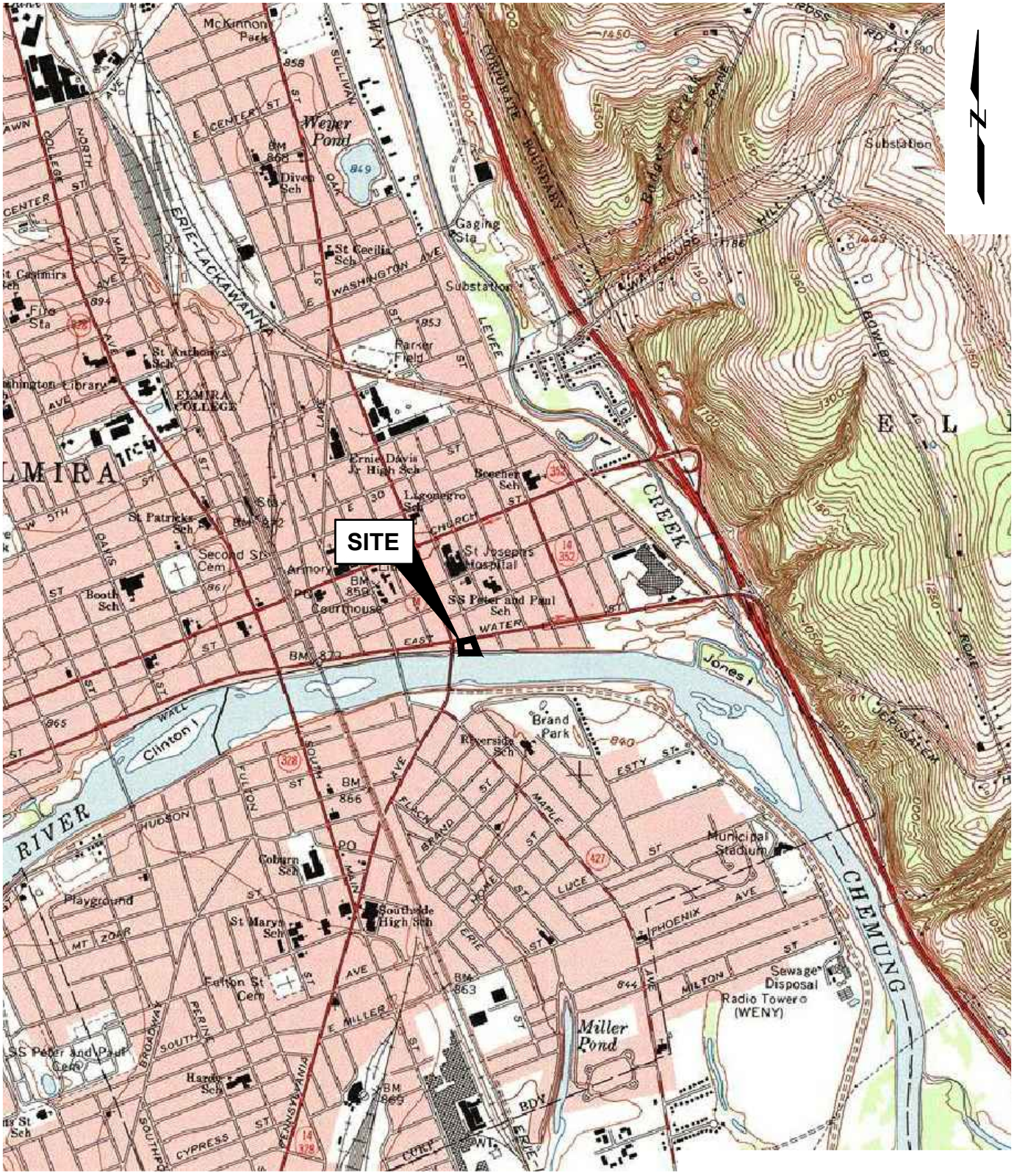
NYSDEC, 2017. Record of Decision - NYSEG – Elmira Water Street MGP State Superfund Project – Elmira, Chemung County, Site No. 808025, March 2017.

Tables

Table 1
Location Points on Gas Holder and Excavation Support
Remedial Design Work Plan
Elmira Water Street MGP Site

Identified Points on Gas Holder Foundation	Easting	Northing
H-1	762266.45	761031.46
H-2	762272.69	761030.47
H-3	762278.33	761027.60
H-4	762282.80	761023.13
H-5	762285.67	761017.49
H-6	762286.66	761011.24
H-7	762285.67	761005.00
H-8	762282.80	760999.36
H-9	762278.33	760994.89
H-10	762272.69	760992.02
H-11	762266.45	760991.03
H-12	762260.20	760992.02
H-13	762254.56	760994.89
H-14	762250.09	760999.36
H-15	762247.22	761005.00
H-16	762246.23	761011.24
H-17	762247.22	761017.49
H-18	762250.09	761023.13
H-19	762254.56	761027.60
H-20	762260.20	761030.47
Identified Points on Excavation Support	**Easting**	**Northing**
S-1	762266.45	761038.73
S-2	762274.94	761037.39
S-3	762282.60	761033.48
S-4	762288.69	761027.40
S-5	762292.59	761019.74
S-6	762293.94	761011.24
S-7	762292.59	761002.75
S-8	762288.69	760995.09
S-9	762282.60	760989.01
S-10	762274.94	760985.10
S-11	762266.45	760983.76
S-12	762257.95	760985.10
S-13	762250.29	760989.01
S-14	762244.21	760995.09
S-15	762240.30	761002.75
S-16	762238.96	761011.24
S-17	762240.30	761019.74
S-18	762244.21	761027.40
S-19	762250.29	761033.48
S-20	762257.95	761037.39

Figures



SOURCE:

U.S.G.S. TOPOGRAPHIC MAP ELMIRA, NY 1969, CREATED WITH TOPO!
® ©2001 NATIONAL GEOGRAPHIC (www.nationalgeographic.com/topo)

Remedial Design Work Plan Elmira Water Street MGP Site Elmira, New York	GEI	SITE LOCATION MAP
NYSEG Binghamton, New York	Project 1704633	June 2018 Fig. 1

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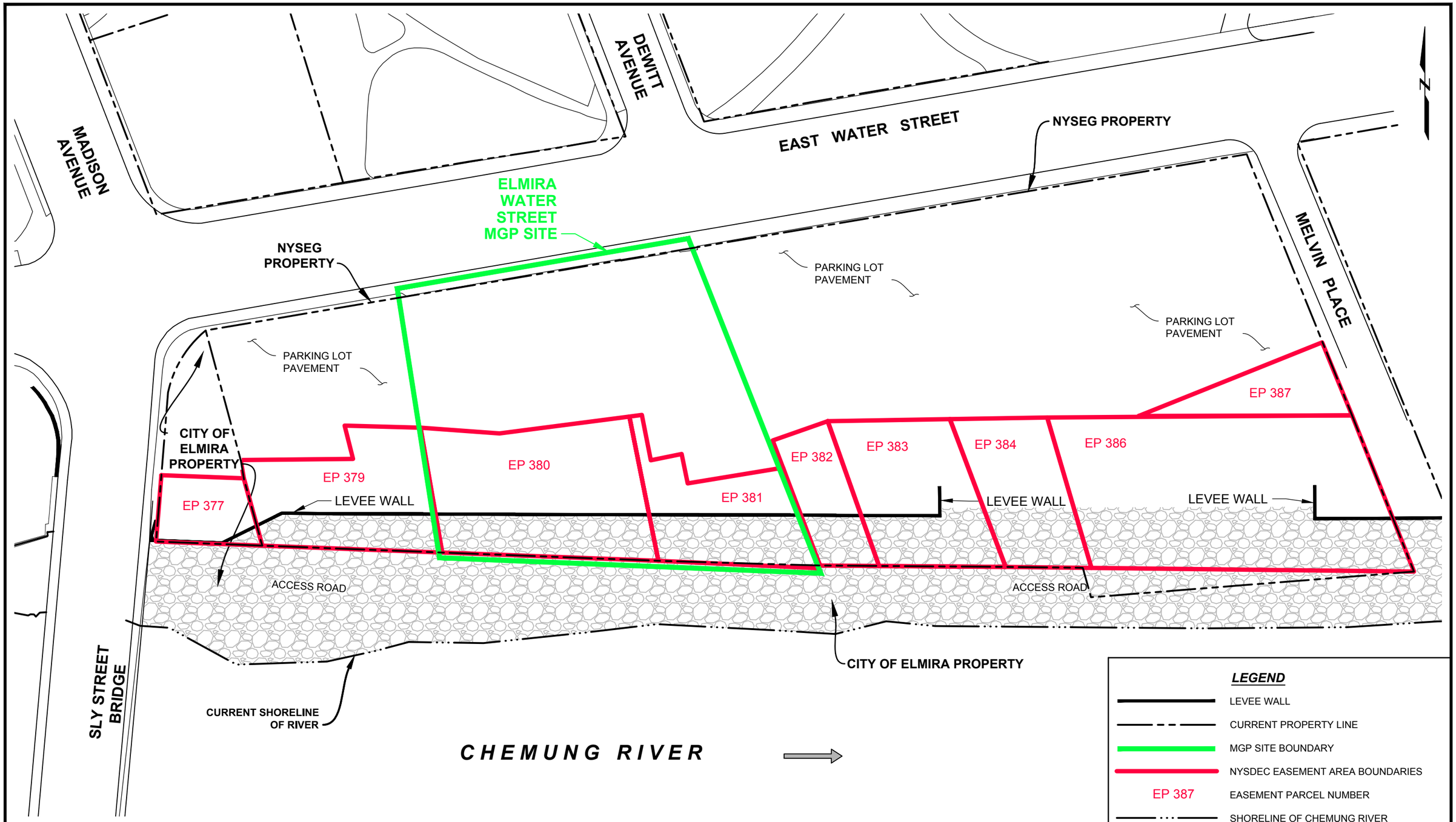

LEGEND

- LEVEE WALL
- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- NYSDEC EASEMENT AREA BOUNDARIES
- EP 387 — EASEMENT PARCEL NUMBER
- SHORELINE OF CHEMUNG RIVER

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. NYSDEC/USACE ELMIRA FLOOD PROTECTION PROJECT FIGURE C-1851 - FINAL PROJECT MAP, DATED 4/26/57.

0 50' 100'

SCALE: 1" = 50'

Remedial Design Work Plan
Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

CURRENT FEATURES AND NYSDEC FLOOD CONTROL EASEMENT AREAS

Project 1704633 | June 2018 | Fig. 2

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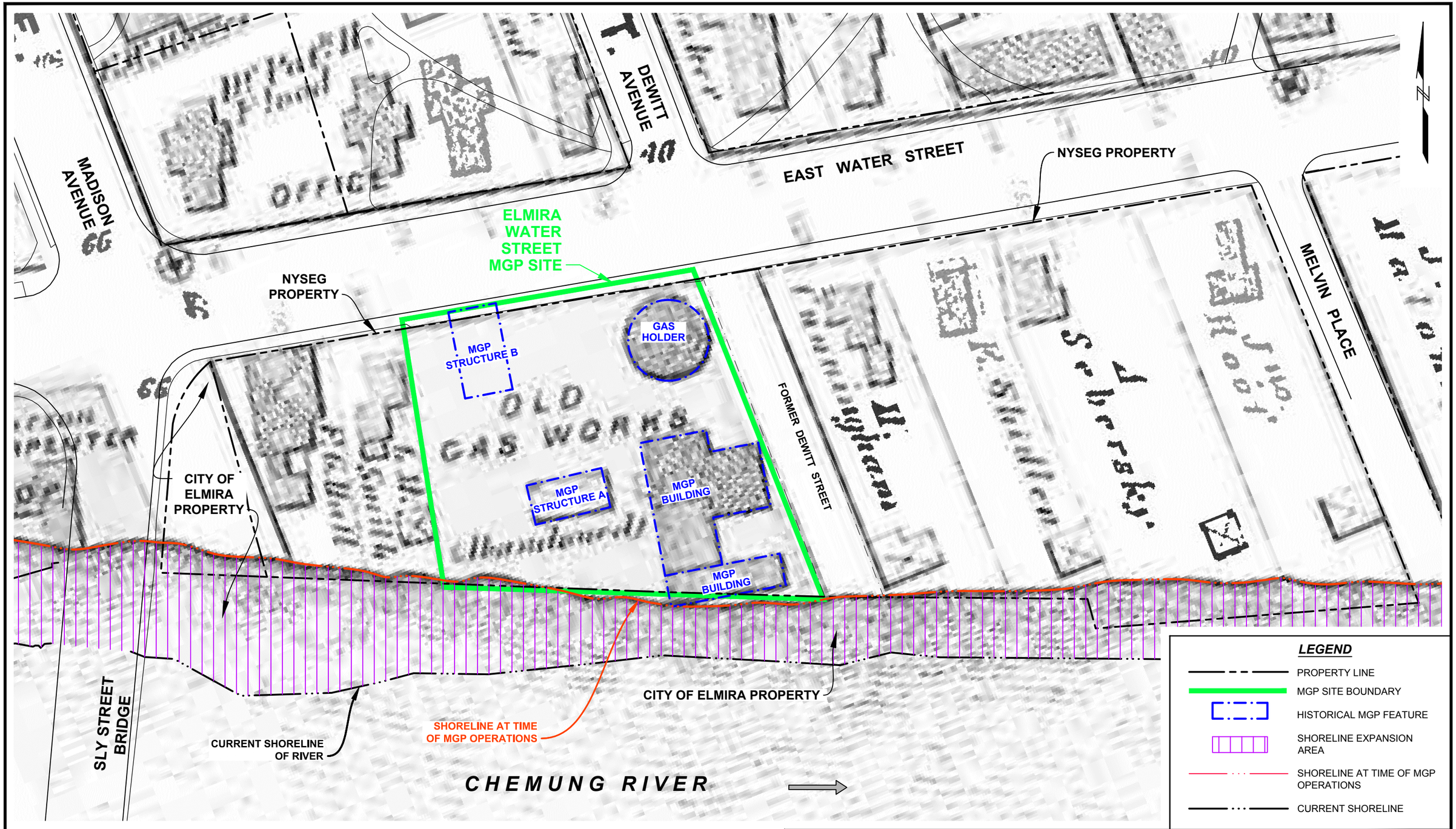

SOURCES

1. 1876 HISTORICAL ATLAS MAP.
2. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.

0 50' 100'

SCALE: 1" = 50'

Remdial Design Work Plan
Elmira Water Street MGP Site
Elmira, New York

NYSEG
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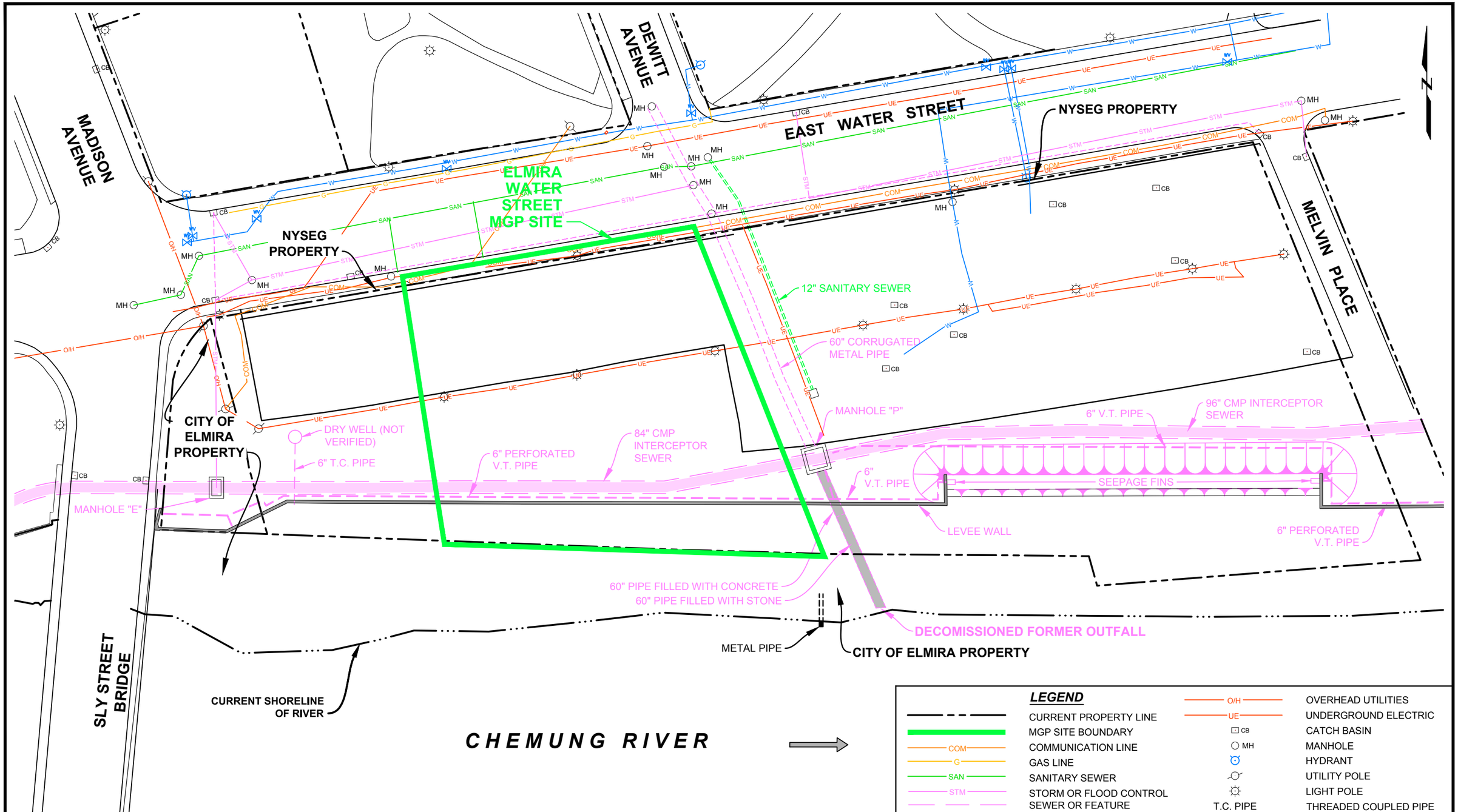
CURRENT AND HISTORICAL MGP FEATURES

Project 1704633 | June 2018 | Fig. 3

\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\3 - 1704633_RDWP.dwg - 3/28/2018



LEGEND

	CURRENT PROPERTY LINE	O/H	OVERHEAD UTILITIES
	MGP SITE BOUNDARY	UE	UNDERGROUND ELECTRIC
COM	COMMUNICATION LINE	CB	CATCH BASIN
G	GAS LINE	MH	MANHOLE
SAN	SANITARY SEWER		HYDRANT
STM	STORM OR FLOOD CONTROL SEWER OR FEATURE		UTILITY POLE
			LIGHT POLE
W	WATER LINE	T.C. PIPE	THREADED COUPLED PIPE
		V.T. PIPE	VITRIFIED PIPE

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50' 100'

SCALE: 1" = 50'

Remedial Design Work Plan
Elmira Water Street MGP Site
Elmira, New York

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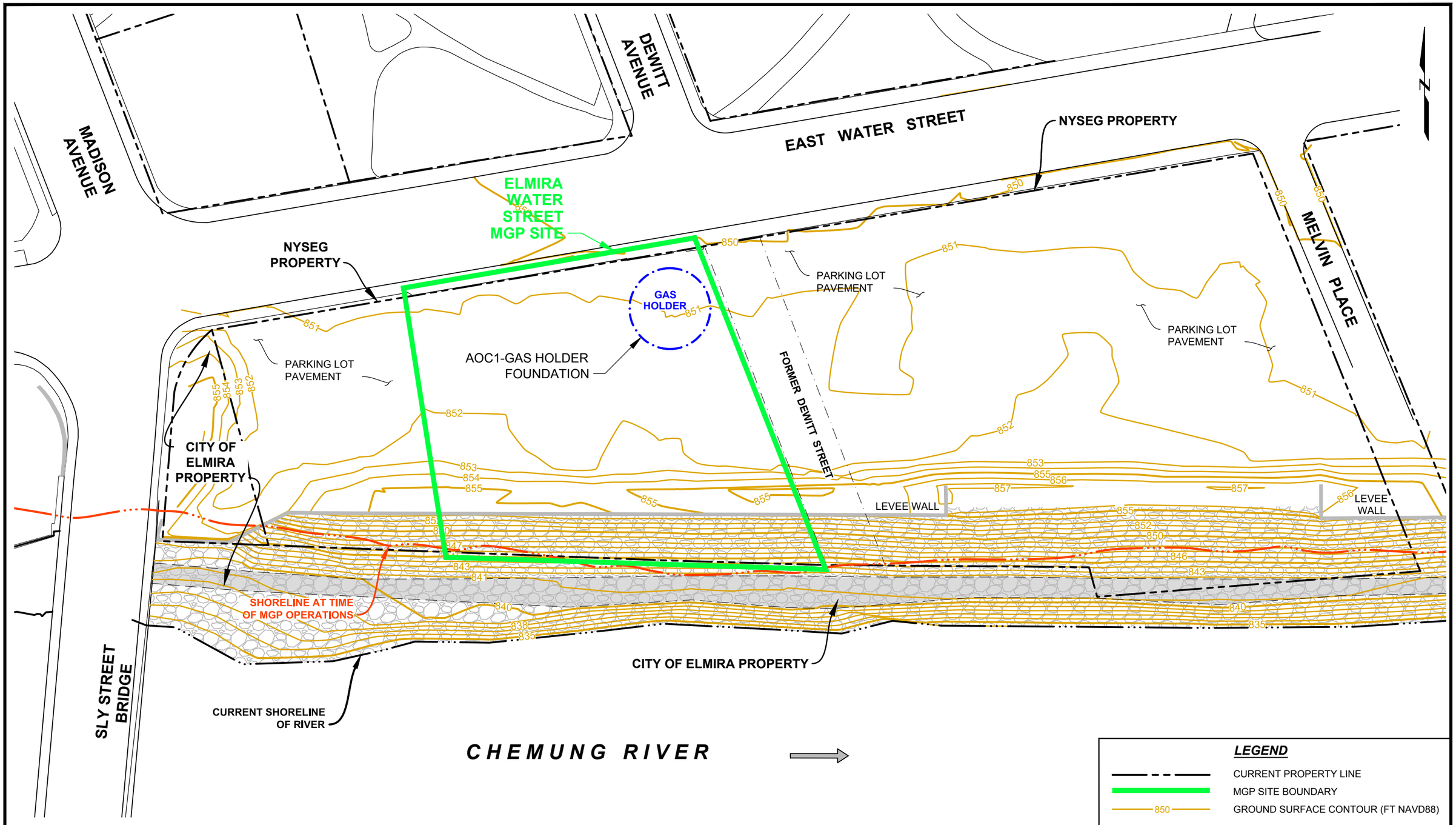
CURRENT UTILITY PLAN

Project 1704633 | June 2018 | Fig. 4



LEGEND

- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- 850 GROUND SURFACE CONTOUR (FT NAVD88)

SOURCES

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50 100

SCALE: 1" = 50'

Remedial Design Work Plan
Elmira Water Street MGP Site
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Binghamton, New York

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SITE LAYOUT, GROUND SURFACE CONTOURS

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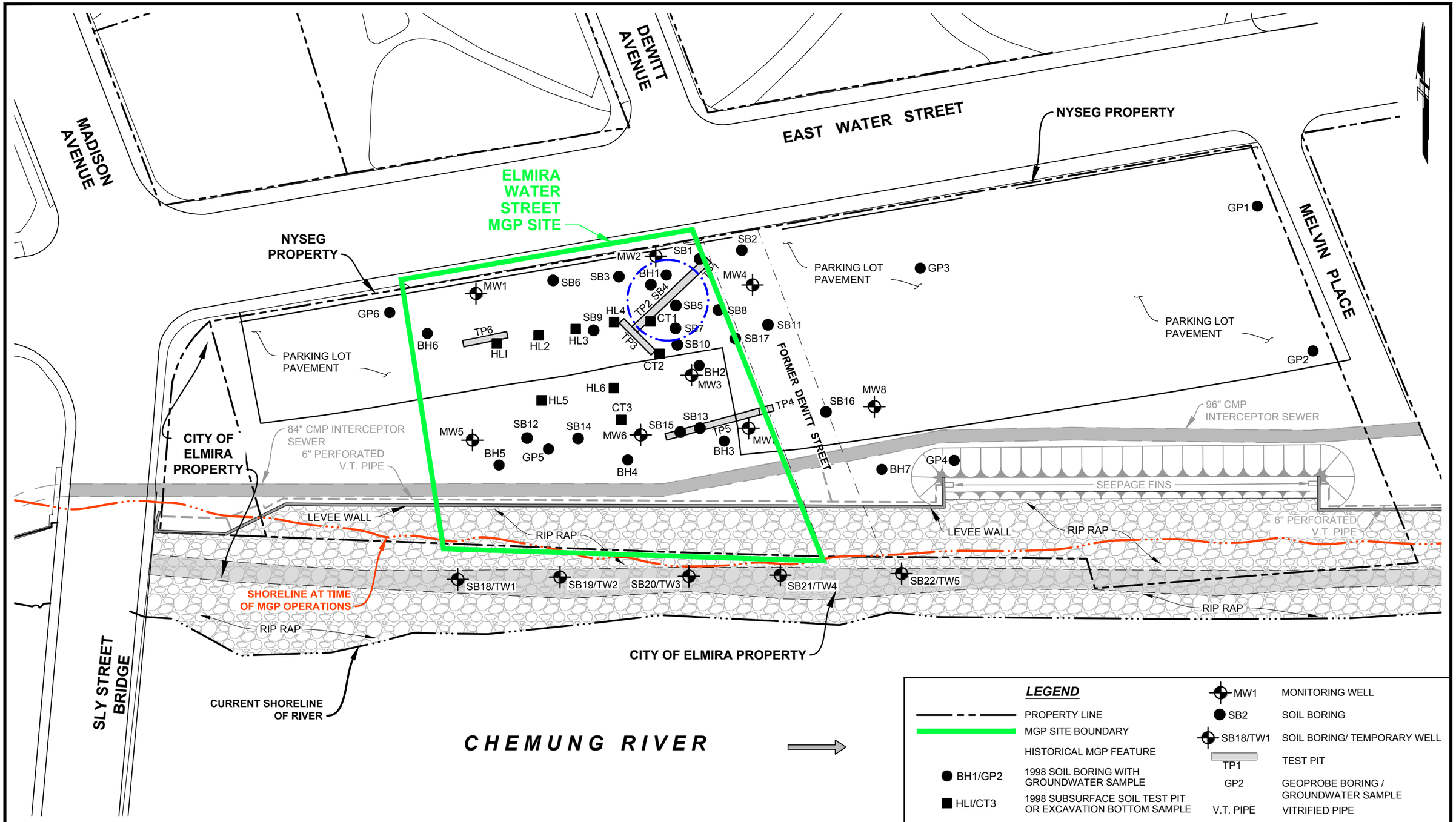
\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\5-7 1704633-RDWP.dwg - 3/28/2018



LEGEND

PROPERTY LINE	MW1 — MONITORING WELL
MGP SITE BOUNDARY	SB2 — SOIL BORING
HISTORICAL MGP FEATURE	SB18/TW1 — SOIL BORING/ TEMPORARY WELL
BH1/GP2 — 1998 SOIL BORING WITH GROUNDWATER SAMPLE	TP1 — TEST PIT
HLI/CT3 — 1998 SUBSURFACE SOIL TEST PIT OR EXCAVATION BOTTOM SAMPLE	GP2 — GEOPROBE BORING / GROUNDWATER SAMPLE
	V.T. PIPE — VITRIFIED PIPE

SOURCES

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50 100

SCALE: 1" = 50'

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REMEDIAL INVESTIGATION EXPLORATION LOCATIONS

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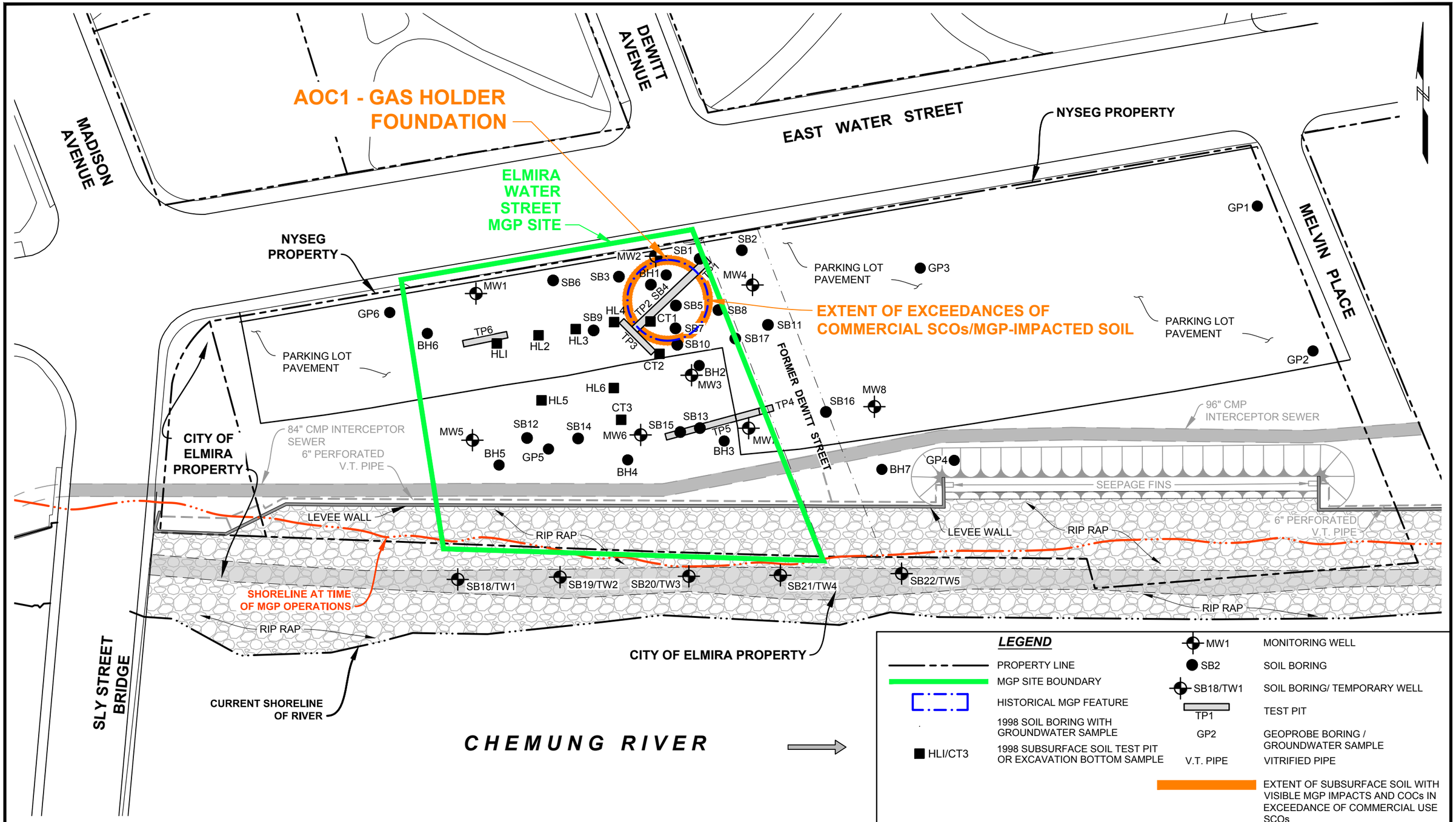
\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\5-7 1704633-RDWP.dwg - 3/28/2018



LEGEND

PROPERTY LINE	MW1 — MONITORING WELL
MGP SITE BOUNDARY	SB2 — SOIL BORING
HISTORICAL MGP FEATURE	SB18/TW1 — SOIL BORING/ TEMPORARY WELL
1998 SOIL BORING WITH GROUNDWATER SAMPLE	TP1 — TEST PIT
1998 SUBSURFACE SOIL TEST PIT OR EXCAVATION BOTTOM SAMPLE	GP2 — GEOPROBE BORING / GROUNDWATER SAMPLE
HLI/CT3	V.T. PIPE — VITRIFIED PIPE
	EXTENT OF SUBSURFACE SOIL WITH VISIBLE MGP IMPACTS AND COCs IN EXCEEDANCE OF COMMERCIAL USE SCOs

SOURCES

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

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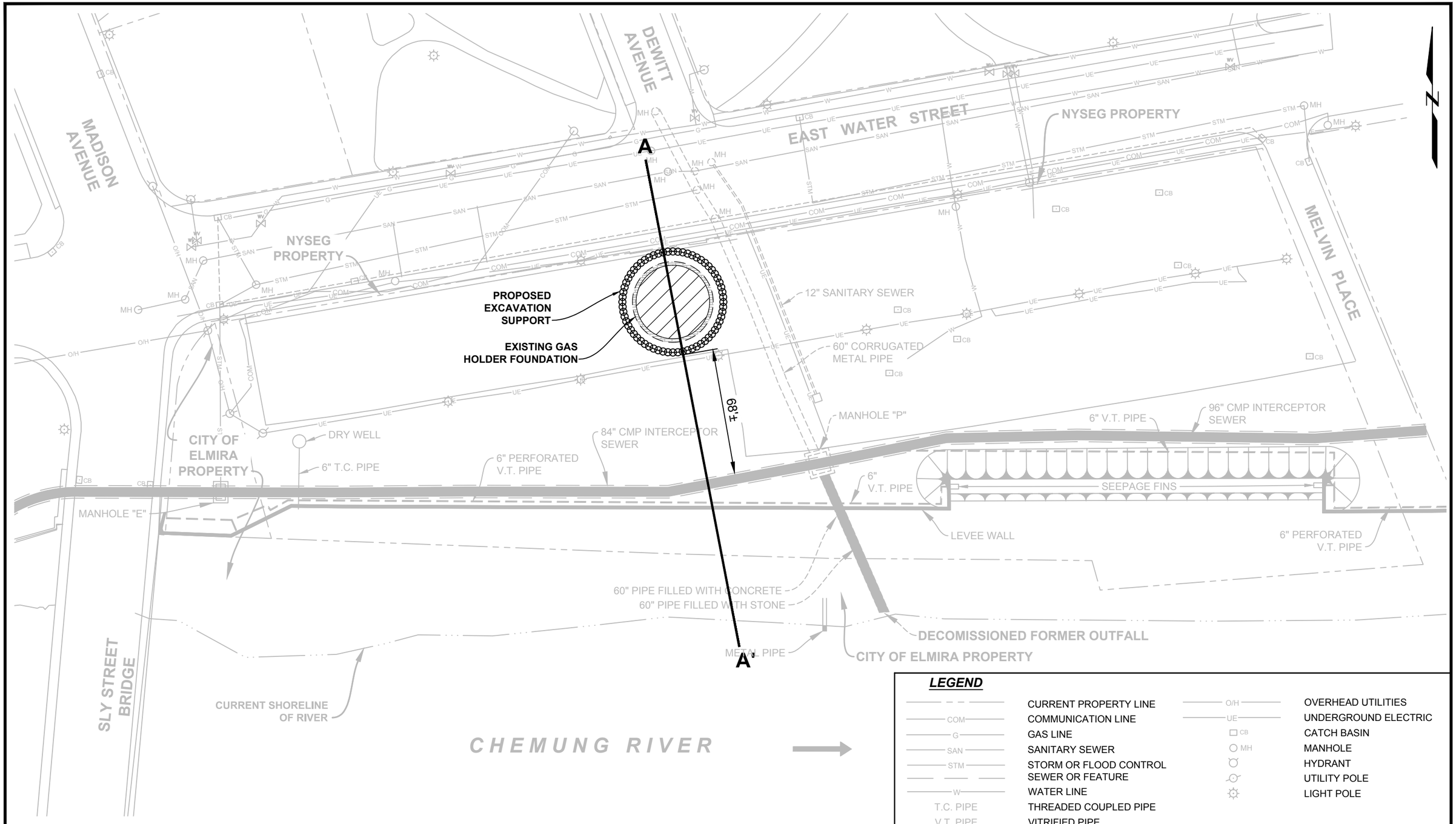
EXTENT OF COMMERCIAL SCO EXCEEDANCES AND VISIBLE MGP-IMPACTED SOIL

Project 1704633 | June 2018 | Fig. 7

\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\5-7 1704633-RDWP.dwg - 3/28/2018



LEGEND

	CURRENT PROPERTY LINE	O/H	OVERHEAD UTILITIES
COM	COMMUNICATION LINE	UE	UNDERGROUND ELECTRIC
G	GAS LINE	CB	CATCH BASIN
SAN	SANITARY SEWER	MH	MANHOLE
STM	STORM OR FLOOD CONTROL SEWER OR FEATURE		HYDRANT
W	WATER LINE		UTILITY POLE
T.C. PIPE	THREADED COUPLED PIPE		LIGHT POLE
V.T. PIPE	VITRIFIED PIPE		

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50' 100'

SCALE: 1" = 50'

Remedial Design Work Plan
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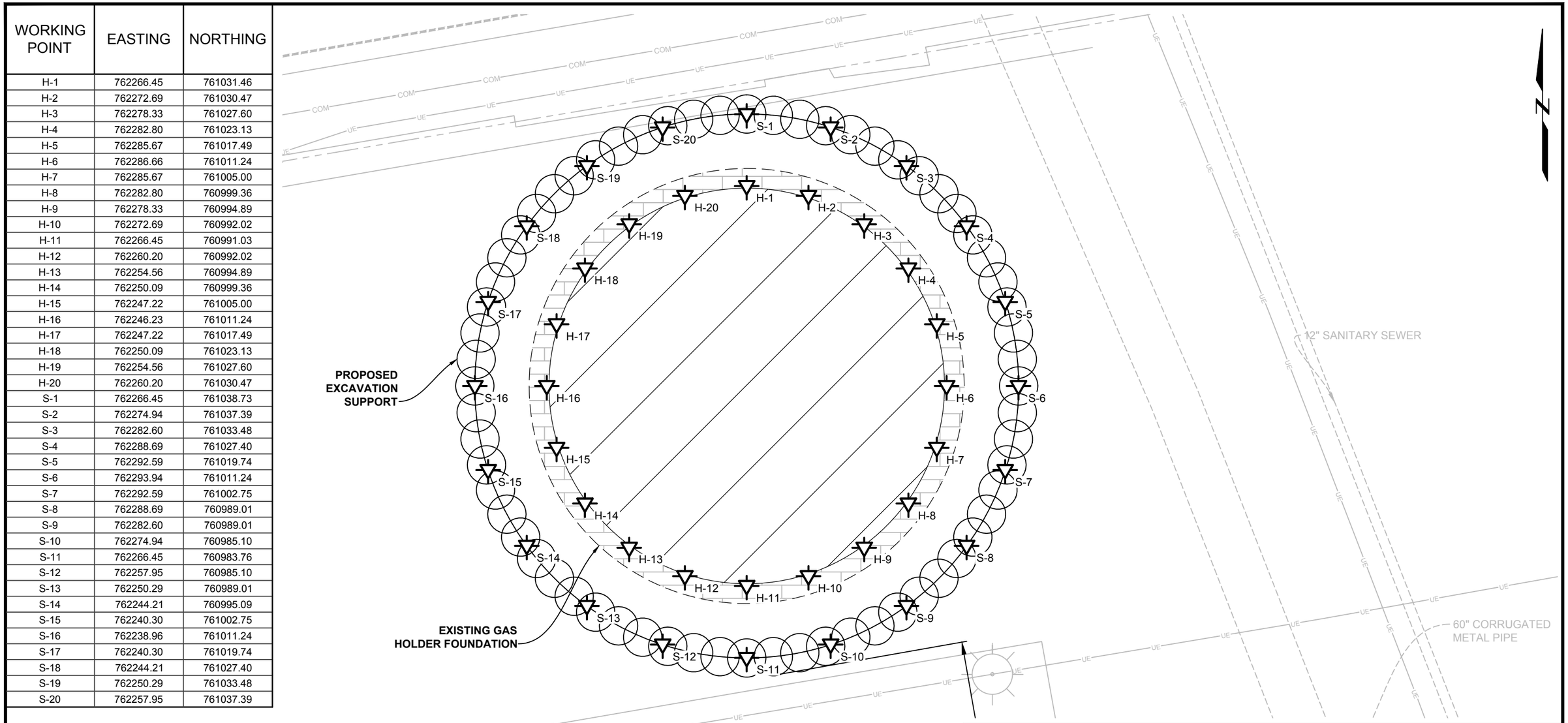
AOC1 EXCAVATION - PLAN VIEW

Project 1704633 | June 2018 | Fig. 8

\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\8-11 1704633_RDWP_Excv_Sect_GW.dwg - 3/28/2018

WORKING POINT	EASTING	NORTHING
H-1	762266.45	761031.46
H-2	762272.69	761030.47
H-3	762278.33	761027.60
H-4	762282.80	761023.13
H-5	762285.67	761017.49
H-6	762286.66	761011.24
H-7	762285.67	761005.00
H-8	762282.80	760999.36
H-9	762278.33	760994.89
H-10	762272.69	760992.02
H-11	762266.45	760991.03
H-12	762260.20	760992.02
H-13	762254.56	760994.89
H-14	762250.09	760999.36
H-15	762247.22	761005.00
H-16	762246.23	761011.24
H-17	762247.22	761017.49
H-18	762250.09	761023.13
H-19	762254.56	761027.60
H-20	762260.20	761030.47
S-1	762266.45	761038.73
S-2	762274.94	761037.39
S-3	762282.60	761033.48
S-4	762288.69	761027.40
S-5	762292.59	761019.74
S-6	762293.94	761011.24
S-7	762292.59	761002.75
S-8	762288.69	760989.01
S-9	762282.60	760989.01
S-10	762274.94	760985.10
S-11	762266.45	760983.76
S-12	762257.95	760985.10
S-13	762250.29	760989.01
S-14	762244.21	760995.09
S-15	762240.30	761002.75
S-16	762238.96	761011.24
S-17	762240.30	761019.74
S-18	762244.21	761027.40
S-19	762250.29	761033.48
S-20	762257.95	761037.39



LEGEND

CURRENT PROPERTY LINE	OVERHEAD UTILITIES
COMMUNICATION LINE	UNDERGROUND ELECTRIC
GAS LINE	CATCH BASIN
SANITARY SEWER	MANHOLE
STORM OR FLOOD CONTROL	HYDRANT
SEWER OR FEATURE	UTILITY POLE
WATER LINE	LIGHT POLE
THREADED COUPLED PIPE	WORKING POINT
VITRIFIED PIPE	

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.
3. COORDINATES ARE NY STATE PLANE, ZONE DATUM: CENTRAL.

0 10' 20'

SCALE: 1" = 10'

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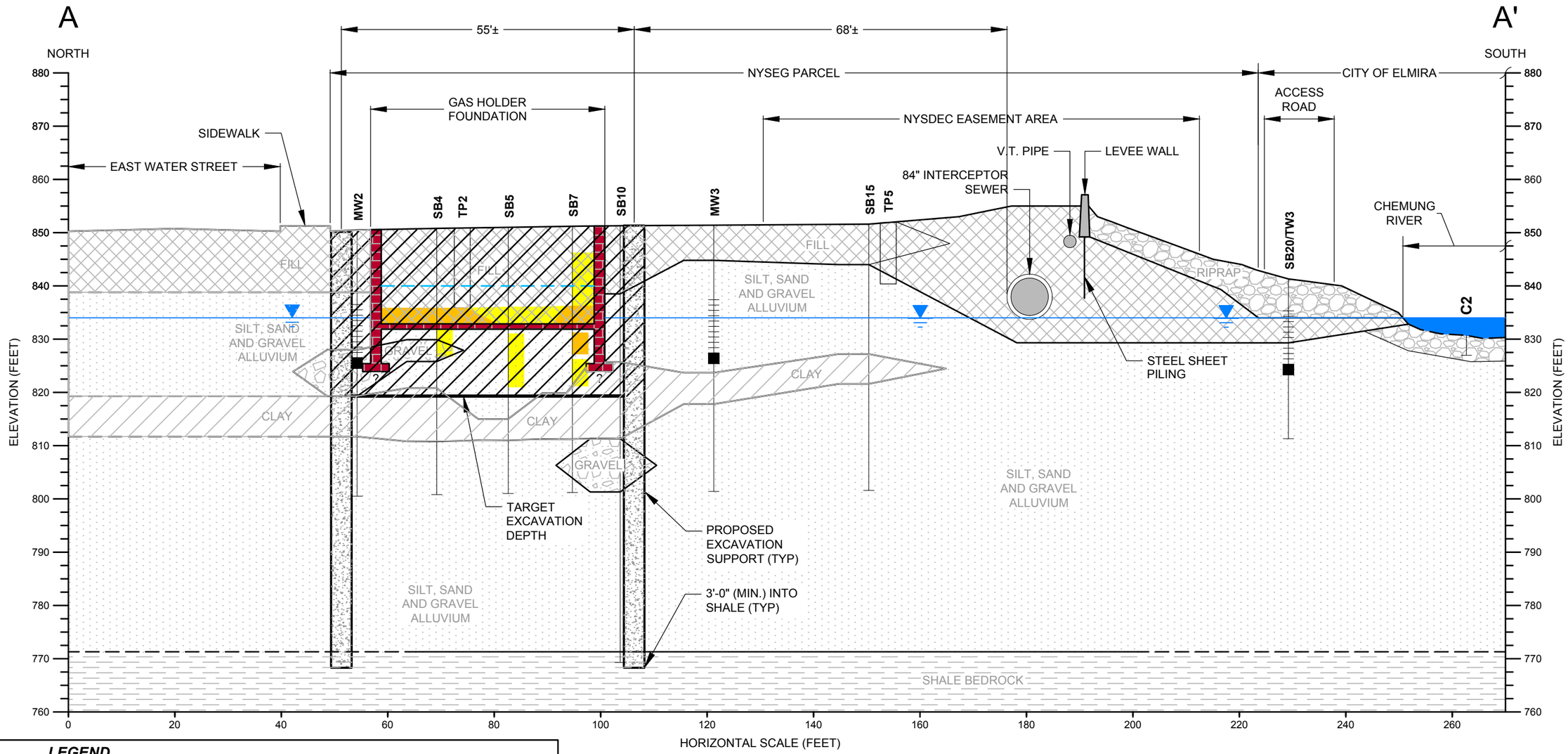
AOC1 EXCAVATION - PLAN VIEW

Project 1704633 | June 2018 | Fig. 9

\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\8-11 1704633_RDWP_Excv_Sect_GW.dwg - 3/28/2018



LEGEND

- WATER LEVEL IN GAS HOLDER FOUNDATION
- GROUNDWATER TABLE (JUNE 18, 2013)
- CONTACT
- INFERRED CONTACT
- MW1 — SOIL BORING/WELL IDENTIFICATION
  - SCREEN INTERVAL
  - DNAPL SUMP
  - BOTTOM OF BORING
- GP2 — GEOPROBE BORING / GROUNDWATER SAMPLE
- V.T. PIPE — VITRIFIED PIPE
- TP2 — TEST PIT
- FILL
- SILT, SAND AND GRAVEL ALLUVIUM
- CLAY
- GRAVEL
- SHALE BEDROCK
- HYDROCARBON STAIN OR ODOR
- BLEBS, GLOBS OR SHEEN

HORIZONTAL SCALE: 1" = 20'

0 20' 40'

0 20' 40'

VERTICAL SCALE: 20'

NOTE: 1x VERTICAL EXAGGERATION

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HOLDER EXCAVATION - TYPICAL SECTION

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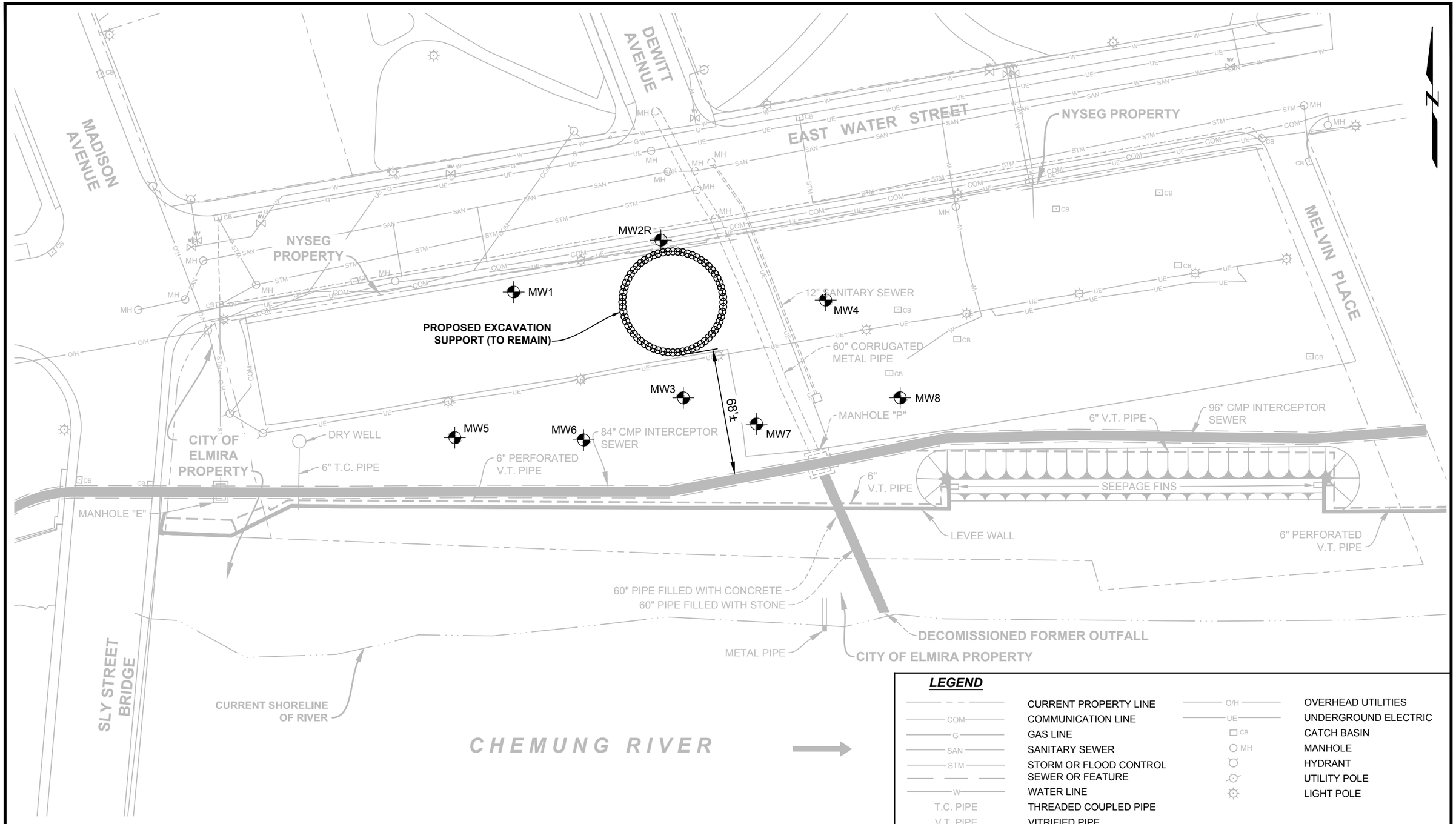
\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\8-11 1704633_RDWP_Excv_Sect_GW.dwg - 3/28/2018



LEGEND

CURRENT PROPERTY LINE	O/H — OVERHEAD UTILITIES
COM — COMMUNICATION LINE	UE — UNDERGROUND ELECTRIC
G — GAS LINE	CB — CATCH BASIN
SAN — SANITARY SEWER	MH — MANHOLE
STM — STORM OR FLOOD CONTROL SEWER OR FEATURE	HYDRANT
W — WATER LINE	UTILITY POLE
T.C. PIPE — THREADED COUPLED PIPE	LIGHT POLE
V.T. PIPE — VITRIFIED PIPE	

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50' 100'

SCALE: 1" = 50'

Remedial Design Work Plan
Elmira Water Street MGP Site
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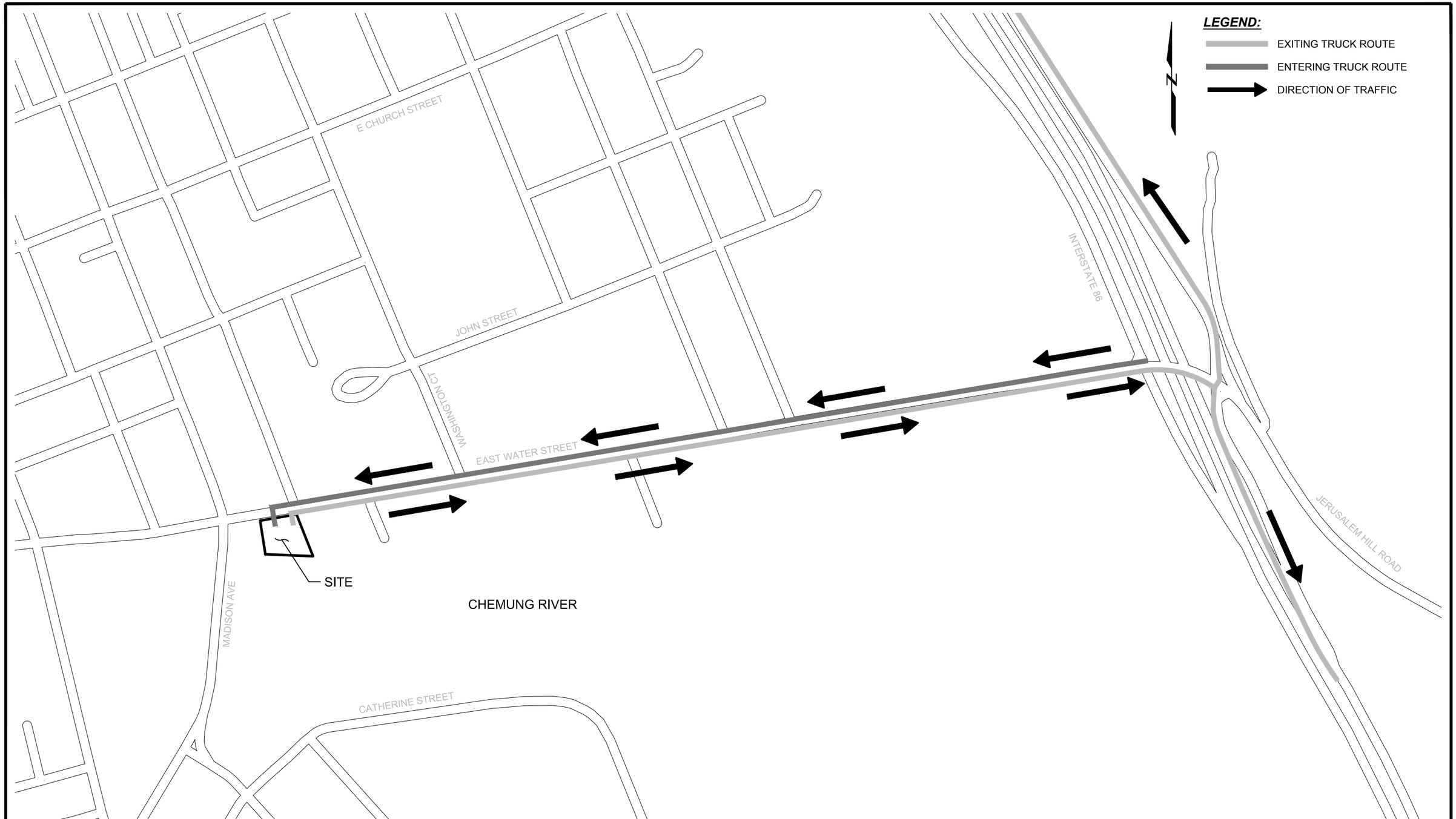
POST-REMEDIAL GROUNDWATER MONITORING LOCATIONS

June 2018 Fig. 11



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Elmira, New York

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PROPOSED TRUCK ROUTE

Project 1704633 | June 2018 | Fig. 12

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Appendix A

Test Pit Logs, Soil Boring Logs, Well Construction Logs

Soil Boring, Test Pit, and Sediment Core Key
Color Code for the Description of MGP-Related and Petroleum-Related Residuals at MGP Sites

COLOR CODE		DESCRIPTION
		TAR SATURATED FILL OR SOIL
		COATED MATERIAL OR LENSES
		HARDENED TAR
		NAPL BLEBS, GLOBS, OR SHEEN
		STAINING, ODOR
		PETROLEUM IMPACTS - SATURATION AND SHEEN
		PETROLEUM IMPACTS - STAINING AND ODORS
		PURIFIER RESIDUALS AND ODOR
		NO OBSERVED IMPACTS

Soil Boring Logs

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB1

GROUND SURFACE ELEVATION (FT): 850.6 LOCATION: Elmira, NY
NORTHING: 761033.86 EASTING: 762283.92 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/2/2013 - 5/15/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4				(0.0'- 0.3') ASPHALT. (0.3'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, many brick fragments, dry, brown.
845	5	S2	5.0	0.4	0.0 0.3 0.0			(5.0'- 7.4') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, few brick fragments, dry to moist, brown. (7.4'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.0 0.0			(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
835	15	S4	5.0	0.4	0.0 0.0 0.0		Env. Sample ID= SB1 (16-17)	(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded, ~10% fines, low plasticity; 5% silt, wet, brown.
830	20	S5	10.0	0.4	0.2 0.0			(20.0'- 30.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~80% gravel, fine to coarse, subrounded, ~15% sand, fine; 5% silt, wet, brown.
	25							

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

GEI Consultants

GEI Consultants, Inc.
1301 Trumansburg Road
Suite N
Ithaca, NY 14850
(607) 216-8955

CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
SB1

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
825	25				0.0			
					0.2			
	30				0.1			
820		S6	10.0	0.8	0.0			(30.0'- 36.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~80% gravel, fine to coarse, subrounded, ~15% sand, fine; 5% silt, wet, brown.
					0.0			
	35				0.0			
815					0.0			(36.0'- 40.7') SANDY LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
					0.0			
	40				0.0			
810		S7	10.0	0.8	0.1			(40.7'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~10% gravel, fine to coarse, subrounded, ~10% sand, fine; 80% silt, moist, gray.
					0.0			
	45				0.0			
805					0.0		Env. Sample ID= SB1 (48-49)	
	50				0.0			Bottom of borehole at 50.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB2

GROUND SURFACE ELEVATION (FT): 850.5 LOCATION: Elmira, NY
NORTHING: 761038.52 EASTING: 762306.86 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/2/2013 - 5/15/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	1.3	0.1	2.9			(0.0'- 0.4') ASPHALT. (0.4'- 2.3') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry, brown, concrete from 1.3' to 2.3' bgs. (2.3'- 6.9') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry to moist, brown.
		S2	4.0	0.3	0.0			
845	5	S3	5.0	0.4	0.0 0.0 0.0			(6.9'- 12.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, moist to wet, brown.
840	10	S4	5.0	0.4	0.2 0.0 0.0 0.0			(12.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, brown.
835	15	S5	5.0	0.4	0.0 0.0 0.0 0.0		Env. Sample ID= SB2 (16-17)	(15.0'- 24.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subangular; 15% silt, wet, brown.
830	20	S6	10.0	0.8	0.0 0.0			
825	25				0.0 0.0			(24.0'- 30.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~80% gravel, fine to coarse, subrounded, ~15% sand, fine; 5% silt, wet, brown.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

GEI Consultants

GEI Consultants, Inc.
1301 Trumansburg Road
Suite N
Ithaca, NY 14850
(607) 216-8955

CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

PAGE 2 of 2

SB2

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
					0.0			
820	30	S7	10.0	0.8	0.0			(30.0'- 36.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~80% gravel, fine to coarse, subrounded, ~15% sand, fine; 5% silt, wet, brown.
					0.0			
815	35				0.0			(36.0'- 46.2') GRAVELLY LEAN CLAY WITH SAND (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
					0.0			
810	40	S8	10.0	0.8	0.0			
					0.0			
805	45				0.0		Env. Sample ID= SB2 (45-46)	(46.2'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% fines, moist, gray.
					0.0			
	50				0.0			Bottom of borehole at 50.0 feet.

NOTES:

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REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB3

GROUND SURFACE ELEVATION (FT): 850.9 LOCATION: Elmira, NY
NORTHING: 761024.10 EASTING: 762239.93 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/2/2013 - 5/15/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	0.3			(0.0'- 0.4') ASPHALT. (0.3'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, few brick fragments, dry, brown.
845	5	S2	10.0	0.8	0.1 0.0 0.1			(5.0'- 12.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% sand, fine, ~5% gravel, fine to coarse, subrounded; 25% silt, dry to moist, light brown.
840	10	S3	10.0	0.2	0.0 0.0			(12.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~5% gravel, fine to coarse, subrounded; 25% silt, moist to wet, light brown.
835	15				0.1 0.1 0.0		Env. Sample ID= SB3 (15-16)	
830	20	S4	10.0	0.5	0.0 0.1			(20.0'- 24.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, brown.
825	25				1.2 0.0			(24.0'- 30.0') LEAN CLAY WITH SAND (CL); medium plasticity, ~10% sand, fine; 90% clay, moist to wet, gray.

NOTES:

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GEI Consultants

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
SB3

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
					0.0			
	30	S5	10.0	0.8				(30.0'- 36.0') LEAN CLAY WITH SAND (CL); medium plasticity, ~10% sand, fine; 90% clay, moist to wet, gray.
820					0.1			
					0.0			
	35				0.0			
815					5.4			(36.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
					4.5			
	40	S6	10.0	0.8				(40.0'- 48.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, gray.
810					4.1			
					4.3			
	45				6.5			
805					64.5			
					56.7		Env. Sample ID= SB3 (48-49)	(48.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
	50							Bottom of borehole at 50.0 feet.

NOTES:

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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 1 of 3

SB4

GROUND SURFACE ELEVATION (FT):	850.8	LOCATION:	Elmira, NY
NORTHING:	761019.73	EASTING:	762257.35
TOTAL DEPTH (FT):	50.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/23/2013 - 5/23/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.2	1.0				(0.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, many brick and coal fragments, dry to moist, brown.
					0.1				
					0.1				
845	5	S2	5.0	0.1	0.4				(5.0'- 12.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, many brick and coal fragments, moist, brown.
					0.1				
					0.5				
840	10	S3	5.0	0.2	0.0				(12.0'- 15.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick and coal fragments, wet, brown.
					0.0				
835	15	S4	5.0	0.3	5.7			Env. Sample ID= SB4 (16-17)	(15.0'- 17.0') FILL: non plastic, ~40% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, 30% brick fragments, 10% glass, wood and ceramic fragments, wet, dark grayish black, medium hydrocarbon-like odor, spots of sheen.

NOTES:

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FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB4

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
					17.3				(17.0'- 17.5') FILL: brick fragments, wet, medium hydrocarbon-like odor (assumed gas holder floor).
					1.4				(17.5'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, brown, slight hydrocarbon-like odor.
	20	S5	3.0	0.2					
830					0.3				(20.0'- 20.9') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~85% sand, fine, ~5% gravel, fine to coarse, subrounded; 10% silt, wet, slight hydrocarbon-like odor.
					0.8				(20.9'- 24.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~85% gravel, fine to coarse, subrounded, ~10% sand, fine; 5% silt, wet, light brown, hydrocarbon-like odor.
		S6	2.0	0.2				Env. Sample ID= SB4 (23-24)	
					0.2				
					0.1				(24.0'- 25.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~85% gravel, fine to coarse, subrounded, ~10% sand, fine; 5% silt, wet, light brown.
	25	S7	5.0	0.4					(25.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
825					1.4				
					0.2				
					0.0			Env. Sample ID= SB4 (29-30)	
	30	S8	10.0	0.8					(30.0'- 36.0') LEAN CLAY (CL); medium plasticity, ~10% sand; 90% clay, moist, gray.
820					0.2				
					0.0				
	35				0.0				
815									(36.0'- 40.0') LEAN CLAY (CL); medium plasticity, ~10% gravel, fine to coarse, subrounded, ~5% sand, fine; 85% clay, moist, gray.

NOTES:

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
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SB4

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
					0.0				
					0.0				
	40	S9	10.0	0.8					(40.0'- 47.8') LEAN CLAY (CL); medium plasticity, ~10% gravel, fine to coarse, subrounded, ~5% sand, fine; 85% clay, moist, gray.
810					0.0				
					0.0				
	45				0.0				
805					0.1				(47.8'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
					0.0				
	50								Bottom of borehole at 50.0 feet.

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 3 SB5

GROUND SURFACE ELEVATION (FT): 851.0 LOCATION: Elmira, NY
NORTHING: 761008.15 EASTING: 762270.73 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/23/2013 - 5/23/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.3	0.0 0.5 1.2				(0.0'- 5.0') FILL: non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick, coal, ash, and glass fragments, dry, brown.
845	5	S2	5.0	0.3	0.1 0.0 0.0				(5.0'- 12.0') FILL: non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick, coal, ash, and glass fragments, dry to moist, brown.
840	10	S3	5.0	0.4	0.9 0.9 1.0				(12.0'- 15.0') FILL: non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick, coal, ash, and glass fragments, moist, brown.
835	15	S4	5.0	0.4	3.2 27.5 732.0 184.0 20.6			Env. Sample ID= SB5 (16.5-17.0) Env. Sample ID= SB5 (18.2-18.6)	(15.0'- 17.0') FILL: ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick fragments, wet, dark grayish black, staining, moderate hydrocarbon-like odor. (17.0'- 17.5') FILL: brick fragments, (assumed gas holder floor). (17.5'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, dry to moist, light brown.
	20								

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 3
SB5

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
830	20	S5	5.0	0.2	26.6 15.1 16.6			Env. Sample ID= SB5 (24-25)	(20.0'- 21.8') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, dry to moist, light brown, strong hydrocarbon-like odor. (21.8'- 25.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, brown, moderate hydrocarbon-like odor.
825	25	S6	5.0	0.4	5.4 0.2 0.2				(25.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown, slight hydrocarbon-like odor.
820	30	S7	10.0	0.8	0.0 0.0 0.0				(30.0'- 36.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
815	35				0.0 0.0				(36.0'- 40.0') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
810	40	S8	10.0	0.8	0.0 0.0				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.

NOTES:

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB5

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
					0.0				
	45								
805					0.0				
					0.0				
	50								Bottom of borehole at 50.0 feet.

NOTES:

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IN. = INCHES
FT. = FEET

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 2
SB6

GROUND SURFACE ELEVATION (FT): 850.8 **LOCATION:** Elmira, NY
NORTHING: 761022.06 **EASTING:** 762204.09 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/2/2013 - 5/16/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	2.5	0.2	0.0			(0.0'- 0.3') ASPHALT. (0.3'- 7.5') FILL: concrete.
		S2	2.5	0.2	0.0 0.0 0.0			
845	5	S3	5.0	0.4	0.3 0.2 0.0			(7.5'- 12.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry to moist, brown.
840	10	S4	5.0	0.4	0.1 0.0 0.0 0.0		Env. Sample ID= SB6 (14-15)	(12.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, brown.
835	15	S5	5.0	0.4	22.4 0.0 5.0 0.1			(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, brown.
830	20	S6	10.0	0.5	8.0 0.2			(20.0'- 21.3') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, brown. (21.3'- 24.8') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
	25				0.0			

NOTES:

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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB6

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
825	25				0.0			(24.8'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~10% gravel, fine to coarse, subrounded; 15% silt, moist to wet, gray.
					0.2			
820	30	S7	10.0	0.8	0.2			(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
					2.4			
	35				0.4			
815					0.1			
					0.2			
810	40	S8	10.0	0.8	1.4			(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
					2.3			
	45				0.4			
805					0.1		Env. Sample ID= SB6 (47-48)	
					0.2			
	50							Bottom of borehole at 50.0 feet.

NOTES:

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FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 1 of 2

SB7

GROUND SURFACE ELEVATION (FT):	851.2	LOCATION:	Elmira, NY
NORTHING:	760995.96	EASTING:	762270.73
TOTAL DEPTH (FT):	50.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/24/2013 - 5/24/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	0.0 0.0 0.3				(0.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick, coal, ash, and glass fragments, moist, brown.
845	5	S2	5.0	0.3	0.1 0.0 0.0				(5.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, few brick, coal, and ash fragments, moist, brown, slight hydrocarbon-like odor.
840	10	S3	5.0	0.3	0.0 0.0 0.0				(10.0'- 15.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, few brick, coal, and ash fragments, wet, brown, slight hydrocarbon-like odor.
835	15	S4	5.0	0.2				Env. Sample ID= SB7 (14-15) Env. Sample ID= SB7 (16-17)	(15.0'- 17.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, some brick, coal, and ash fragments, wet, brown, slight hydrocarbon-like odor, spots of sheen. (17.0'- 17.5') brick fragments, (assumed holder floor).
830	20	S5	5.0	0.2	5.1 6.8 3.3				(20.0'- 24.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 10% silt, few brick, coal, and ash fragments, wet, brown, very vew spots of sheen. (24.0'- 25.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to
	25								

NOTES:

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/12/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
SB7

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	25	S6	5.0	0.2					coarse, subrounded; 10% silt, few brick, coal, and ash fragments, wet, brown.
825					2.3				(25.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown, slight hydrocarbon-like odor.
					0.9				
					0.6				
	30	S7	5.0	0.8				Env. Sample ID= SB7 (30-31)	(30.0'- 31.3') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
820					0.1				(31.3'- 40.0') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
					0.1				
	35				0.1				
815					0.1				
					0.0				
	40	S8	5.0	0.8					(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
810					0.1				
					0.0				
	45				0.0				
805					0.1				
					0.1			Env. Sample ID= SB7 (49-50)	
	50								Bottom of borehole at 50.0 feet.

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/12/13

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PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 1 of 2

SB8

GROUND SURFACE ELEVATION (FT):	851.0	LOCATION:	Elmira, NY
NORTHING:	761005.95	EASTING:	762294.11
TOTAL DEPTH (FT):	50.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/2/2013 - 5/16/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4				(0.0'- 0.3') ASPHALT. (0.3'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, few brick fragments, dry, brown.
845	5	S2	5.0	0.2	3.3 0.0 0.0 0.0			(5.0'- 7.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% brick fragments, dry to moist, brown. (7.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.0 0.0			
835	15	S4	5.0	0.4	0.0 0.0 0.0			(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
830	20	S5	10.0	0.8	0.0 0.0 0.0			(20.0'- 21.5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, wet, light brown. (21.5'- 28.5') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~75% gravel, fine to coarse, subrounded, ~15% sand, fine; 10% silt, wet, light brown.
	25							

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB8

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
825	25				0.0		Env. Sample ID= SB8 (27-28)	
					0.0			(28.5'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~85% sand, fine, ~10% gravel, fine to coarse, subrounded; 5% silt, wet, light brown.
	30	S6	10.0	0.8				(30.0'- 40.0') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
820					0.0			
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S7	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
810					0.0			
					0.0			
	45				0.0			
805					0.0			
					0.0			
	50						Env. Sample ID= SB8 (49-50)	Bottom of borehole at 50.0 feet.

NOTES:

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GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB9

GROUND SURFACE ELEVATION (FT): 851.6 LOCATION: Elmira, NY
NORTHING: 760994.96 EASTING: 762226.01 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/3/2013 - 5/16/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	3.5	0.3	1.0			(0.0'- 0.3') ASPHALT. (0.3'- 3.5') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, dry to moist, dark brown.
		S2	1.5	0.1	0.0			(3.5'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, dry to moist, dark brown.
845	5	S3	5.0	0.4	0.0 3.4 0.0			(5.0'- 8.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick and coal fragments, moist, dark brown. (8.0'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 15% silt, moist, light brown.
840	10	S4	5.0	0.4	0.0 0.0 0.0			(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, moist to wet, light brown.
835	15	S5	5.0	0.4	0.0 0.0 0.0		Env. Sample ID= SB9 (17-18)	(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, light brown.
830	20	S6	10.0	0.3	0.0 0.0			(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, gray.
	25							

NOTES:

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FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB9

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	25				0.0			
825					0.0			
					0.0			
	30	S7	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, gray.
820					0.0			
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S8	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, gray.
810					0.0			
					0.0			
	45				0.0			
805					0.0			
					0.0		Env. Sample ID= SB9 (48-49)	
	50							Bottom of borehole at 50.0 feet.

NOTES:

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CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 1 of 3

SB10

GROUND SURFACE ELEVATION (FT):	851.3	LOCATION:	Elmira, NY
NORTHING:	760987.03	EASTING:	762271.73
TOTAL DEPTH (FT):	82.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/3/2013 - 5/15/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	4.6			(0.0'- 1.8') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, dry to moist, dark brown.
					19.4			(1.8'- 7.9') FILL: 100% brick fragments.
					3.0			
845	5	S2	5.0	0.4	9.3			
					12.1		Env. Sample ID= SB10 (9-10)	(7.9'- 10.0') FILL: NARROWLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC); low plasticity, ~85% sand, fine, ~5% gravel, fine to coarse, subrounded; 10% clay, moist, brown.
840	10	S3	10.0	0.4	4.4			(10.0'- 12.8') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, many brick fragments, moist to wet, brown.
								(12.8'- 25.6') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~85% sand, fine, ~5% gravel, fine to coarse, subrounded; 10% silt, moist to wet, brown.
835	15				8.5			
	20	S4	10.0	0.7	6.4			(20.0'- 23.7') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, brown.
830					3.5			
					2.0			(23.7'- 25.6') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~85% sand, fine, ~5% gravel, fine to coarse, subrounded; 10%
	25							

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
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BORING LOG
PAGE 2 of 3
SB10

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	25				3.6		Env. Sample ID= SB10 (26-27)	silt, wet, brown.
825					2.3			(25.6'- 35.9') LEAN CLAY (CL); medium plasticity, ~5% sand, fine; 95% clay, moist, gray.
					0.2			
	30	S5	10.0	0.8				
820					0.3			
					1.6			
	35				17.8			
815					20.6			(35.9'- 38.7') LEAN CLAY (CL); medium plasticity, ~10% gravel, fine to coarse, subrounded, ~5% sand, fine; 85% clay, some weathered rock fragments, moist, gray.
					26.1			(38.7'- 40.0') LEAN CLAY (CL); medium plasticity, ~15% gravel, fine to coarse, subrounded, ~5% sand, fine; 80% clay, weathered rock, moist to dry, gray.
	40	S6	10.0	0.4				(40.0'- 50.0') NARROWLY GRADED GRAVEL WITH SILT AND SAND (GP-GM); non plastic, ~85% gravel, fine to coarse, subrounded, ~5% sand, fine; 10% silt, wet, gray.
810					1.8			
					0.0			
	45				0.0			
805					0.0			
					0.0			
	50	S7	10.0	0.4				(50.0'- 57.6') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.
800					0.3			
					0.1			

NOTES:

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FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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BORING LOG
PAGE 3 of 3
SB10

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	55				0.2			
795					0.0			
					0.0			(57.6'- 60.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.
	60	S8	10.0	0.8				(60.0'- 70.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
790					0.2			
					0.0			
	65				0.0			
785					0.1			
					0.0			
	70	S9	10.0	0.8				(70.0'- 76.7') NARROWLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC); medium plasticity, ~70% sand, fine, ~5% gravel, fine to coarse, subrounded; 25% clay, moist to wet, gray.
780					0.1			
					0.2			
	75				0.1		Env. Sample ID= SB10 (75-76)	
775					0.2			(76.7'- 80.0') CLAYEY SAND (SC); low plasticity, ~70% sand, fine, ~10% gravel, fine to coarse, subrounded; 20% clay, trace weathered shale, moist to dry, grayish green.
					0.2			
	80	S10	2.0	0.2				(80.0'- 82.0') SHALE; dry, dark gray, hard, slight weathering on joint surfaces.
770					0.2			
								Bottom of borehole at 82.0 feet.

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB11

GROUND SURFACE ELEVATION (FT): 851.3 LOCATION: Elmira, NY
NORTHING: 760997.86 EASTING: 762321.09 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/2/2013 - 5/16/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	1.3	0.1				(0.0'- 0.4') ASPHALT. (0.4'- 1.3') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, dry, brown, concrete at 1.3' bgs.
		S2	3.7	0.3	1.9			
					0.3			(1.3'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, dry to moist, brown.
	5				0.0			
845		S3	5.0	0.4				(5.0'- 6.2') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, moist, brown.
					0.0			(6.2'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~85% sand, fine, ~5% gravel, fine to coarse, subrounded; 10% filt, moist, light brown.
					0.0			
					0.0			
	10							
840		S4	5.0	0.4				(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
					0.0			
					0.0			
					0.0			
	15							
835		S5	5.0	0.4				(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
					0.0		Env. Sample ID= SB11 (17-18)	
					0.0			
					0.0			
	20							
830		S6	10.0	0.3				(20.0'- 32.2') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~75% gravel, fine to coarse, subrounded, ~15% sand, fine; 10% silt, wet, light brown.
					0.0			
					0.0			
	25							

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants

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1301 Trumansburg Road
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(607) 216-8955

CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
SB11

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	25				0.0			
825					0.0			
					0.0			
	30	S7	10.0	0.8				
820					0.0			(32.2'- 44.2') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S8	10.0	0.8				
810					0.0		Env. Sample ID= SB11 (44-45)	(44.2'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
					0.0			
	45				0.0			
805					0.0			
					0.0			
	50							Bottom of borehole at 50.0 feet.

NOTES:

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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB12

GROUND SURFACE ELEVATION (FT): 851.8 LOCATION: Elmira, NY
NORTHING: 760936.24 EASTING: 762189.90 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/6/2013 - 5/20/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	3.0			(0.0'- 2.0') FILL: NARROWLY GRADED GRAVEL WITH SILT AND SAND (GP-GM); ~60% gravel, ~30% sand, fine; 10% silt, dry to moist, brown. (2.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~5% gravel, subrounded; 15% silt, some brick fragments, dry to moist, brown.
845	5	S2	5.0	0.4	0.0 0.0 0.1			(5.0'- 5.8') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, few brick fragments, moist, brown. (5.8'- 9.6') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.5 0.2		Env. Sample ID= SB12 (14-15)	(9.6'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, light brown. (10.0'- 21.7') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
835	15	S4	5.0	0.4	0.0 0.0 0.0			
830	20	S5	10.0	0.8	0.1 0.0			(21.7'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
	25							

NOTES:

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FT. = FEET

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
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SB12

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	25				0.3			
825					0.3			
					0.8			
	30	S6	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, moist to wet, gray.
820					0.0			
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S7	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.
810					0.0			
					0.0			
	45				0.0			
805					0.0			
					0.0			
	50						Env. Sample ID= SB12 (49-50)	Bottom of borehole at 50.0 feet.

NOTES:

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

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SB13

GROUND SURFACE ELEVATION (FT):	851.6	LOCATION:	Elmira, NY
NORTHING:	760941.62	EASTING:	762284.01
TOTAL DEPTH (FT):	50.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/6/2013 - 5/17/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	2.2			(0.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, some brick fragments, dry, brown.
845	5	S2	5.0	0.4	0.0 0.0 0.0			(5.0'- 7.6') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry to moist. (7.6'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.0 0.0			(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
835	15	S4	5.0	0.4	0.0 0.0 0.0		Env. Sample ID= SB13 (18-19)	(15.0'- 24.4') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
	20							

NOTES:

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB13

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	20	S5	10.0	0.8				
830					0.0			
					0.0			(24.4'- 30.0') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
	25				0.0			
825					0.0			
					0.0			
	30	S6	10.0	0.8				(30.0'- 36.4') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
820					0.0			
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S7	10.0	0.8			Env. Sample ID= SB13 (40-41)	(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
810					0.0			

NOTES:

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IN. = INCHES
FT. = FEET

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CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG

SB13

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	45				0.0			
805					0.0			
					0.0			
	50				0.0			

Bottom of borehole at 50.0 feet.

NOTES:

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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG	BORING LOG
	PROJECT: Elmira Water Street MGP Site	PAGE 1 of 2
	CITY/STATE: Elmira, NY	SB14
	GEI PROJECT NUMBER: 116120	

GROUND SURFACE ELEVATION (FT): 851.5 LOCATION: Elmira, NY
NORTHING: 760935.99 EASTING: 762217.69 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/6/2013 - 5/20/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	3.1			(0.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, subrounded; 10% silt, few brick fragments, dry to moist, brown.
845	5	S2	5.0	0.4	0.6 0.0 0.0			(5.0'- 6.2') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, few brick fragments, moist, brown. (6.2'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.3 0.1		Env. Sample ID= SB14 (14-15)	(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
835	15	S4	5.0	0.4	0.3 0.1 0.0			(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, wet, light brown.
830	20	S5	10.0	0.8	0.2 0.0			(24.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
825	25				0.0 0.0			

NOTES:

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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 2 of 2 SB14

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
					0.0			
	30	S6	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
820					0.0			
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S7	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
810					0.0			
					0.0			
	45				0.0			
805					0.0			
					0.0		Env. Sample ID= SB14 (49-50)	
	50							Bottom of borehole at 50.0 feet.

NOTES:

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FT. = FEET

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 SB15

GROUND SURFACE ELEVATION (FT): 852.0 LOCATION: Elmira, NY
NORTHING: 760939.46 EASTING: 762273.30 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/6/2013 - 5/17/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	3.0	0.3				(0.0'- 3.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, many brick fragments, dry, brown.
		S2	2.0	0.2	3.4			(3.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, many brick fragments, dry, brown.
	5	S3	5.0	0.4	0.0			(5.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, dry to moist, light brown.
845					0.0			
					0.0			
	10	S4	5.0	0.4				(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
840					0.0			
					0.0			
	15	S5	5.0	0.4				(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, wet, light brown.
835					0.0			
					0.0			
	20	S6	10.0	0.8				(20.0'- 25.3') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
830					0.0		Env. Sample ID= SB15 (22-23)	
	25							

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FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
SB15

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	25				0.0			(25.3'- 30.0') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
825					0.0			
	30	S7	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
820					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S8	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.
810					0.0			
					0.0			
	45				0.0			
805					0.0			
					0.0		Env. Sample ID= SB15 (49-50)	
	50							Bottom of borehole at 50.0 feet.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 2
SB16

GROUND SURFACE ELEVATION (FT): 851.2 **LOCATION:** Elmira, NY
NORTHING: 760950.42 **EASTING:** 762352.66 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/3/2013 - 5/16/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	2.3			(0.0'- 0.4') ASPHALT. (0.4'- 5.0') FILL: SILTY SAND (SM); ~75% sand, fine, ~5% gravel, fine to coarse, subrounded; 20% silt, trace brick fragments, dry to moist, brown.
845	5	S2	5.0	0.4	0.0 0.0 0.0			(5.0'- 7.5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, dry to moist, light brown. (7.5'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
840	10	S3	5.0	0.3	0.0 0.0 0.0			
835	15	S4	5.0	0.3	0.0 0.0 0.0		Env. Sample ID= SB16 (17-18)	(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
830	20	S5	10.0	0.8	0.0 0.0 0.0 0.0 0.0			(20.0'- 30.6') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~75% gravel, fine to coarse, subrounded, ~15% sand, fine; 10% silt, wet, light brown.
825	25							
	30	S6	10.0	0.8				

NOTES:

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PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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1301 Trumansburg Road
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(607) 216-8955

CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 2 of 2

SB16

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
820					0.0			(30.6'- 44.6') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S7	10.0	0.8				
810					0.0			
					0.0		Env. Sample ID= SB16 (44-45)	
	45				0.0			(44.6'- 22.1') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt.
805					0.0			
					0.0			
	50							Bottom of borehole at 50.0 feet.

NOTES:

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IN. = INCHES
FT. = FEET

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 2
SB17

GROUND SURFACE ELEVATION (FT): 851.3 **LOCATION:** Elmira, NY
NORTHING: 760990.42 **EASTING:** 762303.31 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/2/2013 - 5/16/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** NA

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	2.1			(0.0'- 0.4') ASPHALT. (0.4'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry, brown.
845	5	S2	5.0	0.4	0.0 0.0 0.0			(5.0'- 6.5') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry to moist, brown. (6.5'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.0 0.0			(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
835	15	S4	5.0	0.4	0.0 0.0 0.0		Env. Sample ID= SB17 (15-16)	(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
830	20	S5	10.0	0.8	0.0 0.0			(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~20% gravel, fine to coarse, subrounded; 5% silt, wet, light brown.
	25							

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
SB17

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
825	25				0.0			
					0.0			
					0.0			
	30	S6	10.0	0.8				(30.0'- 41.3') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.
820					0.0			
					0.0			
	35				0.0			
815					0.0			
					0.0			
	40	S7	10.0	0.8				
810					0.0			(41.3'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~10% gravel, fine to coarse, subrounded; 15% silt, moist, gray.
					0.0			
	45				0.0			
805					0.0			
					0.0		Env. Sample ID= SB17 (49-50)	
	50							Bottom of borehole at 50.0 feet.

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

Monitoring Well Construction Logs

GEI Consultants, Inc.
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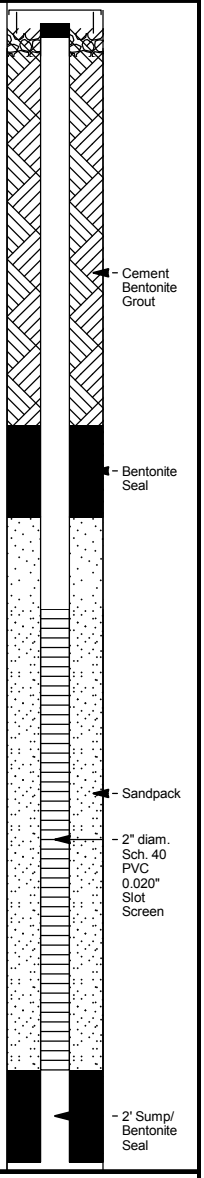
CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 2
MW1

GROUND SURFACE ELEVATION (FT): 851.1 **LOCATION:** Elmira, NY
NORTHING: 761014.91 **EASTING:** 762162.07 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/3/2013 - 5/22/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 850.67

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	4.2			(0.0'- 0.4') ASPHALT. (0.4'- 3.5') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry, brown.
	5	S2	5.0	0.4	0.2			(3.5'- 4.5') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry, brown. (4.5'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
845					0.0			
					0.0			
					0.0			
	10	S3	5.0	0.4	0.0			(5.0'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, light brown. (10.0'- 21.3') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
840					0.0			
					0.0			
	15	S4	5.0	0.1	0.0		Env. Sample ID= MW1 (14-15)	
835					0.0			
					0.0			
	20	S5	10.0	0.4	0.0			(21.3'- 30.0') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~85% gravel, subrounded, ~10% sand, fine; 5% silt, wet, light brown.
830					0.0			
	25							



NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
MW1

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
	25				0.0				
825					0.0				
					0.0				
	30	S6	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	
820					0.0				
					0.0				
	35				0.0				
815					0.0				~ Bentonite Backfill
					0.0				
	40	S7	10.0	0.8			Env. Sample ID= MW1 (41-42)	(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.	
810					0.0				
					3.2				
	45				0.0				
805					0.0				
					0.0				
	50							Bottom of borehole at 50.0 feet.	

NOTES:

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FT. = FEET

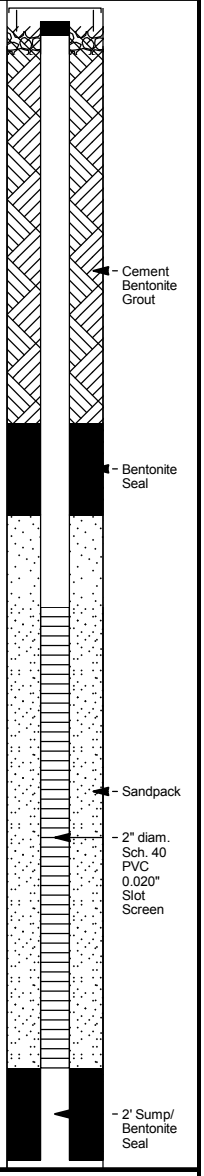
ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 MW2

GROUND SURFACE ELEVATION (FT): 850.5 LOCATION: Elmira, NY
NORTHING: 761035.24 EASTING: 762259.98 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/2/2013 - 5/22/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): 850.07

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	1.7			(0.0'- 0.3') ASPHALT. (0.3'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, many brick fragments, dry, brown.
845	5	S2	5.0	0.2	0.0 0.0 0.0			(5.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, moist, brown.
840	10	S3	5.0	0.4	0.0 0.0 0.0			(10.0'- 11.7') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, few brick fragments, wet, brown. (11.7'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
835	15	S4	5.0	0.4	0.0 0.0 0.0		Env. Sample ID= MW2 (15-16)	
830	20	S5	10.0	0.8	0.0 0.0			(20.0'- 22.5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown. (22.5'- 31.2') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); non plastic, ~85% gravel, fine to coarse, subrounded, ~10% sand, fine; 5% silt, wet, light brown.
	25							

WELL CONSTRUCTION DETAILS



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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
MW2

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
825	25				0.0				
					0.0				
					0.0		Env. Sample ID= MW2 (29-30)		
820	30	S6	10.0	0.8				(31.2'- 38.8') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.	
					0.0				
					0.0				
815	35				0.0				
					0.0				~ Bentonite Backfill
					0.0			(38.8'- 42.4') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, gray.	
810	40	S7	10.0	0.8					
					0.0			(42.4'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.	
					0.0				
805	45				0.0		Env. Sample ID= MW2 (46-47)		
					0.0				
					0.0				
	50							Bottom of borehole at 50.0 feet.	

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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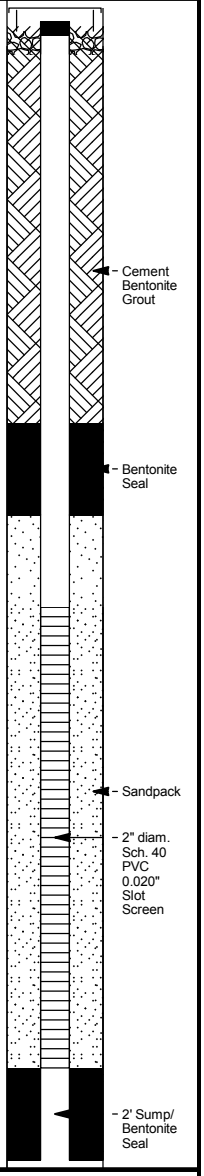
GROUND SURFACE ELEVATION (FT): 851.4 LOCATION: Elmira, NY
NORTHING: 760970.41 EASTING: 762279.49 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/6/2013 - 5/21/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): 851.08

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	2.1			(0.0'- 3.5') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, many brick fragments, dry, brown.
	5	S2	5.0	0.4	0.0			(3.5'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, many brick fragments, dry, brown.
845					0.0			(5.0'- 6.6') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~15% gravel, fine to coarse, subrounded; 5% silt, many brick fragments, dry to moist, brown.
					0.0			
					0.0			(6.6'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
	10	S3	5.0	0.4	0.5			(10.0'- 27.7') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
840					0.1			
					0.0			
	15	S4	5.0	0.4	0.4		Env. Sample ID= MW3 (49-50)	
835					0.0			
					0.0			
	20	S5	10.0	0.8	0.1			
830					0.0			
	25							

WELL CONSTRUCTION DETAILS



NOTES:

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PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
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CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 2 of 2

MW3

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
	25				0.0				
825					0.0				
					0.2			(27.7'- 33.6') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.	
	30	S6	10.0	0.8					
820					0.0				
					0.0			(33.6'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.	
	35				0.0				
815					0.0				~ Bentonite Backfill
					1.1				
	40	S7	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.	
810					0.2				
					0.0				
	45				0.1				
805					0.0				
	50				0.0		Env. Sample ID= MW3 (49-50)	Bottom of borehole at 50.0 feet.	

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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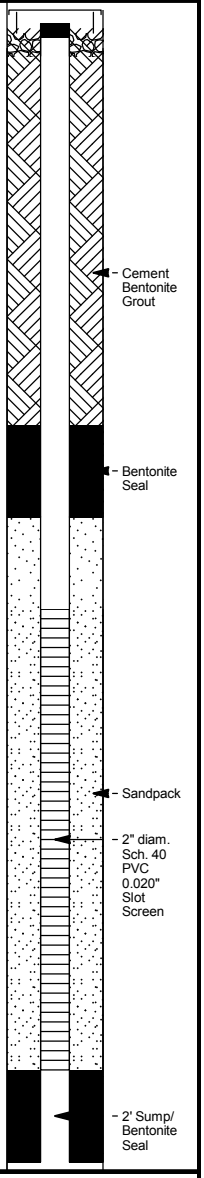
CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 2
MW4

GROUND SURFACE ELEVATION (FT): 851.0 **LOCATION:** Elmira, NY
NORTHING: 761019.58 **EASTING:** 762312.70 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/2/2013 - 5/21/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 850.54

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	1.3			(0.0'- 0.4') ASPHALT. (0.4'- 1.3') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry, brown. (1.3'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick fragments, moist, brown, concrete at 1.3' bgs.
					0.0			
					0.0			
					0.0			
845	5	S2	5.0	0.4	0.0			(5.0'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, brown.
					0.0			
					0.0			
840	10	S3	5.0	0.4	0.0			(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
					0.0			
					0.1			
835	15	S4	5.0	0.4	0.2		Env. Sample ID= MW4 (15-16)	(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
					0.0			
					0.0			
830	20	S5	10.0	0.7	0.1			(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~20% gravel, fine to coarse, subrounded; 5% silt, wet, light brown.
					0.0			
	25							



NOTES:

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IN. = INCHES
FT. = FEET

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
MW4

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
825	25				0.0				
					0.0				
					0.0				
	30	S6	10.0	0.8				(30.0'- 31.8') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~20% gravel, fine to coarse, subrounded; 5% silt, wet, light brown.	
820					0.0			(31.8'- 46.2') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.	
					0.0				
	35				0.0				
815					0.0				~ Bentonite Backfill
					0.0				
	40	S7	10.0	0.8					
810					0.0				
					0.0				
	45				0.0				
805					0.0		Env. Sample ID= MW4 (47-48)	(46.2'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.	
	50							Bottom of borehole at 50.0 feet.	

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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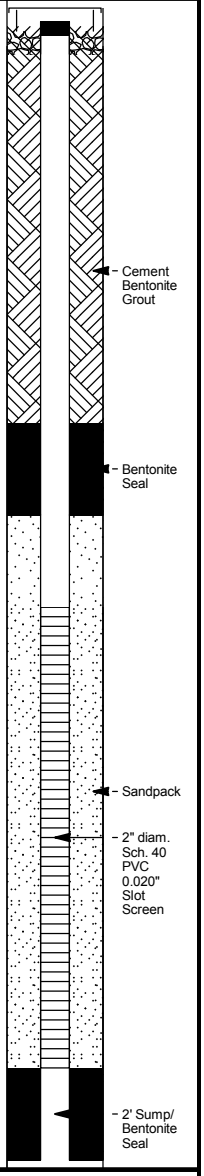
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 2
MW5

GROUND SURFACE ELEVATION (FT): 852.3 **LOCATION:** Elmira, NY
NORTHING: 760935.02 **EASTING:** 762160.13 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/6/2013 - 5/20/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 851.85

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	2.5			(0.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry to moist, brown.
845	5	S2	5.0	0.4	0.0 0.0 0.0			(5.0'- 6.6') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, some brick and concrete fragments, dry to moist, brown. (6.6'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~85% sand, fine, ~5% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
840	10	S3	5.0	0.4	0.0 0.1 0.0		Env. Sample ID= MW5 (14-15)	(10.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
835	15	S4	5.0	0.4	0.5 0.0 0.0			
830	20	S5	10.0	0.8	0.7 1.2			(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist to wet, gray.
	25							

WELL CONSTRUCTION DETAILS



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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CITY/STATE: Elmira, NY
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BORING LOG
PAGE 2 of 2
MW5

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
	25				0.1				
825					0.0				
					0.0				
	30	S6	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	
820					1.0				
					0.1				
	35				0.0				
815					0.0				~ Bentonite Backfill
					1.4				
	40	S7	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	
810					0.0				
					0.0				
	45				0.0				
805					0.0				
					0.0		Env. Sample ID= MW5 (49-50)		
	50							Bottom of borehole at 50.0 feet.	

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FT. = FEET

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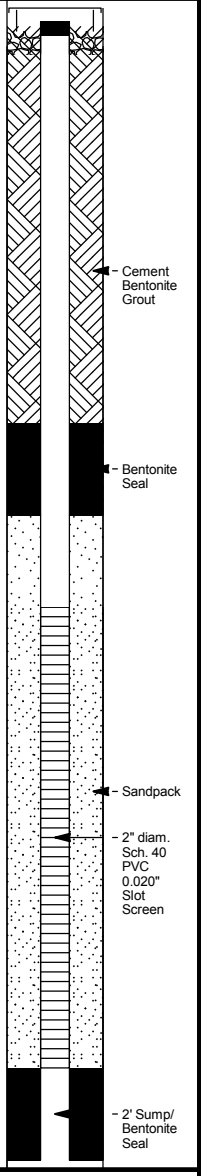
GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca, NY 14850 (607) 216-8955	CLIENT: NYSEG PROJECT: Elmira Water Street MGP Site CITY/STATE: Elmira, NY GEI PROJECT NUMBER: 116120	BORING LOG PAGE 1 of 2 MW6

GROUND SURFACE ELEVATION (FT): 852.1 LOCATION: Elmira, NY
NORTHING: 760937.91 EASTING: 762251.76 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/6/2013 - 5/20/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): 851.49

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	3.0			(0.0'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, dry, brown.
845	5	S2	5.0	0.4	0.0 0.0 0.2			(5.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, moist, brown.
840	10	S3	5.0	0.4	0.0 0.3 0.3			(10.0'- 13.8') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, some brick fragments, moist to wet, brown.
835	15	S4	5.0	0.4	0.0 0.0 7.3		Env. Sample ID= MW6 (19-20)	(13.8'- 21.7') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
830	20	S5	10.0	0.8	0.0 0.0			(21.7'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
	25							

WELL CONSTRUCTION DETAILS



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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CITY/STATE: Elmira, NY
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BORING LOG
PAGE 2 of 2
MW6

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
	25				0.0				
825					0.0				
					0.0				
	30	S6	10.0	0.8				(30.0'- 40.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	
820					0.0				
					0.0				
	35				0.0				
815					0.0				~ Bentonite Backfill
					0.0				
	40	S7	10.0	0.8				(40.0'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	
810					0.0				
					0.0				
	45				0.0				
805					0.3		Env. Sample ID= MW6 (48-49)		
	50				0.2				

Bottom of borehole at 50.0 feet.

NOTES:

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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GROUND SURFACE ELEVATION (FT): 851.5 LOCATION: Elmira, NY
NORTHING: 760941.59 EASTING: 762310.57 TOTAL DEPTH (FT): 50.0
DRILLED BY: Frontz Drilling DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt DATE START / END: 5/3/2013 - 5/21/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): RISER ELEVATION (FT): 851.14

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	4.8			(0.0'- 0.4') ASPHALT. (0.4'- 2.5') FILL: SILTY SAND (SM); ~75% sand, fine, ~10% gravel, fine to coarse; 15% silt, trace brick fragments, dry to moist, brown.
					0.2			
	5				0.2			(2.5'- 5.0') FILL: SILTY SAND (SM); non plastic, ~75% sand, fine, ~10% gravel, fine to coarse, subrounded; 15% silt, some brick fragments, dry to moist, brown.
		S2	5.0	0.4				
845					2.4			(5.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick fragments, moist, brown.
					0.2			
					0.0			
	10	S3	5.0	0.4				(10.0'- 11.4') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, many brick fragments, moist, brown.
840					0.0			
					0.0			(11.4'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
					0.0			
	15	S4	5.0	0.4				(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
835					0.0			
					0.0			
					3.0		Env. Sample ID= MW7 (18-19)	
	20	S5	10.0	0.8				(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
830					1.2			
					0.0			
	25							

WELL CONSTRUCTION DETAILS: Cement Bentonite Grout; Bentonite Seal; Sandpack; 2" diam. Sch. 40 PVC 0.020" Slot Screen; 2' Sump/ Bentonite Seal

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
MW7

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
	25				0.0				
825					0.1				
	30				0.0				
		S6	10.0	0.8				(30.0'- 44.6') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.	
820					0.0				
					0.0		Env. Sample ID= MW7 (34-35)		
	35				0.0				
815					0.2				~ Bentonite Backfill
					0.0				
	40	S7	10.0	0.8					
810					0.0				
					0.0				
	45				0.0			(44.6'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, gray.	
805					0.0				
					0.0				
	50				0.0				

Bottom of borehole at 50.0 feet.

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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
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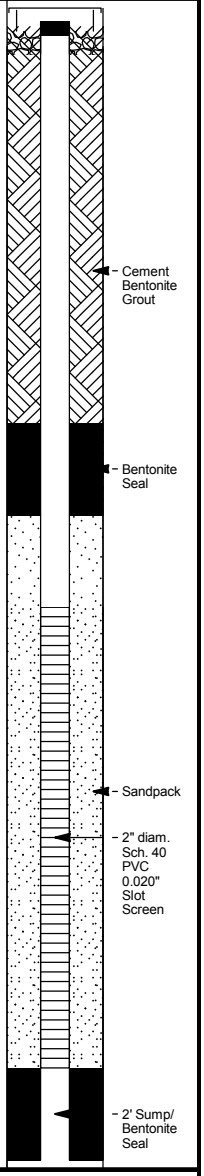
BORING LOG
PAGE 1 of 2
MW8

GROUND SURFACE ELEVATION (FT): 851.1 **LOCATION:** Elmira, NY
NORTHING: 760953.26 **EASTING:** 762379.06 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/3/2013 - 5/21/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 850.69

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
850	0	S1	5.0	0.4	0.3			(0.0'- 0.2') ASPHALT. (0.2'- 5.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~5% gravel, fine to coarse, subrounded; 15% silt, dry, brown.
845	5	S2	5.0	0.4	0.0 0.0 1.1			(5.0'- 6.7') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry to moist, brown. (6.7'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, moist, light brown.
840	10	S3	5.0	0.4	0.1 0.3 0.0			(10.0'- 15.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist to wet, light brown.
835	15	S4	5.0	0.4	0.1 0.0 0.0		Env. Sample ID= MW8 (17-18)	(15.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
830	20	S5	10.0	0.8	0.0 0.0			(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
	25							

WELL CONSTRUCTION DETAILS



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CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 2 of 2
MW8

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
	25				0.0				
825					0.1				
					0.7				
	30	S6	10.0	0.8				(30.0'- 43.6') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist, gray.	
820					0.0				
					0.0				
	35				0.0				
815					0.0				~ Bentonite Backfill
					0.0				
	40	S7	10.0	0.8					
810					0.0				
					0.0		Env. Sample ID= MW8 (44-45)	(43.6'- 50.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, moist, gray.	
	45				0.0				
805					1.0				
					0.1				
	50							Bottom of borehole at 50.0 feet.	

NOTES:

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PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc.
1301 Trumansburg Road
Suite N
Ithaca, NY 14850
(607) 216-8955

CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 1
SB18/TW1

GROUND SURFACE ELEVATION (FT): 840.6 **LOCATION:** Elmira, NY
NORTHING: 760859.36 **EASTING:** 762152.71 **TOTAL DEPTH (FT):** 30.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/22/2013 - 5/22/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 840.33

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
840	0	S1	10.0	0.8	0.0			(0.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~20% gravel, fine to coarse, subangular; 5% silt, few brick fragments, dry, brown.	
					0.0				
	5				0.0				
835					0.0				
	10	S2	10.0	0.8	0.0		Env. Sample ID= SB18/TW1 (12-13)	(10.0'- 11.9') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~20% gravel, fine to coarse, subangular; 5% silt, wet, light brown. (11.9'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	Sandpack; 2" diam. Sch. 40 PVC 0.020" Slot Screen
830					0.0				
	15				0.0				
825					0.0				
	20	S3	10.0	0.8	0.0			(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	2' Sump/ Bentonite Seal
820					0.0				
	25				0.0				
815					0.0				
	30				0.0		Env. Sample ID= SB18/TW1 (29-30)	Bottom of borehole at 30.0 feet.	

NOTES:

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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Ithaca, NY 14850
(607) 216-8955

CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

BORING LOG

PAGE 1 of 1

SB19/TW2

GROUND SURFACE ELEVATION (FT):	841.2	LOCATION:	Elmira, NY
NORTHING:	760860.52	EASTING:	762207.88
TOTAL DEPTH (FT):	30.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/22/2013 - 5/22/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	840.88

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
840	0	S1	10.0	0.8	0.0			(0.0'- 3.1') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, few brick fragments, dry, brown.	
					0.0				
	5				0.0			(3.1'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, dry, brown.	
835					0.0				
					0.0				
	10	S2	10.0	0.8	0.0		Env. Sample ID= SB19/TW2 (11-12)	(10.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	Sandpack; 2" diam. Sch. 40 PVC 0.020" Slot Screen
830					0.0				
	15				0.0				
825					0.0				
					0.0				
	20	S3	10.0	0.8	0.0			(20.0'- 26.7') WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); low plasticity, ~70% gravel, fine to coarse, subrounded, ~20% sand, fine; 10% silt, wet, gray.	2' Sump/ Bentonite Seal
820					0.0				
	25				0.0				
815					0.0			(26.7'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.	
					0.0				
	30				0.0		Env. Sample ID= SB19/TW2 (29-30)	Bottom of borehole at 30.0 feet.	

NOTES:

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc.
1301 Trumansburg Road
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Ithaca, NY 14850
(607) 216-8955

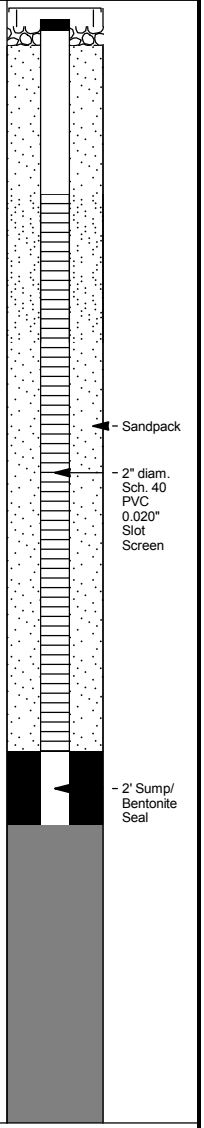
CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 1
SB20/TW3

GROUND SURFACE ELEVATION (FT): 841.3 **LOCATION:** Elmira, NY
NORTHING: 760861.04 **EASTING:** 762278.11 **TOTAL DEPTH (FT):** 30.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/22/2013 - 5/22/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 840.84

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
840	0	S1	10.0	0.8	0.0				(0.0'- 10.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~20% gravel, fine to coarse, subangular; 10% silt, dry, brown, few brick fragments from 0' to 1.3' bgs.
					0.0				
835	5				0.0				
					0.0				
					0.0				
830	10	S2	10.0	0.8	4.5			Env. Sample ID= SB20/TW3 (10-11)	(10.0'- 12.0') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, wet, gray, very slight petroleum-like odor.
					0.0				(12.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, trace brick fragments, wet, gray.
825	15				0.0				
					0.0				
					0.0				
820	20	S3	10.0	0.8	0.0				(20.0'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~70% sand, fine, ~20% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
					0.0				
815	25				0.0				
					0.0				
	30				0.0			Env. Sample ID= SB20/TW3 (29-30)	Bottom of borehole at 30.0 feet.

WELL CONSTRUCTION DETAILS



NOTES:

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IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

GEI Consultants, Inc.
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Ithaca, NY 14850
(607) 216-8955

CLIENT:	NYSEG
PROJECT:	Elmira Water Street MGP Site
CITY/STATE:	Elmira, NY
GEI PROJECT NUMBER:	116120

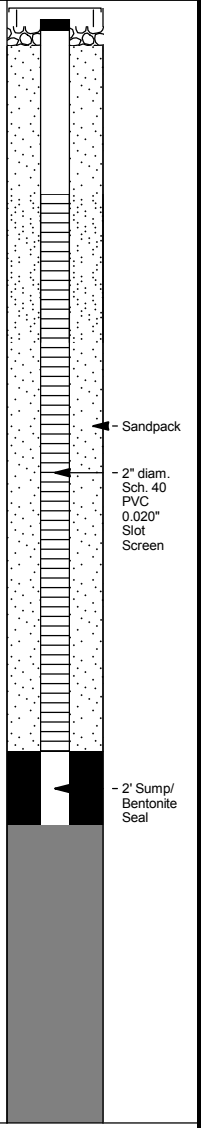
BORING LOG

PAGE 1 of 1

SB21/TW4

GROUND SURFACE ELEVATION (FT):	841.1	LOCATION:	Elmira, NY
NORTHING:	760861.90	EASTING:	762328.52
TOTAL DEPTH (FT):	30.0		
DRILLED BY:	Frontz Drilling	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Garrett Schmidt	DATE START / END:	5/22/2013 - 5/22/2013
DRILLING DETAILS:	Rotosonic		
WATER LEVEL ELEVATION (FT):		RISER ELEVATION (FT):	840.86

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
840	0	S1	10.0	0.8	0.0			(0.0'- 4.1') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~25% gravel, fine to coarse, subangular; 5% silt, trace brick fragments, dry, light brown.
					0.0			
835	5				0.0			(4.1'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry, light brown.
					0.0			
					0.0			
830	10	S2	10.0	0.8	0.0		Env. Sample ID= SB21/TW4 (12-13)	(10.0'- 11.3') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
					0.0			(11.3'- 30.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
825	15				0.0			
					0.0			
					0.0			
820	20	S3	10.0	0.8	0.0			
					0.0			
815	25				0.0			
					0.0			
					0.0			
	30				0.0		Env. Sample ID= SB21/TW4 (29-30)	Bottom of borehole at 30.0 feet.



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ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

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1301 Trumansburg Road
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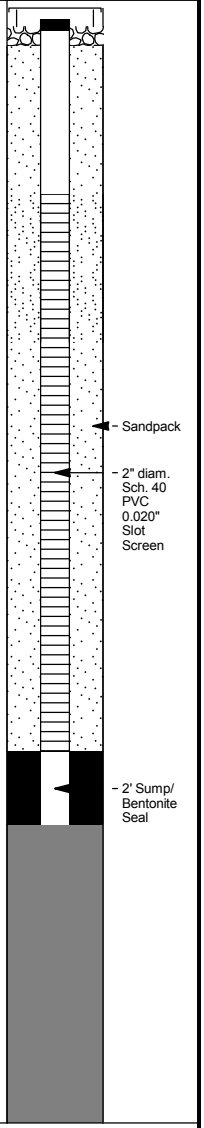
Ithaca, NY 14850
(607) 216-8955

CLIENT: NYSEG
PROJECT: Elmira Water Street MGP Site
CITY/STATE: Elmira, NY
GEI PROJECT NUMBER: 116120

BORING LOG
PAGE 1 of 1
SB22/TW5

GROUND SURFACE ELEVATION (FT): 841.7 **LOCATION:** Elmira, NY
NORTHING: 760862.24 **EASTING:** 762393.84 **TOTAL DEPTH (FT):** 30.0
DRILLED BY: Frontz Drilling **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Garrett Schmidt **DATE START / END:** 5/22/2013 - 5/22/2013
DRILLING DETAILS: Rotosonic
WATER LEVEL ELEVATION (FT): **RISER ELEVATION (FT):** 841.35

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (PPM)	STRATA	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
840	0	S1	10.0	0.8	0.0			(0.0'- 2.8') FILL: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~70% sand, fine, ~25% gravel, fine to coarse, subangular to subrounded; 5% silt, dry, light brown.
					0.0			(2.8'- 10.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~80% sand, fine, ~10% gravel, fine to coarse, subrounded; 10% silt, dry, light brown.
835	5				0.0			
					0.0			
	10	S2	10.0	0.5	0.0		Env. Sample ID= SB22/TW5 (11-12)	(10.0'- 20.0') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); non plastic, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, light brown.
830					0.0			
	15				0.0			
825					0.0			
					0.0			
	20	S3	10.0	0.4	0.0			(20.0'- 21.3') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); low plasticity, ~75% sand, fine, ~15% gravel, fine to coarse, subrounded; 10% silt, wet, gray.
820					0.0			(21.3'- 30.0') LEAN CLAY (CL); medium plasticity, ~10% sand, fine; 90% clay, moist to wet, gray.
	25				0.0			
815					0.0			
	30				0.0		Env. Sample ID= SB22/TW5 (29-30)	Bottom of borehole at 30.0 feet.



NOTES:

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REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
PPM = PARTS PER MILLION
IN. = INCHES
FT. = FEET

ENVIRONMENTAL BORING LOG_REV JULY 2013 ELMIRA WATER ST BORELOGS.GPJ GEI CONSULTANTS.GDT 8/1/13

Test Pit Logs

Test Pit Log

TP1

GEI PROJECT NO: 116120	TEST PIT DESIGNATION: TP1	SURFACE ELEVATION END NAVD88: 850.6
CLIENT: NYSEG	SITE LOCATION OR AREA: Gas Holder East Wall Outside	SURFACE ELEVATION CENTER NAVD88: 850.6
SITE NAME: Elmira Water Street RI	EQUIPMENT USED: Backhoe	SURFACE ELEVATION END NAVD88: 850.6
GEOLOGIST: Garrett Schmidt	EARTHWORK SUBCONTRACTOR: TREC Environmental	NORTHING NAD83: 761,033.86
DEPTH WATER ENCOUNTERED: N/A	OPERATOR: Paul Willey	EASTING NAD83: 762,283.92
START DATE: 5/1/13	START TIME: 1000	LATITUDE: 42° 05' 19.18766"
FINISH DATE: 5/1/13	FINISH TIME: 1100	LONGITUDE: 76° 47' 48.27081"

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
1	0.0			Asphalt	Asphalt: 0.0-0.3 feet bgs.	
2					Fill: Narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	Top of gas holder foundation wall at 1.8 feet bgs. Wall is 1.4 feet thick and is brick construction.
3	0.0			Fill		
4						
5	0.0					
6				Fill	Fill: Narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
7	0.0					
8						
9	0.0					
10				Fill		
11	0.0					
12					Fill: Narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
13	**0.0**	TP1 (12-13)			**BOTTOM OF TEST PIT EXCAVATION**	Bottom of wall or footer not reached in test pit.

Comments:

TEST PIT LENGTH: 10 Feet
TEST PIT WIDTH; 6 Feet
TEST PIT BACKFILL: Yes
LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

Hydrocarbon Stain, Sheen, or NAPL Blebs
Coal Tar or Coal Tar NAPL Coated or Saturated Soil

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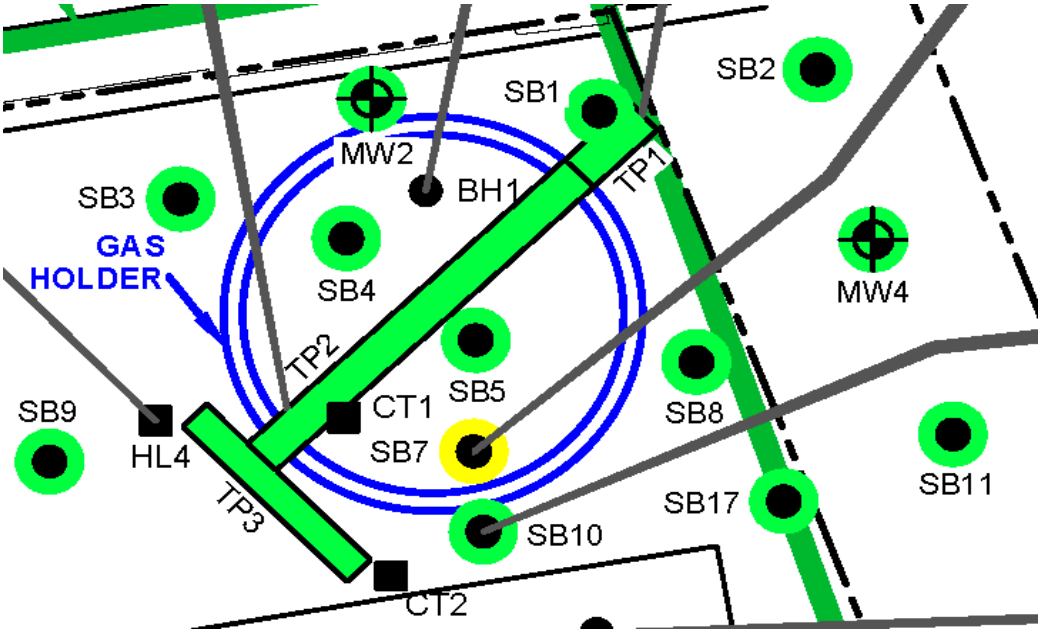
GEI Consultants	Test Pit Plan View and Photographs	TP1



Comments:	GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca New York 14850

Test Pit Log

TP2

GEI PROJECT NO: 116120	**TEST PIT DESIGNATION: TP2**	**SURFACE ELEVATION END NAVD88: 851.0**
CLIENT: NYSEG	**SITE LOCATION OR AREA: Inside Gas Holder**	**SURFACE ELEVATION CENTER NAVD88: 851.0**
SITE NAME: Elmira Water Street RI	**EQUIPMENT USED: Backhoe**	**SURFACE ELEVATION END NAVD88: 851.0**
GEOLOGIST: Garrett Schmidt	**EARTHWORK SUBCONTRACTOR: Trec Environmental**	**NORTHING NAD83: 761,008.15**
DEPTH WATER ENCOUNTERED: 10.0' bgs	**OPERATOR: Paul Willey**	**EASTING NAD83: 762,270.73**
START DATE: 5/1/13	**START TIME: 1100**	**LATITUDE: 42° 05' 18.93338"**
FINISH DATE: 5/1/13	**FINISH TIME: 1230**	**LONGITUDE: 76° 47' 48.44487"**

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
1	0.0			Asphalt	Asphalt: 0.0-0.3 feet bgs.	
2					Fill: 0.3-2.0 feet bgs, narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
3	0.0			Fill	Fill: 2.0-3.5 feet bgs, ash mixed with soil.	Top of gas holder foundation wall at 1.8 feet bgs. Wall is 1.4 feet thick and is brick construction.
4					Fill: 3.5-14.0 feet bgs, 70% sand, 10% silt, 20% fine to course sub-rounded gravel, brown, dry. Many brick fragments, glass, leather, pottery, and metal.	
5	0.0					
6		TP2(6)				
7	0.0			Fill		
8						
9	0.0					
10						
11	0.0			Fill	Becomes wet at 10 feet bgs.	
12						
13	0.0	TP2(13)				Bottom of holder not encountered in test pit.
14					**BOTTOM OF TEST PIT EXCAVATION**	

Comments:

TEST PIT LENGTH: 14 feet
TEST PIT WIDTH; 10 feet
TEST PIT BACKFILL: Yes
LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

Hydrocarbon Stain, Sheen, or NAPL Blebs
Coal Tar or Coal Tar NAPL Coated or Saturated Soil

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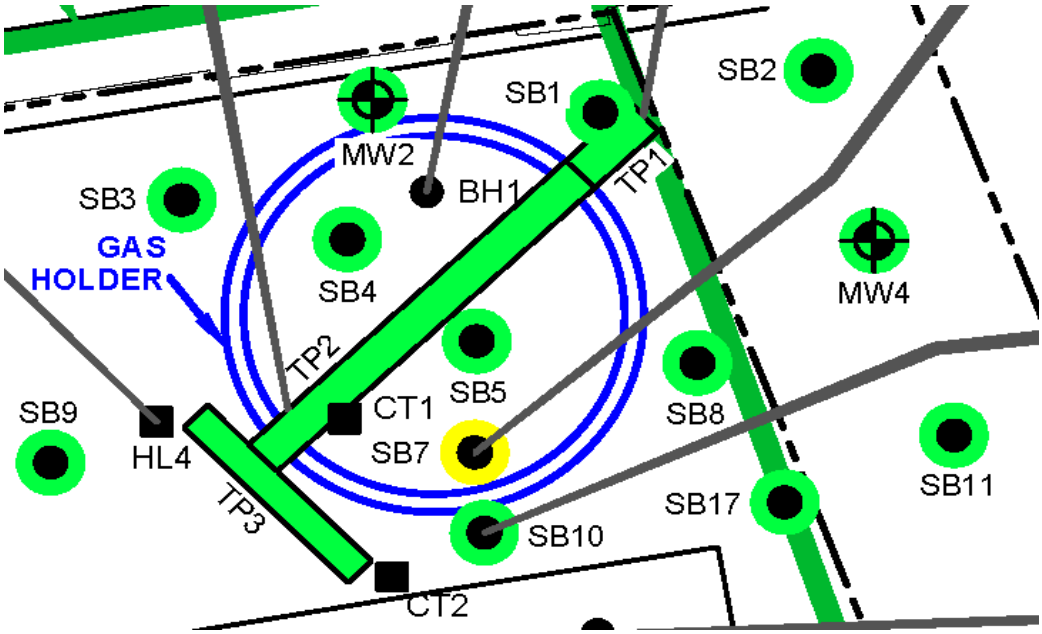
GEI Consultants	Test Pit Plan View and Photographs	TP2



Comments:	GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca New York 14850

Test Pit Log

TP3

GEI PROJECT NO: 116120	**TEST PIT DESIGNATION: TP3**	**SURFACE ELEVATION END NAVD88: 850.9**
CLIENT: NYSEG	**SITE LOCATION OR AREA: Gas Holder West Wall Inside**	**SURFACE ELEVATION CENTER NAVD88: 850.9**
SITE NAME: Elmira Water Street RI	**EQUIPMENT USED: Backhoe**	**SURFACE ELEVATION END NAVD88: 850.9**
GEOLOGIST: Garrett Schmidt	**EARTHWORK SUBCONTRACTOR: TREC Environmental**	**NORTHING NAD83: 761,024.10**
DEPTH WATER ENCOUNTERED: N/A	**OPERATOR: Paul Willey**	**EASTING NAD83: 762,239.93**
START DATE: 5/1/13	**START TIME: 1400**	**LATITUDE: 42° 05' 19.09015"**
FINISH DATE: 5/1/13	**FINISH TIME: 1530**	**LONGITUDE: 76° 47' 48.85399"**

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
1	0.0			Asphalt	Asphalt: 0.0-0.3 feet bgs.	
2					Fill: Narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
3	0.0			Fill		Top of gas holder foundation wall at 1.8 feet bgs. Wall is 1.4 feet thick and is brick construction.
4						
5	0.0					
6					Fill: Narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
7	0.0			Fill		
8						
9	0.0					
10						
11	0.0			Fill		
12					Fill: Narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
13	0.0					
14						

Comments:
TEST PIT LENGTH: 47 feet
TEST PIT WIDTH; 5 feet
TEST PIT BACKFILL: Yes
LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

Hydrocarbon Stain, Sheen, or NAPL Blebs
Coal Tar or Coal Tar NAPL Coated or Saturated Soil

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1301 Trumansburg Road
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Ithaca, New York 14850

Test Pit Log

TP3

GEI PROJECT NO: 116120	**TEST PIT DESIGNATION: TP3**	**SURFACE ELEVATION END NAVD88: 850.9**
CLIENT: NYSEG	**SITE LOCATION OR AREA: Gas Holder West Wall Inside**	**SURFACE ELEVATION CENTER NAVD88: 850.9**
SITE NAME: Elmira Water Street RI	**EQUIPMENT USED: Backhoe**	**SURFACE ELEVATION END NAVD88: 850.9**
GEOLOGIST: Garrett Schmidt	**EARTHWORK SUBCONTRACTOR: TREC Environmental**	**NORTHING NAD83: 761,024.10**
DEPTH WATER ENCOUNTERED: N/A	**OPERATOR: Paul Willey**	**EASTING NAD83: 762,239.93**
START DATE: 5/1/13	**START TIME: 1400**	**LATITUDE: 42° 05' 19.09015"**
FINISH DATE: 5/1/13	**FINISH TIME: 1530**	**LONGITUDE: 76° 47' 48.85399"**

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
15	0.0			Fill	Fill: 0.3-19.0 feet bgs, (SP-SM) narrowly graded sand (80%) with 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, brown, dry.	
16						
17	0.0					
18						
19	0.0					
		TP3(19-20)		SP	19.0-23.0 feet bgs, (SP) fine sand (90%), with 5% silt, 5 % sub-rounded gravel.	
20						
21	0.0					
22						
	0.0					Bottom of holder or footer not encountered in test pit.
23					**BOTTOM OF TEST PIT EXCAVATION**	

Comments:

TEST PIT LENGTH: 47 feet

TEST PIT WIDTH; 5 feet

TEST PIT BACKFILL: Yes

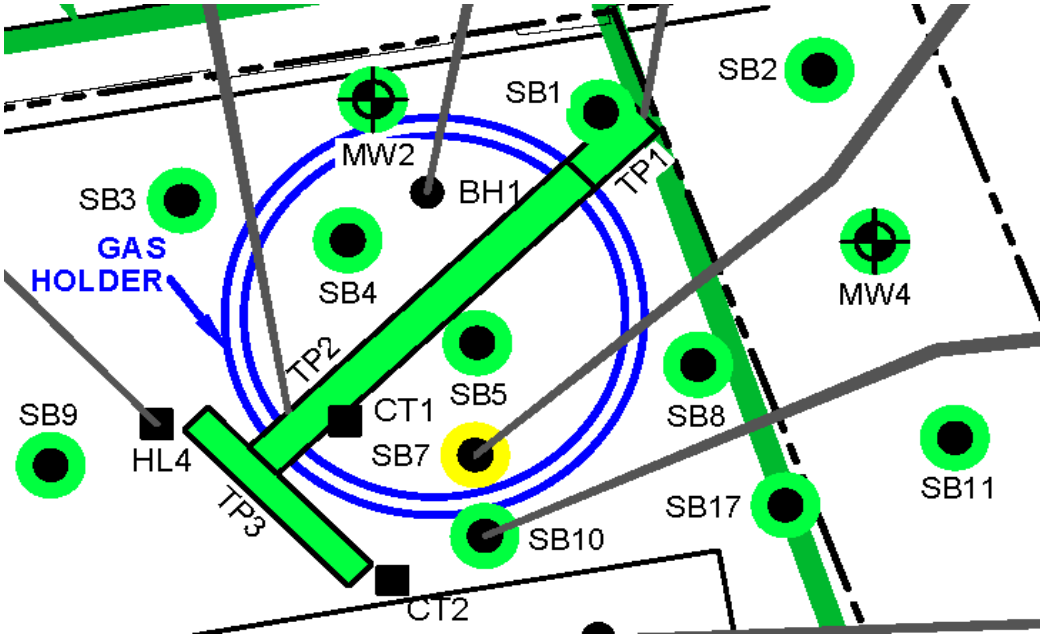
LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

Hydrocarbon Stain, Sheen, or NAPL Blebs

Coal Tar or Coal Tar NAPL Coated or Saturated Soil

GEI Consultants, Inc.
1301 Trumansburg Road
Suite N
Ithaca, New York 14850

GEI Consultants	Test Pit Plan View and Photographs	TP3



Comments:	GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca New York 14850

Test Pit Log

TP4

GEI PROJECT NO: 116120	**TEST PIT DESIGNATION: TP4**	**SURFACE ELEVATION END NAVD88: 851.5**
CLIENT: NYSEG	**SITE LOCATION OR AREA: East of MGP Building Foundation**	**SURFACE ELEVATION CENTER NAVD88: 851.5**
SITE NAME: Elmira Water Street RI	**EQUIPMENT USED: Backhoe**	**SURFACE ELEVATION END NAVD88: 851.5**
GEOLOGIST: Garrett Schmidt	**EARTHWORK SUBCONTRACTOR: TREC Environmental**	**NORTHING NAD83: 760,941.59**
DEPTH WATER ENCOUNTERED: N/A	**OPERATOR: Paul Willey**	**EASTING NAD83: 762,310.57**
START DATE: 5/2/13	**START TIME: 0830**	**LATITUDE: 42° 05' 18.27675"**
FINISH DATE: 5/2/13	**FINISH TIME: 0930**	**LONGITUDE: 76° 47' 47.91434"**

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
1	0.0			Asphalt	Asphalt: 0.0-0.4 feet bgs.	0.0-6.0 feet bgs, stone and brick foundation wall on west side of test pit (suspected MGP building wall foundation).
2				Fill	Fill: Narrowly graded sand (80%), 10% silt, 10% fine to course sub-rounded gravel, dry, brown, many brick fragments.	
3	1.4	TP4(3)		Fill		
4						
5	0.0			Fill	Fill: Narrowly graded sand (80%), 10% silt, 10% fine to course sub-rounded gravel, dry, brown, many brick fragments.	
6						5.5-6.0 feet bgs concrete encounted on east side of test pit.
7	2.5			Fill		
8		TP4(8)				
9	0.0			Fill	Fill: Narrowly graded sand (80%), 10% silt, 10% fine to course sub-rounded gravel, dry, brown, many brick fragments.	
10						
11					**BOTTOM OF TEST PIT EXCAVATION**	
12						
13						
14						

Comments:

TEST PIT LENGTH: 20 feet

TEST PIT WIDTH; 6 feet

TEST PIT BACKFILL: Yes

LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

Hydrocarbon Stain, Sheen, or NAPL Blebs

Coal Tar or Coal Tar NAPL Coated or Saturated Soil

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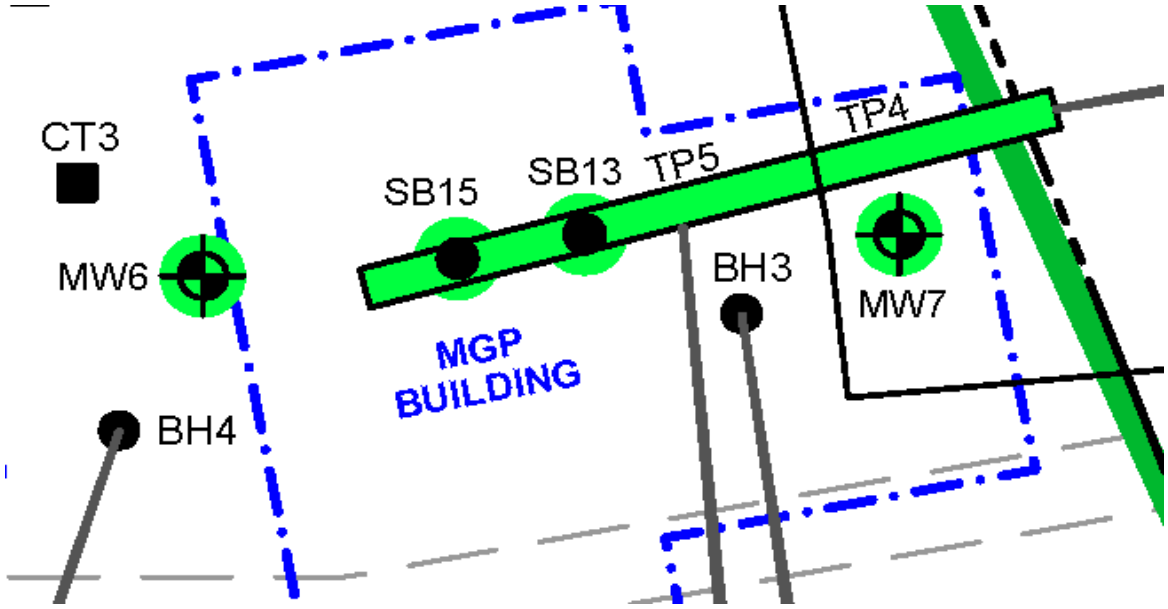
Suite N
Ithaca, New York 14850

GEI Consultants	Test Pit Plan View and Photographs	TP4



Comments:

	Hydrocarbon Stain, Sheen, or NAPL Blebs
	Coal Tar or Coal Tar NAPL Coated or Saturated Soil

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1301 Trumansburg Road
Suite N
Ithaca New York 14850

Test Pit Log

TP5

GEI PROJECT NO: 116120	**TEST PIT DESIGNATION: TP5**	**SURFACE ELEVATION END NAVD88: 851.6**
CLIENT: NYSEG	**SITE LOCATION OR AREA: Footprint of MGP Building**	**SURFACE ELEVATION CENTER NAVD88: 851.6**
SITE NAME: Elmira Water Street RI	**EQUIPMENT USED: Backhoe**	**SURFACE ELEVATION END NAVD88: 851.6**
GEOLOGIST: Garrett Schmidt	**EARTHWORK SUBCONTRACTOR: TREC Environmental**	**NORTHING NAD83: 760,941.62**
DEPTH WATER ENCOUNTERED: N/A	**OPERATOR: Paul Willey**	**EASTING NAD83: 762,284.01**
START DATE: 5/2/13	**START TIME: 0930**	**LATITUDE: 42° 05' 18.27649"**
FINISH DATE: 5/2/13	**FINISH TIME: 1000**	**LONGITUDE: 76° 47' 48.26651"**

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
1	0.0			Topsoil	Topsoil: 0.0-0.3 feet bgs.	0.0-6.0 feet bgs, stone and brick structure on west side of test pit.
2				Fill	Fill: 0.3-2.5 feet bgs, coal fragments, brick fragments, ash, with 80% fine sand, 10% silt, 10% fine to course sub-rounded gravel, dry, brownish black.	
3	2.4	TP5(3) East		Fill	Fill: 80% fine sand, 10% silt, 10% fine to course sub-rounded gravel,brown, many brick fragments.	
4		TP5(3) West				
5	0.0			Fill		
6						
7	1.7	TP5(7) East		SP-SM	6.0-7.0 feet bgs, (SP-SM) with 90% fine sand, 10% silt, light brown, dry to moist.	
		TP5(7) West			**BOTTOM OF TEST PIT EXCAVATION**	
8						
9						
10						
11						
12						
13						
14						

Comments:

TEST PIT LENGTH: 32 feet

TEST PIT WIDTH; 6 feet

TEST PIT BACKFILL: Yes

LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

Hydrocarbon Stain, Sheen, or NAPL Blebs

Coal Tar or Coal Tar NAPL Coated or Saturated Soil

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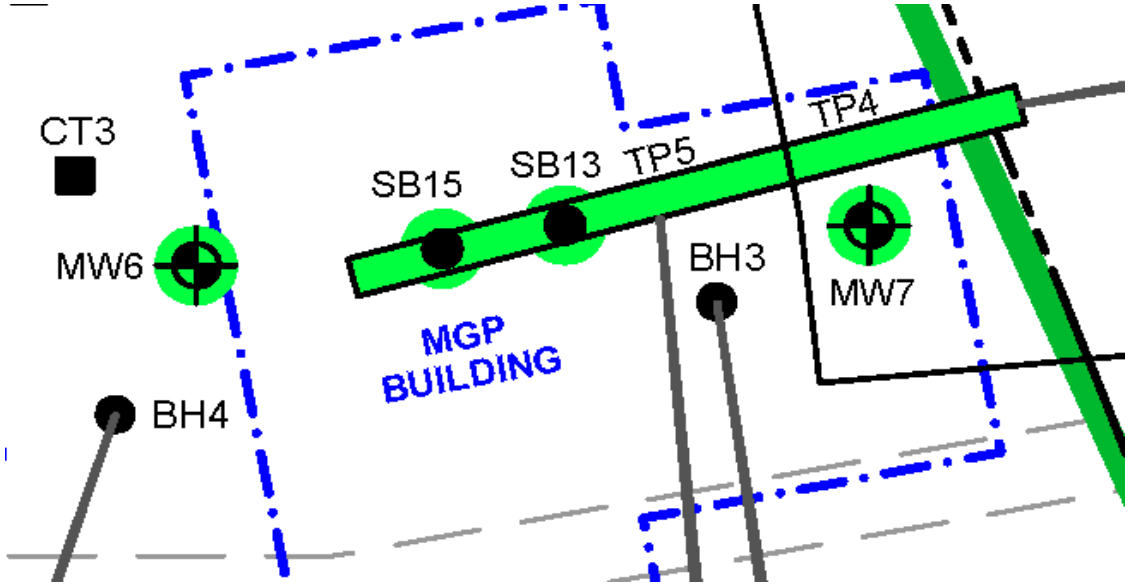
Ithaca, New York 14850

GEI Consultants	Test Pit Plan View and Photographs	TP5



Comments:		
	Hydrocarbon Stain, Sheen, or NAPL Blebs	GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca New York 14850
	Coal Tar or Coal Tar NAPL Coated or Saturated Soil	

Test Pit Log

TP6

GEI PROJECT NO: 116120	**TEST PIT DESIGNATION: TP6**	**SURFACE ELEVATION END NAVD88: 851.1**
CLIENT: NYSEG	**SITE LOCATION OR AREA: West of Holder**	**SURFACE ELEVATION CENTER NAVD88: 851.1**
SITE NAME: Elmira Water Street RI	**EQUIPMENT USED: Backhoe**	**SURFACE ELEVATION END NAVD88: 851.1**
GEOLOGIST: Garrett Schmidt	**EARTHWORK SUBCONTRACTOR: TREC Environmental**	**NORTHING NAD83: 761,014.91**
DEPTH WATER ENCOUNTERED: N/A	**OPERATOR: Paul Willey**	**EASTING NAD83: 762,162.07**
START DATE: 5/2/13	**START TIME: 1320**	**LATITUDE: 42° 05' 18.99748"**
FINISH DATE: 5/2/13	**FINISH TIME: 1400**	**LONGITUDE: 76° 47' 49.88625"**

DEPTH (FEET)	PID HEADSPACE (PPM)	LABORATORY SAMPLE (FEET)	VISUAL OBSERVATIONS	SOIL LITHOLOGY USCS	SOIL DESCRIPTION LOG	STRUCTURES ENCOUNTERED OR COMMENTS
1	0.0			Asphalt	Asphalt: 0.0-0.3 feet bgs.	
2				Fill	Fill: 80% narrowly graded fine sand, 10% silt, 10% fine to course sub-rounded gravel, many brick fragments, glass fragments, brown.	
3	0.0	TP6(3)		Fill		
4						
5	0.0			SP-SM	4.5-6.0 feet bgs, (SP-SM) with 85% fine sand, 10% silt, 5% fine to course sub-rounded gravel, dry to moist, light brown.	
6		TP6(6)			**BOTTOM OF TEST PIT EXCAVATION**	
7						
8						
9						
10						
11						
12						
13						
14						

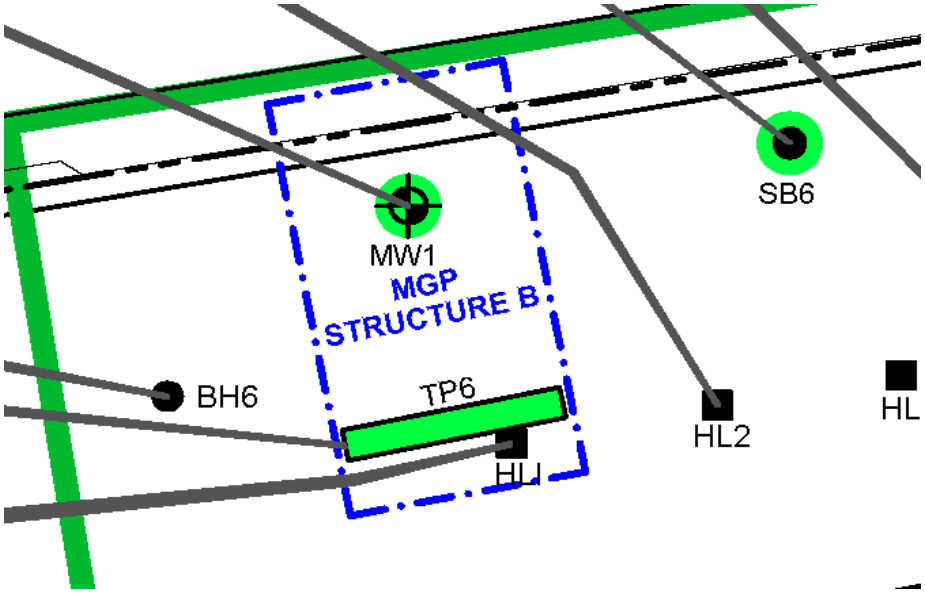
Comments:

TEST PIT LENGTH: 25 feet
TEST PIT WIDTH; 4 feet
TEST PIT BACKFILL: Yes
LABORATORY ANALYSES: VOCs, SVOCs, TAL Metals, Total Cyanide

	Hydrocarbon Stain, Sheen, or NAPL Blebs
	Coal Tar or Coal Tar NAPL Coated or Saturated Soil

GEI Consultants, Inc.
1301 Trumansburg Road
Suite N
Ithaca, New York 14850

GEI Consultants	Test Pit Plan View and Photographs	TP6



Comments:		
	Hydrocarbon Stain, Sheen, or NAPL Blebs	GEI Consultants, Inc. 1301 Trumansburg Road Suite N Ithaca New York 14850
	Coal Tar or Coal Tar NAPL Coated or Saturated Soil	

Appendix B

Pre-Design Investigation Work Plan

GEI Consultants

Consulting
Engineers and
Scientists

Pre-Design Investigation Work Plan

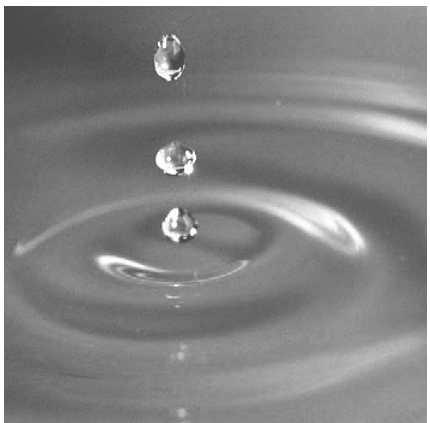
Remedial Design
Elmira Water Street Manufactured Gas Plant Site
City of Elmira, New York

NYSDEC Site #808025
Index #: D0-0002-9309

Submitted to:
NYSEG
18 Link Drive
Binghamton, NY 13902-5224

Submitted by:
GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

Project # 1704633



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Abbreviations and Acronyms

AOC	Area of Concern
ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	below ground surface
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
BTU	British Thermal Unit
CAMP	Community Air Monitoring Plan
CMP	Corrugated Metal Pipe
COC	Constituents of Concern
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
ELAP	Environmental Laboratory Approval Program
EPA	U.S. Environmental Protection Agency
FER	Final Engineering Report
FPP	Flood Protection Project
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc., P.C.
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HSA	Hollow-Stem Auger
ICP	Inductively Coupled Plasma
IDW	Investigation-Derived Waste
LTTD	Low-Temperature Thermal Desorption
MGP	Manufactured Gas Plant
NAD83	North American Horizontal Datum 1983
NAPL	Non-Aqueous Phase Liquid
NAVD88	North American Vertical Datum 1988
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated Biphenyls
PDI	Pre-Design Investigation
PID	Photo-Ionization Detector
PLS	Professional Land Surveyor
PPE	Personal Protection Equipment
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
RQD	Rock Quality Designation
SOP	Standard Operating Procedure
SPT	Standard Penetration Testing

SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compound
VWP	Vibrating Wire Piezometer

1. Introduction

This work plan describes the scope of work and proposed methods to be used for a Pre-Design Investigation (PDI) at the Elmira Water Street Former Manufactured Gas Plant (MGP) located in the City of Elmira, New York (site).

1.1 Background

A Remedial Investigation (RI) for the site has been completed. The investigation was performed according to the methods described in the document entitled "*Remedial Investigation Work Plan, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309,*" dated February 18, 2013 [GEI, 2013]. The results of the RI were summarized in the document entitled "*Remedial Investigation Report, Elmira Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309,*" August 27, 2014 [GEI, 2014].

The New York State Department of Environmental Conservation (NYSDEC) has selected a remedy for site cleanup. The required remedial action is described in the document entitled "*Record of Decision - NYSEG – Elmira Water Street MGP State Superfund Project – Elmira, Chemung County, Site No. 808025,*" March 2017 [NYSDEC, 2017].

NYSEG will implement the remedial action pursuant to a Multi-site Order on Consent between NYSEG and the NYSDEC, and the guidance provided in the document entitled "*NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation*" (DER10) [NYSDEC, 2010].

The elements for a remedial design (RD) required by NYSDEC Division of Environmental Remediation (DER) are provided in Section 5.2 of the DER10 document. Included are: an introduction, a summary of the design investigation, a description of the design scope, identification of required permits or authorizations, a project schedule, and a description of the post-construction plans.

This work plan is included as an appendix (Appendix B) to the Remedial Design Work Plan (RDWP), and presents the proposed scope of work for the design investigation task for the RD. The additional elements of the RD described above are described in the RDWP. Following the approval of this work plan by the NYSDEC, the tasks described below will be implemented, and the data obtained used to support the preparation of the subsequent RD phases.

1.2 Work Plan Organization

Following this introduction, the remainder of this work plan describes the proposed PDI methods and activities, and describes the elements to be included in the RD.

- **Section 2** – describes the proposed field activities and laboratory analyses.
- **Section 3** – describes the companion documents for this PDI.
- **Section 4** – provides a list of the references cited in this work plan.

2. Pre-Design Investigation Activities

This section describes the field activities that will be implemented for the PDI. Additional information regarding the methods and procedures to be used during the PDI are provided in the Field Sampling Plan (FSP) in Appendix D.

2.1 Utility Clearance and Mapping

The utilities identified during the RI are shown on Figure 1. Additional utility locating work is proposed to mark the locations of utilities prior to the PDI activities, and also to obtain additional information that can be used during the RD phase.

Dig Safely New York will be contacted to arrange for the location and marking of all underground utilities. A private utility locating service will be contracted to trace and mark-out all identified subsurface utilities, and to obtain invert information where possible. The utility locating service will perform a comprehensive site utility survey using ground penetrating radar (GPR), magnetometer, and other utility locating techniques as appropriate.

PDI boring locations may be modified, if necessary, from their work plan locations following completion of this task. Following the field activities for the PDI, the horizontal locations of, and the available invert elevations of all the identified utilities, will be surveyed by a New York State Professional Land Surveyor (PLS).

2.2 Geotechnical Soil Borings and Analyses

Three borings (GTSB1, GTSB2, and GTSB3) are proposed to obtain geotechnical data for the excavation support design. Details of the proposed borings, and the proposed geotechnical laboratory analyses are provided in Table 1. The approximate locations of the borings are shown (in purple) on Figure 2, and for two of the borings, on the cross-sectional view (Figure 3 – Section A-A'). The proposed sample locations are presented on the table and figures; however, final drilling and sampling details will be determined in the field as the work progresses, in consultation with GEI's senior geotechnical engineering personnel.

2.2.1 Physical Characteristics

At each boring, standard penetration testing (SPT) of the overburden will be performed using 2-inch outside diameter split-spoon samplers in accordance with American Society of Testing and Materials (ASTM) D1586. The SPTs will be performed continuously through the borings to the final depths. SPT N-values will be recorded, and each boring will extend to the bedrock unit which is approximately 80 feet deep.

Soil recovered from each sample interval will be visually characterized (for soil type, grain size, color, texture, and moisture content) and screening for headspace organic vapors using a photo-ionization detector (PID). In addition, the presence of odors or visible evidence of impact by MGP-related residuals will be noted.

2.2.2 Geotechnical Analyses

Soil samples from each sample interval will be collected during drilling, and each soil strata observed during the drilling program (fill, silt, sand and gravel alluvium, and clay) will have a bulk sample collected and submitted to a geotechnical laboratory for the following analyses:

- **Grain Size – Sieve and Hydrometer** - ASTM D422 and D1140 / T88 - Sieve and Hydrometer if fines > 10%.
- **Atterberg Limits** - ASTM D4318.
- **Moisture (water) Content** - ASTM D2216.

These tests will help to confirm the field soil classification, and will also assist in the estimation of soil parameters that may be used in the design of excavation support.

2.2.3 Rock Core

At one of the soil boring locations, a rock core sample will be collected to estimate bedrock characteristics and strength. The soil boring will be advanced until refusal has been met, and/or a split-spoon sampler indicates that the drilling has reached the depth of the top of competent bedrock. A NX core barrel tool will then be used to collect a rock core sample. The core barrel will be advanced in multiple 5-foot "runs" to obtain a sample of competent bedrock. We assume that a total of approximately 10 feet of rock core drilling will be performed. The core samples will be logged for physical characteristics, rock quality designations (RQDs) will be computed, and the rock core samples will be photographed. A boring log will be prepared for use in the RD, and the samples will be retained for future evaluations, testing, and viewing during the bid process.

2.2.4 Piezometer Installation

For one of the soil borings advanced for the geotechnical evaluation, two vibrating wire piezometers (VWPs) will be installed in the grouted borehole. One of the piezometers will have a screened interval 10 feet below the groundwater table. The second piezometer's screened interval will be installed 5 feet above the bedrock.

2.2.5 Geotechnical Borehole Abandonment

Following completion of the geotechnical borings, the borings not used for piezometer installation will be backfilled up to the ground surface with cement-bentonite grout using

tremie methods. The location of each boring will be surveyed at the completion of the PDI field activities by a PLS.

2.3 Soil Pre-Characterization for Disposal

A pre-characterization task to evaluate and profile materials for disposal will be performed. To ensure that the most current requirements of the targeted disposal facilities are met prior to mobilization, the plan will need to be updated and confirmed with the facilities prior to the PDI sample collection task.

2.3.1 Low-Temperature Thermal Desorption Facilities

The waste characterization profile for low-temperature thermal desorption (LTTD) facilities is based on the results of the facility acceptance analyses listed below for LTTD at ESMI's Fort Edward, New York facility. This facility is a NYSEG-approved facility. The characterization required by ESMI is summarized below.

Coal Tar / MGP Soils:

- Total Petroleum Hydrocarbons (TPH) – Method 8015 GRO/DRO
- Total Volatile Organic Compounds (VOCs) – Method 8260C
- Total Semi-volatile Organic Compounds (SVOCs) – Method 8270D
- Total Polychlorinated Biphenyls (PCBs) – Method 8080
- Total Metals – Method 6010B
- Total Cyanide – Method 9014A
- Total Sulfide – Method 9030B/9034
- Percent Sulfur – ASTM Method D129-64
- British Thermal Unit (BTU) – ASTM Method D240-87

ESMI currently requires three samples for the first 500 cubic yards, and one sample for each 500 cubic yards thereafter.

2.3.2 Landfill Facilities

Excavated materials may also be disposed of as non-hazardous material at a landfill facility. Three NYSEG-approved facilities are discussed below; however, the final list of potential facilities will need to be confirmed prior to remediation by the Remedial Contractor. The target facilities currently considered for landfill disposal include:

- **Ontario County Landfill**, Stanley, New York
- **Seneca Meadows Landfill**, Waterloo, New York

- **High Acres Landfill - Waste Management**, Fairport, New York

To meet the sample requirements of these facilities, the pre-characterization samples will be analyzed for the following:

- Toxicity Characteristic Leaching Procedure (TCLP) ZHE Extraction – U.S. Environmental Protection Agency (EPA) Method 1311;
- TCLP VOC – Method 1311/8260B;
- TCLP SVOC – Method 1311/8270C;
- TCLP Inductively Coupled Plasma (ICP) Metals – Method 6010B;
- TCLP Herbicides – Method 1311/8151A;
- TCLP Pesticides – Method 1311/8081A;
- TPH – 8015 GRO/DRO;
- VOCs Target Compound List (TCL) – Method 8260C;
- SVOCs TCL – Method 8270D;
- Total Cyanide – Method 9014A;
- PCBs – Method 8082;
- Reactive Sulfide – Method 7.3.4.1;
- Reactive Cyanide – Method 7.3.3.2;
- Ignitability – Method 1010/Flashpoint;
- Corrosivity / pH – Method 9045;
- Total Residue/Percent Solids – ASTM D-2216-90; and
- Target Analyte List (TAL) Metals – 6000-7000 Method Series.

Landfill facilities typically require one sample per 500 tons of soil to be characterized.

2.3.3 Sample Collection

Samples will be collected during the PDI and analyzed for the methods identified above. The approximate locations for the soil borings are shown on Figure 2. A hollow stem auger drilling rig will be used to collect the samples from locations within the footprint of Area of Concern 1 (AOC1). The sampling plan is designed to provide information that the Remedial Contractor may use to develop several options for waste materials management.

For the borings outside of the Gas Holder foundation, the borings will be advanced to 30 feet. Composite samples will be collected from the ground surface to the bottom of the borings. Borings advanced inside the holder will be advanced to approximately 17.5 feet, to the floor of the holder foundation. At each boring location inside the Gas Holder foundation, a composite sample will be collected from the 0-10 foot interval. This interval was not observed to have MGP-related impacts during the RI. A second sample will be collected from the 10-17.5 foot interval. This interval was observed to have MGP-related impacts during the RI, and based on the analytical results, this material will be managed by either LTTD or by landfill disposal.

A New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory will be used for the analyses. Level 2 Reports will be prepared for the sample delivery groups. The chain-of-custody record and the laboratory Form I Report sheets for the analyses will be provided by the Remedial Engineer to the Remedial Contractor and the target disposal facilities, as directed by NYSEG. The analytical results will also be included in the Final Engineering Report (FER).

2.4 PDI Reconnaissance Tasks

A reconnaissance will be performed to document pre-remedial conditions for several features at the site, and also to collect information that may be used for the design of the excavation support system.

2.4.1 I-Wall Structural Assessment

A structural assessment will be performed to document and evaluate the condition of the concrete flood I-Wall in the NYSDEC Flood Protection Project (FPP) easement area. The location and magnitude of observed deflection and cracks in the wall will be recorded and photographed. Also, constructed control or expansion joints as well as other structural details that may be relevant to the RD will be recorded and photographed. Locations or features found to be relevant for the RD will be surveyed by the PLS during the PDI survey task.

2.4.2 Interceptor Sewer Evaluation

A visual evaluation will be performed to observe and document the condition of the 84-inch diameter corrugated metal pipe (CMP) interceptor sewer. The reconnaissance will be performed in consultation and collaboration with the City of Elmira Department of Public Works. The methods to be used for the reconnaissance will be selected prior to mobilization in consultation with the City Engineer, and the NYSDEC will be notified in advance regarding the methods and the schedule for the field activities.

2.5 Vibration Monitoring

A vibration monitoring program will be conducted to gather baseline information on the typical level of vibrations experienced by structures near the site. This information will be

used to evaluate the effects of potential construction methods based on the expected level of vibrations that would be generated during installation.

After the monitoring event is completed, the data will be analyzed during the RD process to plot the baseline level of vibrations experienced by the structure(s). This data can then be used to aid with the evaluation of the proposed construction methods, and to develop specification requirements during the design phase.

2.6 Hydrology Characterization

Testing will be performed to obtain data for dewatering design, permitting, and cost estimating. The testing will be performed to provide a spatial and depth distribution of estimated hydraulic conductivity values. Locations adjacent to the excavation area will be tested, including wells screened at the groundwater table. Three types of tests will be performed: falling-head tests will be performed in an open boring to assess permeability in absence of sand pack effects, slug tests will be performed in monitoring wells to measure hydraulic conductivity for comparison to other methods, and single-well pump tests will be performed to estimate specific capacity and hydraulic conductivity, where sand pack effects are filtered out with sustained pumping.

2.6.1 Borehole Permeability Tests

Falling-head permeability tests will be performed during the soil borings advanced for the geotechnical evaluation. The tests will be performed in open boreholes during drilling. Time-drawdown data will be analyzed using Hvorslev Case C, the case representing flush open bottom in uniform soil [Hvorslev, 1951]. The calculations will be utilized in the RD and included as an attachment in the FER.

2.6.2 Slug Tests

Slug tests will be performed for wells in close proximity to the Gas Holder foundation. Three slug tests will be performed per well, with additional tests performed as needed if measurement data from any tests appear unusable. The data will be analyzed using the Bouwer-Rice Method to compute hydraulic conductivity from the results [Bouwer, 1976].

2.6.3 Pump Tests

Short-duration pump tests will be performed for select wells. Time-drawdown curves will be prepared. Calculation of hydraulic conductivity from pumping phase data will be performed using Robbins methodology, with results summarized in tables [Robbins, 2009]. Specific capacity will be calculated as pumping rate divided by drawdown.

2.7 As-Built and Topographic Surveying

A survey of the as-built PDI exploration locations, existing utilities, and important site features not surveyed during the RI will be performed at the end of the field activities by a

PLS. Horizontal locations will be reported in the applicable New York State horizontal coordinates (North American Horizontal Datum 1983 [NAD83], NYS Central Zone), and latitude and longitude coordinates. Elevation data will be reported in North American Vertical Datum 1988 [NAVD88].

2.8 Community Air Monitoring

Community air monitoring will be performed during the PDI to provide real-time measurements of total VOCs and particulate (airborne dust) concentrations in air at the downwind perimeter of each designated work area when intrusive investigation activities (such as drilling) are in progress at the site. The monitoring is designed to provide protection for the downwind community, including residences and businesses and on-site workers not directly involved with the PDI work activities, from potential releases of airborne constituents resulting from the investigation activities. The procedures used will follow methods described in the Community Air Monitoring Plan (CAMP) (RDWP Appendix F).

2.9 Investigation-Derived Waste Management

Investigation-derived waste (IDW) will be placed in appropriate waste containers and temporarily staged at a location on the NYSEG parcel. Soil cuttings, personal protective equipment (PPE), and spent disposable sampling materials will be placed in drums. Decontamination water, pump test water, and drilling water will be stored in closed-top drums or a bulk water tank. Storage containers will be appropriately labeled with the contents, generator, location, and date for appropriate off-site transportation and disposal at a NYSEG-approved facility.

3. Companion Work Plan Documents

Four companion documents detail the methods and procedures to be used during the PDI. Each of the documents is included as an appendix to the RDWP.

3.1 Field Sampling Plan

Sampling and analyses will be conducted in accordance with the methods described in the site-specific FSP. The FSP provides a description of the objectives and methods for each of the investigation field activities, and details concerning the project organization.

3.2 Quality Assurance Project Plan

In addition to the FSP, a full Quality Assurance Project Plan (QAPP) has been developed for use on this project. The QAPP identifies the quality assurance objectives for the measurement data, the QA/QC procedures to be used in the field, the sample chain-of-custody methods to be used, and the analytical procedures to be followed. The QAPP will also include a description of the manner in which each type of data is to be used.

3.3 Community Air Monitoring Plan

A CAMP has been developed for this project that will be followed during the invasive field work (soil borings). Included in the CAMP is a description of methods that may be used to control odors during the investigation field activities, if needed.

3.4 Site-Specific Health and Safety Plan

A site-specific Health and Safety Plan (HASP) has been prepared to describe health and safety risks and procedures for all site workers and visitors. Included in the HASP is information regarding physical and chemical hazards at the site, emergency procedures and contact information, incident reporting procedures, and the route to the hospital.

4. References

Bouwer and Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells. Herman Bouwer and R.C. Rice, Water Resources Research, Vol. 12, No. 3, June 1976.

GEI, 2013. Remedial Investigation Work Plan, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309, dated February 18, 2013.

GEI, 2014. Remedial Investigation Report, Elmira Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309, August 27, 2014.

GEI, 2015. Feasibility Study Report, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309, dated November 2, 2015.

Hvorslev, 1951. Time Lag and Soil Permeability in Ground-Water Observations. U.S. Army Corps of Engineers, Waterway Experiment Station, Bulletin No. 36, April 1951.

NYSDEC, 2010. DER10 – Technical Guidance for Site Investigation and Remediation, May 2010.

NYSDEC, 2017. Record of Decision - NYSEG – Elmira Water Street MGP State Superfund Project – Elmira, Chemung County, Site No. 808025, March 2017.

Robbins, 2009. Determining Hydraulic Conductivity Using Pumping Data from Low-Flow Sampling. Ground Water, Vol 47, No. 2, March-April 2009.

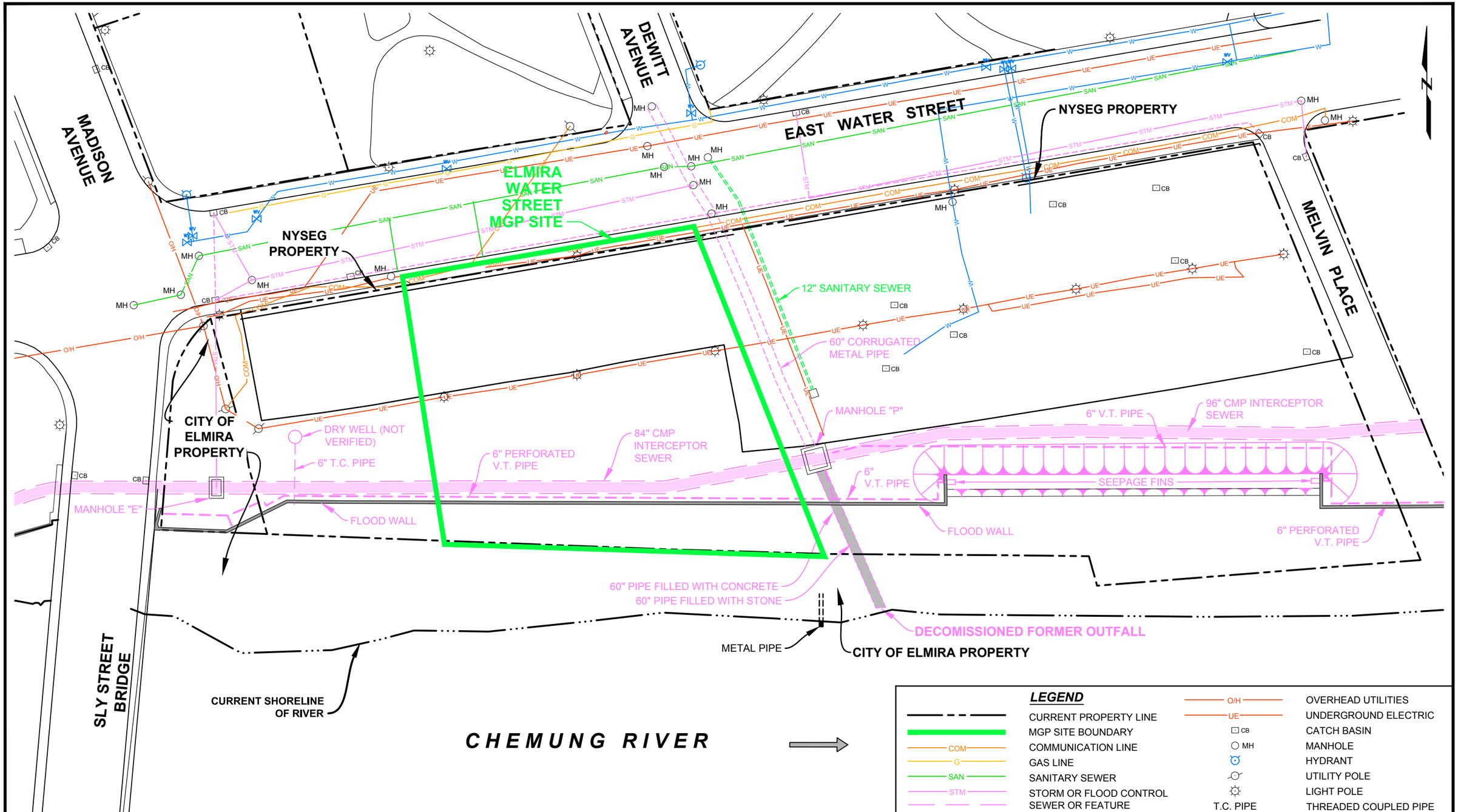
Table

Table 1
Proposed PDI Soil Boring Summary
Elmira Water Street Former MGP Site

Soil Boring Summary																		
Soil Boring Description								Physical Characteristics				Geotechnical Bulk Samples			Bedrock Core		Waste Profile
Sample Designation	Sample Date	Sample Location or Rationale	Ground Surface Elevation (Feet NAVD88)	Northing (NAD83)	Easting (NAD83)	Target Depth of Boring	Sample Depth (feet below ground surface)	Standard Penetration Testing D1586	Visual Characterization (soil type, grain size, color, texture, moisture content)	PID Head Space	Visual Observations of Hydrocarbon Impacts	Grain Size - Sieve and Hydrometer - ASTM D422 and D1140 / T88 Sieve and Hydrometer if fines > 10%	Atterberg Limits - ASTM D4318 (3 point - dry method standard	Moisture (water) Content - ASTM D2216-90	Visual Characterization (type, fractures)	Rock Quality Designation	Suite of Analyses in PDI WP
Proposed Geotechnical Soil Borings																	
GTSB1	TBD	Adjacent to Gas Holder Foundation; Excavation Support Design	TBD	TBD	TBD	80	Multiple, See Log	**X**	**X**	**X**	**X**	**One sample of the Fill Unit, One Sample of the Silt / Sand / Gravel Unit, One Sample of the Clay**			**One ten foot core from one boring**		NA
GTSB2	TBD	Adjacent to Gas Holder Foundation; Excavation Support Design	TBD	TBD	TBD	80	Multiple, See Log	**X**	**X**	**X**	**X**						NA
GTSB3	TBD	Adjacent to Gas Holder Foundation; Excavation Support Design	TBD	TBD	TBD	80	Multiple, See Log	**X**	**X**	**X**	**X**						NA
Proposed Waste Characterization Borings																	
WCB1	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB1(0-10)
																	WCB1(10-17.5)
WCB2	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB2(0-10)
																	WCB2(10-17.5)
WCB3	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB3(0-10)
																	WCB3(10-17.5)
WCB4	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB4(0-10)
																	WCB4(10-17.5)
WCB5	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB5(0-10)
																	WCB5(10-17.5)
WCB6	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB6(0-10)
																	WCB6(10-17.5)
WCB7	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB7(0-10)
																	WCB7(10-17.5)
WCB8	TBD	Soil characterization for disposal estimates. Inside Gas Holder Foundation.	TBD	TBD	TBD	18	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCB8(0-10)
																	WCB8(10-17.5)
WCB9	TBD	Soil characterization for disposal estimates. Outside of Gas Holder Foundation.	TBD	TBD	TBD	30	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCSB9(0-30)
WCB10	TBD	Soil characterization for disposal estimates. Outside of Gas Holder Foundation.	TBD	TBD	TBD	30	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCSB10(0-30)
WCB11	TBD	Soil characterization for disposal estimates. Outside of Gas Holder Foundation.	TBD	TBD	TBD	30	Composite	NA	**X**	**X**	**X**	NA	NA	NA	NA	NA	WCSB11(0-30)

TBD - To be determined or measured during PDI field activities.
Horizontal Coordinates to be reported in New York State Plane, Central Zone, NAD83 North American Datum 1983 (NAD83), and latitude and longitude.
Vertical Coordinates to be reported in North American Datum 1988 (NAVD88).

Figures



LEGEND

	CURRENT PROPERTY LINE	O/H	OVERHEAD UTILITIES
	MGP SITE BOUNDARY	UE	UNDERGROUND ELECTRIC
COM	COMMUNICATION LINE	CB	CATCH BASIN
G	GAS LINE	MH	MANHOLE
SAN	SANITARY SEWER		HYDRANT
STM	STORM OR FLOOD CONTROL SEWER OR FEATURE		UTILITY POLE
			LIGHT POLE
W	WATER LINE	T.C. PIPE	THREADED COUPLED PIPE
		V.T. PIPE	VITRIFIED PIPE

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50' 100'

SCALE: 1" = 50'

Preliminary Design Investigation Work Plan
Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

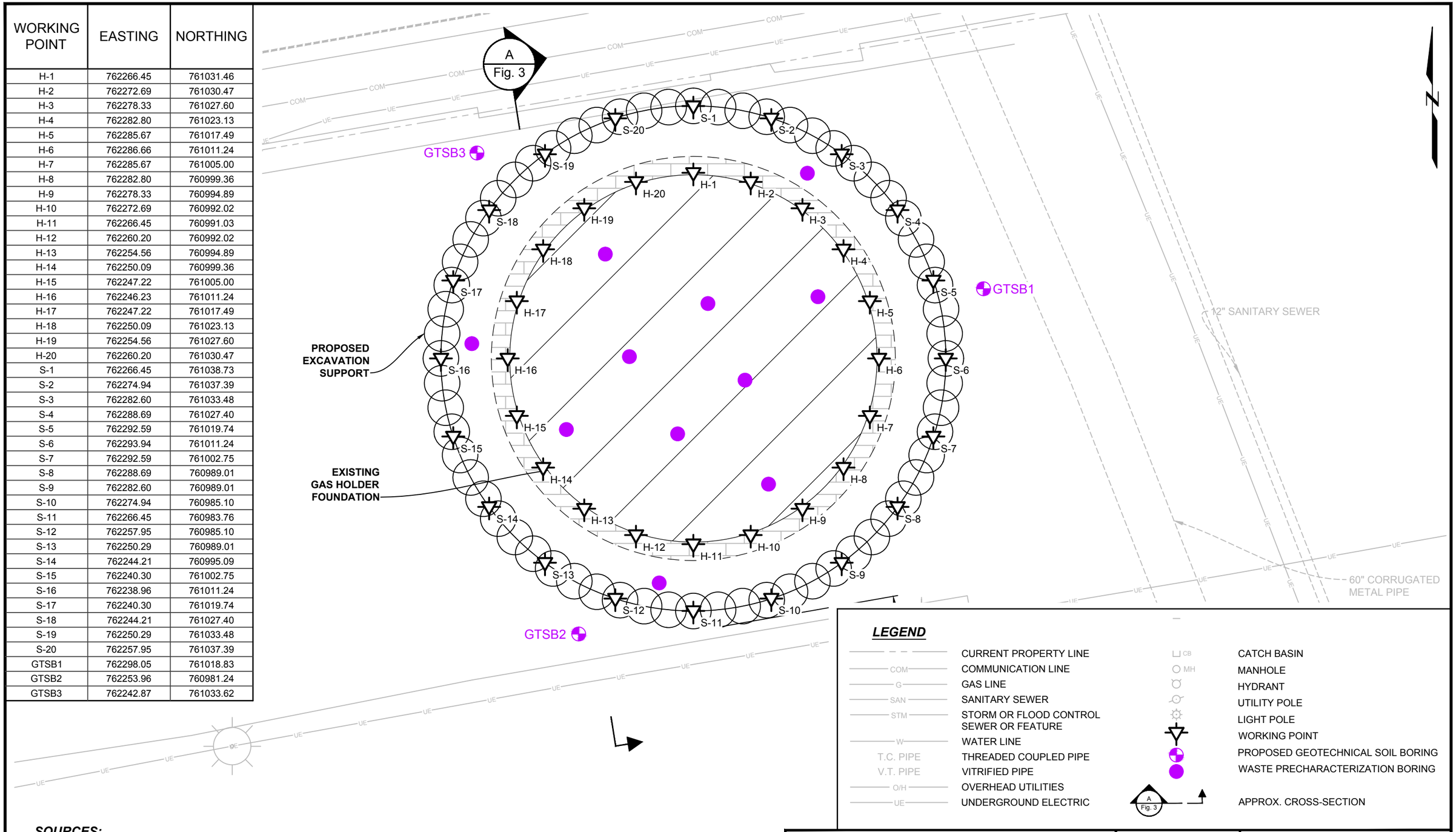
GEI Consultants

CURRENT UTILITY PLAN

Project 1704633 | June 2018 | Fig. 1

---- B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\PDIWP\1 - 1704633-PDIWP.dwg - 3/28/2018

WORKING POINT	EASTING	NORTHING
H-1	762266.45	761031.46
H-2	762272.69	761030.47
H-3	762278.33	761027.60
H-4	762282.80	761023.13
H-5	762285.67	761017.49
H-6	762286.66	761011.24
H-7	762285.67	761005.00
H-8	762282.80	760999.36
H-9	762278.33	760994.89
H-10	762272.69	760992.02
H-11	762266.45	760991.03
H-12	762260.20	760992.02
H-13	762254.56	760994.89
H-14	762250.09	760999.36
H-15	762247.22	761005.00
H-16	762246.23	761011.24
H-17	762247.22	761017.49
H-18	762250.09	761023.13
H-19	762254.56	761027.60
H-20	762260.20	761030.47
S-1	762266.45	761038.73
S-2	762274.94	761037.39
S-3	762282.60	761033.48
S-4	762288.69	761027.40
S-5	762292.59	761019.74
S-6	762293.94	761011.24
S-7	762292.59	761002.75
S-8	762288.69	760989.01
S-9	762282.60	760989.01
S-10	762274.94	760985.10
S-11	762266.45	760983.76
S-12	762257.95	760985.10
S-13	762250.29	760989.01
S-14	762244.21	760995.09
S-15	762240.30	761002.75
S-16	762238.96	761011.24
S-17	762240.30	761019.74
S-18	762244.21	761027.40
S-19	762250.29	761033.48
S-20	762257.95	761037.39
GTSB1	762298.05	761018.83
GTSB2	762253.96	760981.24
GTSB3	762242.87	761033.62



LEGEND

CURRENT PROPERTY LINE	CATCH BASIN
COMMUNICATION LINE	MANHOLE
GAS LINE	HYDRANT
SANITARY SEWER	UTILITY POLE
STORM OR FLOOD CONTROL SEWER OR FEATURE	LIGHT POLE
WATER LINE	WORKING POINT
THREADED COUPLED PIPE	PROPOSED GEOTECHNICAL SOIL BORING
VITRIFIED PIPE	WASTE PRECHARACTERIZATION BORING
OVERHEAD UTILITIES	
UNDERGROUND ELECTRIC	APPROX. CROSS-SECTION

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 10' 20'

SCALE: 1" = 10'

Preliminary Design Investigation Work Plan
Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

PDI BORING LOCATIONS

Project 1704633 | June 2018 | Fig. 2

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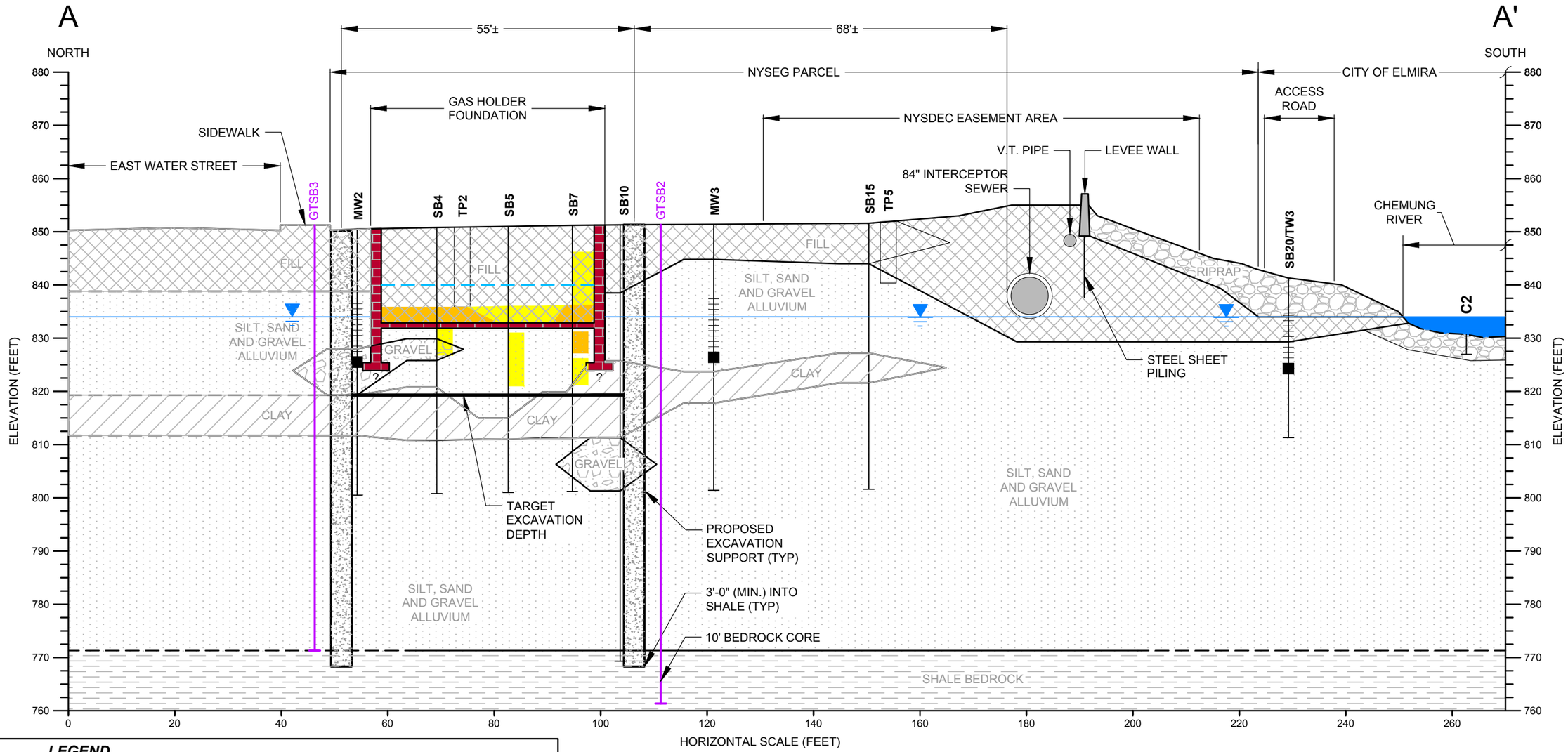

LEGEND

- WATER LEVEL IN GAS HOLDER FOUNDATION
- GROUNDWATER TABLE (JUNE 18, 2013)
- CONTACT
- INFERRED CONTACT
- GTSB3 — PROPOSED BORING (CONCEPTUAL)
- SB15 — SOIL BORING/WELL IDENTIFICATION
- SCREEN INTERVAL
- DNAPL SUMP
- BOTTOM OF BORING
- GP2 — GEOPROBE BORING / GROUNDWATER SAMPLE
- V.T. PIPE — VITRIFIED PIPE
- TEST PIT
- FILL
- SILT, SAND AND GRAVEL ALLUVIUM
- CLAY
- GRAVEL
- SHALE BEDROCK
- HYDROCARBON STAIN OR ODOR
- BLEBS, GLOBS OR SHEEN

HORIZONTAL SCALE: 1" = 20'

0 20' 40'

0 20' 40'

VERTICAL SCALE: 20'

NOTE: 1x VERTICAL EXAGGERATION

NOTES:

1. THE LOCATION OF THE BEDROCK CORE IS SHOWN FOR INFORMATIONAL PURPOSES. THE ACTUAL LOCATION WILL BE DETERMINED IN THE FIELD.
2. THE LOCATIONS OF BORINGS GTSB2 AND GTSB3 ARE CONCEPTUAL AND ARE PROJECTED ON THE CROSS SECTION.

Preliminary Design Investigation Work Plan
Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

A-A' PDI BORING LOCATIONS

Project 1704633 | June 2018 | Fig. 3

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Appendix C

NYSDEC Record of Decision

RECORD OF DECISION

NYSEG - Elmira Water St. MGP
State Superfund Project
Elmira, Chemung County
Site No. 808025
March 2017

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - RECORD OF DECISION

NYSEG - Elmira Water St. MGP
State Superfund Project
Elmira, Chemung County
Site No. 808025
March 2017

Statement of Purpose and Basis

This document presents the remedy for the NYSEG - Elmira Water St. MGP site, a Class 2 inactive hazardous waste disposal site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375, and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for the NYSEG - Elmira Water St. MGP site and the public's input to the proposed remedy presented by the Department. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Description of Selected Remedy

The elements of the selected remedy are as follows:

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows;

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and

- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. Excavation

Excavation and off-site disposal of MGP structures and contaminant source areas, including:

- the gas holder and contents;
- grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- soil containing visually impacted soils, visual coal tar or non-aqueous phase liquid;
- soil containing total PAHs exceeding 500 ppm; and
- soil that create a nuisance condition, as defined in Commissioner Policy CP-51 Section G.

Approximately 3,815 cubic yards of contaminated soil will be removed from the site. Approximate depth of the excavation will be 30'. Clean fill meeting the requirements of 6 NYCRR Part 375-6.7(d) will be brought in to replace the excavated soil or complete the backfilling of the excavation and establish the designed grades at the site.

3. Cover System

A site cover currently exists outside of the excavation area described in paragraph 2 above and will be maintained to allow for commercial use of the site. Any site redevelopment will maintain the existing site cover, which consists either of the structures such as buildings, pavement, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable soil cleanup objectives (SCOs) for commercial use. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6NYCRR part 375-6.7(d).

4. Institutional Controls

Imposition of an institutional control in the form of an environmental easement for the controlled property (including the areas covered by the flood control easements located in the southern portion of the site) which:

- requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- allows the use and development of the controlled property for commercial or industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or County DOH;
- requires compliance with the Department approved Site Management Plan.

5. Site Management Plan

A Site Management Plan is required, which includes the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in paragraph 4 above.
Engineering Controls: The soil cover system discussed in paragraph 3 above.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations on-site;

- a provision for further investigation and remediation should large scale redevelopment occur, such as maintenance, reconstruction, replacement of the flood control structure, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible. The nature and extent of contamination in areas where access was previously limited or unavailable including the area within the flood control easements which was not investigated due the setback limits stipulated in the permit issued by the Department, will be immediately and thoroughly investigated pursuant to the investigation work plan approved by the Department. Based on the investigation results and the Department determination of the need for a remedy, a Remedial Action Work Plan (RAWP) will be developed for the final remedy for the site, including removal and/or treatment of any source areas to the extent feasible. All necessary approvals for the construction within the flood control easement will be obtained. Citizen Participation Plan (CPP) activities will continue through this process. Any necessary remediation will be completed prior to, or in association with, redevelopment;

- descriptions of the provisions of the environmental easement including any land use, and/or groundwater;

- a provision for evaluation of the potential for soil vapor intrusion for any future buildings that are developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;

- provisions for the management and inspection of the identified engineering controls;

- maintaining site access controls and Department notification; and

- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

b. a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- monitoring of ground water to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department; and;
- monitoring for vapor intrusion for future buildings that are developed on the site as may be required by the Institutional and Engineering Control Plan discussed above.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

March 31, 2017

Date

Robert W. Schick, P.E., Director
Division of Environmental Remediation

RECORD OF DECISION

NYSEG - Elmira Water St. MGP
Elmira, Chemung County
Site No. 808025
March 2017

SECTION 1: SUMMARY AND PURPOSE

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), has selected a remedy for the above referenced site. The disposal of hazardous wastes at the site has resulted in threats to public health and the environment that would be addressed by the remedy. The disposal or release of hazardous wastes at this site, as more fully described in this document, has contaminated various environmental media. The remedy is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This Record of Decision (ROD) identifies the selected remedy, summarizes the other alternatives considered, and discusses the reasons for selecting the remedy.

The New York State Inactive Hazardous Waste Disposal Site Remedial Program (also known as the State Superfund Program) is an enforcement program, the mission of which is to identify and characterize suspected inactive hazardous waste disposal sites and to investigate and remediate those sites found to pose a significant threat to public health and environment.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and 6 NYCRR Part 375. This document is a summary of the information that can be found in the site-related reports and documents.

SECTION 2: CITIZEN PARTICIPATION

The Department seeks input from the community on all remedies. A public comment period was held, during which the public was encouraged to submit comment on the proposed remedy. All comments on the remedy received during the comment period were considered by the Department in selecting a remedy for the site. Site-related reports and documents were made available for review by the public at the following document repositories:

Chemung County Steele Memorial Library
Attn: Connie Ogilvie
101 E. Church St.
Elmira, NY 14901
Phone: 607-733-9175

NYSDEC, Region 8

Attn: Linda Vera
6274 E. Avon-Lima Rd.
Avon, NY 14414
Phone: 585-226-5324

A public meeting was also conducted. At the meeting, the findings of the remedial investigation (RI) and the feasibility study (FS) were presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period was held, during which verbal or written comments were accepted on the proposed remedy.

Comments on the remedy received during the comment period are summarized and addressed in the responsiveness summary section of the ROD.

Receive Site Citizen Participation Information By Email

Please note that the Department's Division of Environmental Remediation (DER) is "going paperless" relative to citizen participation information. The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county email listservs. Information will be distributed for all sites that are being investigated and cleaned up in a particular county under the State Superfund Program, Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and Resource Conservation and Recovery Act Program. We encourage the public to sign up for one or more county listservs at http://www.dec.ny.gov/chemical/61092.html

SECTION 3: SITE DESCRIPTION AND HISTORY

Location: The site is located at 510 East Water Street, City of Elmira, New York. The site is situated on south side of East Water Street near the intersection of Dewitt Street. The Chemung River is located south of the site. The area to the east and west of the site are additional parcels owned by NYSEG which are vacant and partially paved.

Site Features: The site is approximately one acre in area and is currently vacant. In the northern portion of the site, the ground surface is covered by an asphalt parking lot. The site is surrounded to the south, east, and west by grass-covered areas. The southern portion of the site is bisected by a flood control levee constructed along the bank of the Chemung River. The levee is comprised of a concrete retaining wall, 82” interceptor sewer line, soil embankment, and an access road. The embankment is flat in the area of the concrete wall, and then slopes steeply to the south down to the access road, which is approximately 20 feet north of the shoreline of the river. The levee wall appears to have been constructed in the same foot print as historic Manufactured Gas Plan (MGP) structures.

Current Zoning/Use: The site is zoned for commercial land use and is currently vacant. The Chemung County Nursing facility and Elmira Housing Authority housing complex are located across East Water Street.

Past Uses of the Site: The Elmira Water Street MGP was constructed in 1852 by the Elmira Gas

Light Company on the site. The Elmira Gas Light Company became part of New York State Electric and Gas (NYSEG) through several mergers/acquisitions. The MGP was constructed and operated as a coal carbonization plant using coal as a feedstock until 1867 when operation ceased. The facility continued to be used as gas storage facility until 1869. Some time prior to 1898, the above grade portion of the gas holder was demolished. More recently, the site was the location of the former Hartman Lincoln Mercury auto dealership and repair shop which operated until 1997. Around 1998 the car dealership structures were demolished and in 1998 several underground storage tanks and hydraulic lifts were removed during Phase II of the Environmental Site Assessment. During the Phase II investigation, the presence of coal tar in the area of the former gas holder was identified.

Site Geology and Hydrology: A layer of fill material was observed at the majority of the soil borings installed in and around the former MGP operation areas. Fill material mostly consisted of sand and gravel, mixed with varying amounts of brick fragments, clinkers, ash, and coal. Underlying the fill is a thick alluvial deposit of comprised of a heterogeneous mix of silt, sand, and gravel. Interbedded within the alluvium are lenses of lacustrine clay. Shale (bedrock) was encountered at a depth of 82 feet below grade. The depth of the water table varies between approximately 6 feet (southern portion of the site) and 16 feet below grade (northern portion of the site). The groundwater generally flows from north to south towards the Chemung River.

A site location map is attached as Figure 1.

SECTION 4: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, alternatives (or an alternative) that restrict(s) the use of the site to commercial use (which allows for industrial use) as described in Part 375-1.8(g) were/was evaluated in addition to an alternative which would allow for unrestricted use of the site.

A comparison of the results of the RI to the appropriate standards, criteria and guidance values (SCGs) for the identified land use and the unrestricted use SCGs for the site contaminants is included in the Tables for the media being evaluated in Exhibit A.

SECTION 5: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRPs for the site, documented to date, include:

NYSEG

The NYSDEC and NYSEG entered into a multi-site Consent Order on March 30, 1994. The Consent Order (#D0-0002-9309) obligates the responsible party to implement a full remedial program for 33 former MGP sites across the State, including the Elmira Water street site. After

the remedy is selected, NYSEG will be required to implement the selected remedy under an Order on Consent.

SECTION 6: SITE CONTAMINATION

6.1: Summary of the Remedial Investigation

A Remedial Investigation (RI) has been conducted. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in the RI Report.

The following general activities are conducted during an RI:

- Research of historical information,
- Geophysical survey to determine the lateral extent of wastes,
- Test pits, soil borings, and monitoring well installations,
- Sampling of waste, surface and subsurface soils, groundwater, and soil vapor,
- Sampling of surface water and sediment,
- Ecological and Human Health Exposure Assessments.

The analytical data collected on this site includes data for:

- groundwater
- soil
- sediment

6.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in Exhibit A list the applicable SCGs in the footnotes. For a full listing of all SCGs see: http://www.dec.ny.gov/regulations/61794.html

6.1.2: RI Results

The data have identified contaminants of concern. A "contaminant of concern" is a hazardous waste that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized in Exhibit A. Additionally, the RI Report contains a full discussion of the data. The contaminant(s) of concern identified at this site is/are:

dibenz[a,h]anthracene
indeno(1,2,3-CD)pyrene
benzo(a)anthracene
benzo(b)fluoranthene
benzo[k]fluoranthene
benzo(a)pyrene
chrysene
fluoranthene
fluorene
phenanthrene
pyrene
dibenzofuran
phenol
polycyclic aromatic hydrocarbons (PAHS), total
xylene (mixed)
benzene
ethylbenzene
toluene

As illustrated in Exhibit A, the contaminant(s) of concern exceed the applicable SCGs for:

- soil

6.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Record of Decision.

There were no IRMs performed at this site during the RI.

6.3: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water.

Based upon the resources and pathways identified and the toxicity of the contaminants of ecological concern at this site, a Fish and Wildlife Resources Impact Analysis (FWRIA) was deemed not necessary for OU 01.

Nature and Extent of Contamination: A Remedial Investigation (RI) was performed in 2013. During the RI soil, groundwater and sediment samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), and pesticides.

Surface Soil: Two samples collected from the grassy area north of the levee wall slightly exceeded commercial SCOs for dibenz(a,h)anthracene, with a maximum concentration of 0.72 ppm, compared to the commercial SCO of 0.56 ppm. No other constituent exceeded the commercial SCOs.

Subsurface Soil: During the remedial investigation, anthropogenic fill material was encountered in the northern and southern parts of the site, as well as off-site in the area along the Chemung River shoreline. Areas north and south of the levee wall have been extensively reworked to enable construction of the various features of the flood control structure, which is reflected in the sampling results. The on-site subsurface investigation revealed manufactured gas plant (MGP) related impacts at the base of the former gas holder foundation and in subsurface soil just below the foundation floor. Levels of total polycyclic aromatic hydrocarbons (tPAHs) in soil ranged from non-detect (ND) to 2116 ppm, with a maximum tPAH concentration observed at a soil boring installed within the gas holder footprint to a depth of 14 -15 feet below grade. Eleven soil samples were taken from the six test pits performed within the footprint of the MGP structures. Five soil samples exceeded commercial SCOs for several PAHs and tPAHs ranged from ND to 110.4 ppm. Evidence of grossly contaminated soils was observed at the bottom of the gas holder and in soils underneath it in the form of stained soil containing sheen and blebs.

No borings were performed in the southern portion of the site. However, five borings were performed off-site along the southern site boundary on the access road along the Chemung River. The subsurface investigation did not reveal any visual presence of coal tar impacts. Two soil borings found exceedances of commercial SCOs for several PAHs including, benzo(a)anthracene at 66 ppm (commercial SCO 5.6 ppm), benzo(b) fluoranthene at 63 ppm (commercial SCO of 56 ppm) and benzo(a)pyrene at 47 ppm (commercial SCO 1 ppm) at a depth of 10 to 11 feet below grade. No other off-site borings were conducted.

Groundwater: Shallow groundwater on-site exceeded the applicable standards for several metals including arsenic (maximum 37 part per billion (ppb), standard 25 ppb) which are not attributable to the site. Additionally, PAHs and benzene, toluene, ethylbenzene and xylene (BTEX) which are more indicative of MGP contamination, were detected but below applicable groundwater standards. The site is served is by municipal water.

Sediment: Sediment probing was performed in the Chemung River adjacent to and downstream of the site to the first sediment depositional area. No visual indications of MGP or petroleum impacts were noted.

Thirty four shallow (0-6 inch) sediment samples were collected from the Chemung River. Out of 34 samples, ten were collected upstream of the site and twenty four were collected adjacent to the site. In addition, six deeper sediment samples (1–4 feet below the river bottom) were collected from the Chemung River adjacent to the site.

The maximum tPAH concentration in shallow sediment samples was 6.9 ppm upstream and 9.1 ppm adjacent to the site (compared to the screening value of 4 ppm tPAH). The maximum tPAH concentration in the deeper sediments was 10.4 ppm (screening value 4.0 ppm). No deeper sediments samples were collected upstream.

The concentrations of the MGP constituents of concerns in sediment samples adjacent to the site are similar to and slightly higher than concentrations detected in upstream areas. The sediment sample results coupled with the lack of visual evidence of MGP impacts indicated that the site is not impacting the Chemung River. As such, no surface water samples were collected.

Special Resources Impacted/Threatened: There is no data to suggest that the special resources are impacted or threatened.

6.4: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

Since the site is covered by asphalt and grass, people are not expected to come into contact with site related soil contamination unless they dig below the surface. Volatile organic compounds in the soil, groundwater, or other sources may move into the soil vapor (air spaces within the soil), which in turn may move into nearby buildings and affect the indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil vapor intrusion. Because there is no on?site building, inhalation of site contaminants in indoor air due to soil vapor intrusion does not represent a concern for the site in its current condition. However, the potential exists for the inhalation of site contaminants due to soil vapor intrusion for any future on-site development. Environmental sampling indicates soil vapor intrusion is not a concern off-site.

6.5: Summary of the Remediation Objectives

The objectives for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial action objectives for this site are:

Groundwater

RAOs for Environmental Protection

- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

SECTION 7: SUMMARY OF THE SELECTED REMEDY

To be selected the remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the site, which are presented in Section 6.5. Potential remedial alternatives for the Site were identified, screened and evaluated in the feasibility study (FS) report.

A summary of the remedial alternatives that were considered for this site is presented in Exhibit B. Cost information is presented in the form of present worth, which represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved. A summary of the Remedial Alternatives Costs is included as Exhibit C.

The basis for the Department's remedy is set forth at Exhibit D.

The selected remedy is referred to as the Removal of Gas Holder Contents, Foundation and Deeper Impacted Soil remedy.

The estimated present worth cost to implement the remedy is $3,050,000. The cost to construct the remedy is estimated to be $2,844,000 and the estimated average annual cost is $12,000.

The elements of the selected remedy are as follows:

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows;

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. Excavation

Excavation and off-site disposal of MGP structures and contaminant source areas, including:

- the gas holder and contents;
- grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
- soil containing visually impacted soils, visual coal tar or non-aqueous phase liquid;
- soil containing total PAHs exceeding 500 ppm; and
- soil that create a nuisance condition, as defined in Commissioner Policy CP-51 Section G.

Approximately 3,815 cubic yards of contaminated soil will be removed from the site. Approximate depth of the excavation will be 30'. Clean fill meeting the requirements of 6 NYCRR Part 375-6.7(d) will be brought in to replace the excavated soil or complete the backfilling of the excavation and establish the designed grades at the site.

3. Cover System

A site cover currently exists outside of the excavation area described in paragraph 2 above and will be maintained to allow for commercial use of the site. Any site redevelopment will maintain the existing site cover, which consists either of the structures such as buildings, pavement, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable soil cleanup objectives (SCOs) for commercial use. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6NYCRR part 375-6.7(d).

4. Institutional Controls

Imposition of an institutional control in the form of an environmental easement for the controlled property (including the areas covered by the flood control easements located in the southern portion of the site) which:

- requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- allows the use and development of the controlled property for commercial or industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or County DOH;
- requires compliance with the Department approved Site Management Plan.

5. Site Management Plan

A Site Management Plan is required, which includes the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in paragraph 4 above.
Engineering Controls: The soil cover system discussed in paragraph 3 above.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations on-site;

- a provision for further investigation and remediation should large scale redevelopment occur, such as maintenance, reconstruction, replacement of the flood control structure, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible. The nature and extent of contamination in areas where access was previously limited or unavailable including the area within the flood control easements which was not investigated due the setback limits stipulated in the permit issued by the Department, will be immediately and thoroughly investigated pursuant to the investigation work plan approved by the Department. Based on the investigation results and the Department determination of the need for a remedy, a Remedial Action Work Plan (RAWP) will be developed for the final remedy for the site, including removal and/or treatment of any source areas to the extent feasible. All necessary approvals for the construction within the flood control easement will be obtained. Citizen Participation Plan (CPP) activities will continue through this process. Any necessary remediation will be completed prior to, or in association with, redevelopment;

- descriptions of the provisions of the environmental easement including any land use, and/or groundwater;

- a provision for evaluation of the potential for soil vapor intrusion for any future buildings that are developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;

- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

b. a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- monitoring of ground water to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department; and;
- monitoring for vapor intrusion for future buildings that are developed on the site as may be required by the Institutional and Engineering Control Plan discussed above.

Exhibit A

Nature and Extent of Contamination

This section describes the findings of the Remedial Investigation for all environmental media that were evaluated. As described in Section 6.1, samples were collected from various environmental media to characterize the nature and extent of contamination.

For each medium for which contamination was identified, a table summarizes the findings of the investigation. The tables present the range of contamination found at the site in the media and compares the data with the applicable SCGs for the site. The contaminants are arranged into three categories; volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and inorganics (metals and cyanide). For comparison purposes, the SCGs are provided for each medium that allows for unrestricted use. For soil, if applicable, the Restricted Use SCGs identified in Section 4 and Section 6.1.1 are also presented.

Waste/Source Areas

As described in the RI report, waste/source materials were identified at the site and is impacting subsurface soil.

Wastes are defined in 6 NYCRR Part 375-1.2(aw) and include solid, industrial and/or hazardous wastes. Source areas are defined in 6 NYCRR Part 375(au). Source areas are areas of concern at a site were substantial quantities of contaminants are found which can migrate and release significant levels of contaminants to another environmental medium. Waste was identified at the site within the former subsurface gas holder located in the northeast corner of site. The diameter of the gas holder at the foundation is 40 feet and depth of the gas holder floor is 17.5 feet below grade. The gas holder is filled with fill material and hydrocarbon odors, staining, blebs and sheen were observed in thefill material at the bottom of the holder foundation. Soil below the gas holder foundation was observed to have hydrocarbon odor and sheens. The soil sample taken at the depth of 16.5 -17 feet below grade within gas holder footprint exceeded the commercial Soil Cleanup Objectives (SCOs) for several polycyclic aromatic hydrocarbons (PAHs), with a total PAHs concentration of 3,372 parts per million (ppm).

The waste/source areas identified will be addressed in the remedy selection process.

Groundwater

Groundwater samples were collected from the thirteen (13) overburden monitoring wells during the remedial investigation and were analyzed for VOCs, SVOCs, inorganics, pesticides, herbicides polychlorinated biphenyls (PCBs) and cyanide. The samples were collected to assess groundwater conditions on and off the site. The results indicate that contaminants in shallow groundwater on-site exceeded the Ambient Water Quality Standard (AWQS) for arsenic (maximum 37 parts per billion (ppb), standard 25 ppb). The arsenic detection was limited to single well located on the access road and was only slightly above the AWQS. PAHs and benzene, toluene, ethylbenzene and xylenes (BTEX) compounds, which are more indicative of MGP contamination, were not detected. No PAHs, except for phenanthrene were detected in any of the groundwater samples. Phenanthrene was detected in one sample at 0.52 ppb which was well below the AWQS of 50 ppb. A summary of groundwater exceedances in samples collected during the 2013 remedial investigation is presented in **Figure 5**. Table 1 summarizes the exceedances of groundwater SCGs found during the remedial investigation.

Table 1 – Groundwater

Detected Constituents	Concentration Range Detected (ppb)[a]	Standard or Guidance Value[b] (ppb)	Frequency Exceeding Standard or Guidance Value
Inorganics			
Arsenic	7.2 - 37	25	1 of 13
Barium	82 - 3900	1000	3 of 13
Iron	99 - 3000	300	10 of 13
Manganese	74 - 2000	300	7 of 13
Sodium	76900 - 194000	20000	13 of 13

a - ppb: parts per billion, which is equivalent to micrograms per liter, ug/L, in water.
b - SCG: Standard Criteria or Guidance - Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).

The iron, manganese and sodium found in shallow groundwater were also noted in up gradient wells and are attributable to the site background conditions. The barium, which was detected above AWQS standards is not deemed constituent of concern for this site. The exceedance of arsenic AWQS is deemed insignificant. Additionally, the site and surrounding area is served by municipal water supply whose source is located upstream of the site. Therefore, no remedial alternatives need to be evaluated for groundwater.

Surface Soil

Twelve surface soil samples were collected from the site during the RI. Surface soil samples were collected from a depth of 0-2 inches to assess direct human exposure. The results indicate that surface soils at the site exceed the unrestricted SCG for PAHs and metals.

Out of twelve samples, four samples (SS-1 through SS-4) were taken from the grassy area located north of the levee wall. Out those four samples, two samples exceeded the SCGs for commercial use for dibenz(a,h)anthracene.

The remaining eight samples taken south of the levee wall slightly exceeded the unrestricted SCO for indeno(1,2,3-cd)pyrene but were less than the commercial SCOs. Out of these eight samples, three samples were taken off-site south of the levee wall from the access road adjacent to the river. The maximum total PAH concentrations in these three samples was 4.38 ppm. A summary of surface soil exceedances in samples collected during the 2013 remedial investigation is presented in Figure 3. Table 2 summarizes the exceedances of surface soil SCGs found during the remedial investigation.

Table 2 - Surface Soil

Detected Constituents	Concentration Range Detected (ppm)[a]	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG	Commercial SCG[c] (ppm)	Frequency Exceeding Commercial SCG
SVOCs					

Benzo(b)fluoranthene	0.63 - 1.1	1	1 of 12	5.6	0 of 12
Dibenz(a,h)anthracene	0.7 - 0.72	0.33	2 of 12	0.56	2 of 12
Indeno(1,2,3-cd)pyrene	0.69 - 0.83	0.5	12 of 12	5.6	0 of 12
Inorganics					
Lead	22.3 - 75	63	1 of 12	1000	0 of 12
Zinc	72.3 - 127	109	1 of 12	10000	0 of 12

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
b - SCG: Part 375-6.8(a), Unrestricted Soil Cleanup Objectives (SCOs).
c - SCG: Part 375-6.8(b), Restricted Use Soil Cleanup Objectives (SCOs) for the Protection of Public Health for commercial Use, unless otherwise noted.

Based on the findings of the Remedial Investigation, exceedance of dibenz(a,h)anthracene in two surface soil samples is deemed insignificant and not related to MGP operations conducted on the site in the past.

Total of five surface soil samples were collected from the sloped embankment and access road located south of the levee wall. There were no exceedances of commercial SCOs. Off-site to the south of the site, three surface soil samples were taken from the grassy area adjacent to the Chemung River. Only indeno(1,2,3-cd)pyrene was noted above the unrestricted SCO in these three samples with a maximum concentration of 0.76 ppm which is slightly above the unrestricted SCO of 0.5 ppm. No other constituent exceed the unrestricted SCO. These exceedances are not related to former MGP operations but rather indicative of the adjacent urban environment, therefore no remedial alternatives are evaluated to address these exceedances.

Therefore, no remedial alternatives need to be evaluated for surface soil.

Subsurface Soil

Twenty two soil borings were performed during the RI to determine the nature and extent of MGP contamination in subsurface. The soil samples taken from underneath the gas holder were found to be impacted with MGP wastes. Visible evidence of MGP related impacts were limited to hydrocarbon staining, sheens and blebs in soil/fill material at the floor of the gas holder and in soils immediately underneath the floor of the holder. Exceedances of unrestricted SCOs for several PAHs were observed within the gas holder footprint between the depths of 14 to 25 feet below grade. The reported maximum total PAH concentration within the holder footprint is 3,372 ppm at a depth of 16.5to 17 feet below grade.

Six test pits were performed in the area of the former MGP structures. Soil samples taken from the test pit adjacent to the gas holder exceeded unrestricted SCOs for several individual PAHs, however the maximum total PAH concentration was 90.3 ppm at the depth of 13 feet below grade.

Samples taken from the test pit within the footprint of MGP building, exceeded the unrestricted SCOs for several PAHs at a depth of 3to 7 feet below grade, with a maximum total PAH concentration of 110.4 ppm.

Off site Subsurface soil:

Off-site, the subsurface soil samples taken from the borings located on south side of the site on the access road adjacent to the river exceeded unrestricted SCOs for several PAHs at a depth of 10 to12 feet below grade. The maximum total PAH concentration is 1,062 ppm at a depth of 10 to 11 feet below grade. At this location there

was no visible evidence of MGP impacts, and groundwater in this area is not impacted by MGP constituents. The subsurface contamination is likely from fill material placed during the construction of the flood control structure. Given the depth at which this contamination exists, the proximity to the flood control levee and the lack of potential exposure, no remedial alternatives are evaluated to address these exceedances.

A summary of subsurface soil exceedances in samples collected during the 2013 remedial investigation is presented in **Figure 4**. Table 3 summarizes the exceedances of subsurface soil SCGs found during the remedial investigation

Table 3 - Subsurface Soil

Detected Constituents	Concentration Range Detected[a] (ppm)	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG	Commercial SCG[c] (ppm)	Frequency Exceeding Commercial SCG
VOCs					
Acetone	0.005 - 0.16	0.05	2 of 78	500	0 of 78
Benzene	0.0026 - 10	0.06	4 of 78	44	0 of 78
Ethylbenzene	0.00044 - 15	1	1 of 78	390	0 of 78
Toluene	0.00043 - 33	0.7	2 of 78	500	0 of 78
Total Xylene	0.0019 - 93	0.26	3 of 78	500	0 of 78
SVOCs					
Acenaphthene	0.0039 - 50	20	3 of 78	500	0 of 78
Acenaphthylene	0.005 - 110	100	1 of 78	500	0 of 78
Anthracene	0.0087 - 160	100	2 of 78	500	0 of 78
Benzo(a)anthracene	0.03 - 220	1	16 of 78	5.6	11 of 78
Benzo(b)fluoranthene	0.0054 - 170	1	16 of 78	5.6	11 of 78
Benzo(k)fluoranthene	0.002 - 91	0.8	14 of 78	56	2 of 78
Benzo(a)pyrene	0.0051 - 150	1	15 of 78	1	15 of 78
Chrysene	0.0064 - 180	1	16 of 78	56	4 of 78
Dibenz(a,h)anthracene	0.15 - 42	0.33	7 of 78	0.56	7 of 78
Dibenzofuran	0.0052 - 130	7	8 of 78	350	0 of 78
Fluoranthene	0.0054 - 440	100	5 of 78	500	0 of 78
Fluorene	0.011 - 180	30	4 of 78	500	0 of 78
Indeno (1,2,3-cd)pyrene	0.0063 - 53	0.5	14 of 78	5.6	8 of 78
2-Methylphenol (o-Cresol)	0.0087 - 19	0.33	2 of 78	500	0 of 78
4-Methylphenol (p-Cresol)	0.018 - 59	0.33	6 of 78	500	0 of 78
Naphthalene	0.0097 - 490	12	2 of 78	500	0 of 78
Phenanthrene	0.0038 - 620	100	4 of 78	500	1 of 78
Phenol	0.45 - 28	0.33	4 of 78	500	0 of 78
Pyrene	0.0022 - 360	100	4 of 78	500	0 of 78
Pesticides					
4,4'-DDE (p,p'-DDE)	0.015 - 0.015	0.0033	1 of 11	62	0 of 11
Inorganics					

Detected Constituents	Concentration Range Detected[a] (ppm)	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG	Commercial SCG[c] (ppm)	Frequency Exceeding Commercial SCG
Arsenic	1.2 - 16.3	13	1 of 78	16	1 of 78
Copper	9.8 - 337	50	3 of 78	270	1 of 78
Lead	4.4 - 2940	63	14 of 78	1000	2 of 78
Manganese	159 - 2000	1600	1 of 78	10000	0 of 78
Mercury	0.0085 - 3.5	0.18	9 of 78	2.8	1 of 78
Nickel	6.4 - 47.5	30	7 of 78	310	0 of 78
Zinc	21 - 1080	109	7 of 78	10000	0 of 78

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
b - SCG: Part 375-6.8(a), Unrestricted Soil Cleanup Objectives.
c - SCG: Part 375-6.8(b), Restricted Use Soil Cleanup Objectives for the Protection of Public Health for commercial Use, unless otherwise noted.

The former gas holder area of concern is be addressed in the remedy selection process.

Sediments

Sediment probing was performed along 22 transects established perpendicular to the Chemung river shoreline adjacent to the site to investigate possible visible evidence of the MGP related impacts. In addition, probing was performed within first depositional area located downstream of the site. No evidence of MGP or petroleum contamination was noted during the sediment probing. Sediment samples were then collected to assess the potential for MGP impacts to the river. Thirty four shallow (0-6 inch) sediment samples were collected from the Chemung River. Out of the 34 samples, 10 samples were collected upstream of the site and 24 were collected adjacent to the site. In addition, six deeper sediment samples (1–4 feet below sediment surface) were collected from the Chemung River adjacent to the site. No deeper sediment samples were collected upstream or downstream of the site.

Except for phenanthrene, lead, and silver there were no exceedances of the Department's Technical Guidance for Screening Contaminated Sediments (the SCG for sediments). The concentration of phenanthrene was noted at 1.6 ppm (SCG 1.5 ppm). Phenanthrene was detected at maximum concentration of 1.1 ppm in an upstream sediment sample. The maximum concentration of lead was noted at 389 ppm (SCG 218 ppm,). Lead was detected at maximum concentration of 300 ppm in upstream sediment sample. The concentration of silver was noted at 19.6 ppm (SCG 3.7 ppm).

Total PAH concentrations in shallow sediments ranged from 0.16 ppm to 9.1 ppm, compared to 6.9 ppm reported for upstream sediment samples. Total PAH concentrations in deeper sediments ranges from 0.17 ppm to 10.4 ppm.

A summary of sediment exceedances in samples collected during the 2013 remedial investigation is presented in **Figure 6**. Table 4 below summarizes the exceedances of sediment SCGs found during the remedial investigation.

Table 4 – Sediment

Detected Constituents	Concentration Range Detected (ppm)[a]	NYSDEC ER-L[b] (ppm)	Frequency Exceeding NYSDEC ER-L	NYSDEC ER-M[b] (ppm)	Frequency Exceeding NYSDEC ER-M
SVOCs					
Acenaphthene	0.038 - 0.17	0.016	6 of 40	0.5	0 of 40
Acenaphthylene	0.047 - 0.17	0.044	6 of 40	0.64	0 of 40
Anthracene	0.044 - 0.78	0.0853	13 of 40	1.1	0 of 40
Benzo(a)anthracene	0.041 - 0.96	0.261	11 of 40	1.6	0 of 40
Benzo(a)pyrene	0.032 - 0.6	0.43	3 of 40	1.6	0 of 40
Chrysene	0.05 - 0.83	0.384	7 of 40	2.8	0 of 40
Dibenz(a,h)anthracene	0.051 - 0.091	0.0634	3 of 40	0.26	0 of 40
Fluoranthene	0.062 - 2	0.6	9 of 40	5.1	0 of 40
Fluorene	0.049 - 0.22	0.019	11 of 40	0.54	0 of 40
Naphthalene	0.055 - 0.084	0.16	0 of 40	2.1	0 of 40
Phenanthrene	0.047 - 1.6	0.24	13 of 40	1.5	1 of 40
Pyrene	0.053 - 1.7	0.665	6 of 40	2.6	0 of 40
Pesticides					
4,4'-DDE (p,p'-DDE)	0.0064 - 0.0069	0.0022	2 of 2	0.027	0 of 2
Inorganics					
Arsenic	2.9 - 30.5	8.2	3 of 32	70	0 of 32
Copper	5.9 - 247	34	8 of 32	270	0 of 32
Lead	7.1 - 389	47	14 of 32	218	2 of 32
Mercury	0.0099 - 0.2	0.15	1 of 32	0.71	0 of 32
Nickel	8.9 - 23.6	21	1 of 32	52	0 of 32
Silver	0.26 - 19.6	1	1 of 32	3.7	1 of 32

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in sediment;

b - SCG: The Department's Technical Guidance for Screening Contaminated Sediments.
ER-M: Effect Range Moderate, ER-L: Effect Range Low

There was no visible evidence of MGP impacts to sediments in the river adjacent and downstream of the site. Sediments samples results were consistent with or only slightly higher than upstream sediment samples results and are consistent with levels anticipated in urban environments. As such, no site-related sediment contamination of concern was identified during the RI.

Therefore, no remedial alternatives need to be evaluated for sediment.

Surface Water

The groundwater investigation did not reveal any former MGP related contamination or its ongoing migration to the Chemung River located south of the site. Above conclusion was reaffirmed by evaluating the results of the past surface water investigation conducted in the Chemung River. As a result, surface water was not sampled during the remedial investigation.

Exhibit B

Description of Remedial Alternatives

The following alternatives were considered based on the remedial action objectives (see Section 6.5) to address the contaminated media identified at the site as described in Exhibit A.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative leaves the site in its present condition and does not provide any additional protection to public health and the environment.

Alternative 2: Cover with Institutional Control

This alternative will include covering MGP impacted soils/materials with the existing asphalt pavement and placement of 1 foot soil cover meeting the SCOs specified in 6 NYCRR Pat 375-6.7(d) for commercial use. Intuitional controls in the form of Environmental Easement restricting land use, prohibiting site ground water use and implementation of Department approved Site Management Plan (SMP) will be required. The SMP will contain an excavation plan to manage soils underneath the cover should they be uncovered. SMP will also contain monitoring plan to assess the effectiveness of the remedy, and periodic inspection of the cover. Periodic certification of the institutional and engineering controls (IC/ECs) will be required.

Present Worth: ..... *$ 400,000*
Capital Cost: ..... *$ 99,000*
Annual Costs: ..... *$ 18,000*

Alternative 3: In-Situ Solidification (ISS) with Institutional Controls

This alternative will include in-situ solidification (ISS) of contaminated soils within and below the gas holder foundation to remediate soils exceeding 500 ppm of total PAHs. This alternate will require excavation of soil in ISS footprint (0-5 feet), then auger ISS soil within and below holder foundation (5-30 feet) and repair asphalt cover. ISS is a process that binds the soil particles in place creating a low permeability mass. The contaminated soil will be mixed in place together with solidifying agents (typically Portland cement) or other binding agents using an excavator or augers. The soil and binding agents are mixed to produce a solidified mass resulting in a low permeability monolith. The solidified mass would then be covered with a cover system to prevent direct exposure to the solidified mass and protect it from freeze/thaw cycles. The resulting solid matrix reduces or eliminates mobility of contamination and reduces or eliminates the matrix as a source of groundwater contamination. Where a soil cover is required over the ISS treatment area, it would consist of a minimum of four feet of soil meeting the SCOs for commercial use. For areas where solidified material underlies the cover, the solidified material itself would serve as the demarcation layer due to the nature of the material. Institutional controls, including periodic certification of the IC/ECs as described in Alternative 2 will be required.

Present Worth: ..... *$ 1,420,000*
Capital Cost: ..... *$ 1,217,000*
Annual Costs: ..... *$ 12,000*

Alternative 4: Source Material Excavation with Site Cover and Institutional Controls

This alternative consists of excavation and off-site disposal of the subsurface gas holder structure and its contents to remediate source material containing visible coal tar impacts and soil/material exceeding 500 ppm of total PAHs. Anticipated depth of excavation is 30' which will require excavation support. Excavation will be backfilled and cover will be installed with the demarcation layer to allow for the commercial use of the property. Institutional controls including periodic certification of the IC/ECs, as described in Alternative 2, will be required.

Present Worth: ..... *$ 3,050,000*
Capital Cost: ..... *$ 2,844,000*
Annual Costs: ..... *$ 12,000*

Alternative 5: Soil Removal to Unrestricted Use SCOs

This alternative includes excavation and off-site disposal of all soil/material that exceeds the unrestricted SCO. The remedy includes placement of backfill meeting the unrestricted SCOs. This alternate includes removal and reconstruction of the flood control features present at the site to remove soils exceeding unrestricted SCOs.

Capital Cost: ..... *$ 21,577,000*

Exhibit C

Remedial Alternative Costs

Remedial Alternative	Capital Cost (2015 $)	Annual Costs ($)	Total Present Worth (Rounded $)
Alternative 1 - No Action	$0	$0	$0
Alternative 2 – Cover with Institutional Control	$99,000	$18,000	$400,000
Alternative 3 - In-Situ Solidification (ISS) with Institutional Controls	$1,217,000	$12,000	$1,420,000
Alternative 4 - Source Material Excavation with Site Cover and Institutional Controls	$2,844,000	$12,000	$3,050,000
Alternative 5 - Soil Removal to Unrestricted Use SCOs	$21,577,000	$0	$21,577,000

Exhibit D

SUMMARY OF THE SELECTED REMEDY

The Department is selecting Alternative 4, **Excavation of Source Material, Site Cover and Institutional Controls** as the remedy for this site. Alternative 4 would achieve the remediation goals for the site by removal of the gas holder foundation contents, foundation and deeper impacted soils, removal and imposition institutional controls and engineering controls (IC/ECs) to restricting the use of the site to commercial use and prohibit use of site ground water. The elements of this remedy are described in Section 7. The selected remedy is depicted in Figure 7.

Basis for Selection

The selected remedy is based on the results of the RI and the evaluation of alternatives. The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment. Alternative 1 (No Action) does not protect public health and the environment and therefore, does not meet the threshold criteria. Alternative 1 will not be evaluated further. The four remaining alternatives include common elements that will result in overall protection of human health and the environment. Alternative 5 (removal to unrestricted Soil Cleanup Objectives (SCOs)) would return the site to pre-release conditions and remove all contamination from the site. Alternative 2 (site cover), Alternative 3 (In-situ Soil Stabilization (ISS) of source material)) and Alternative 4 (excavation of source material) all meet the criterion as they include placement of a soil cover and measures to prevent migration of contamination to the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

All four of the remaining alternatives include common elements that will result in compliance with the SCGs. Alternative 5 meets all of the site specific SCGs as it returns the site to pre-release conditions. Alternatives 2 through 4 meet the criterion for subsurface soils, as they all include establishment of a soil cover. Alternatives 3 and 4 would address source materials through treatment and removal respectively, and would therefore continue to meeting applicable groundwater SCGs.

The next six "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of

these controls.

Alternative 5 would be the most effective and permanent, because it would involve the removal of all contamination to unrestricted levels but would provide little additional benefit compared to the high cost. Alternative 4 (excavation of the gas holder) is the next most effective and permanent option due to the removal of source materials by excavation, and would eliminate the source of potential future groundwater impacts. Under Alternative 3 the contamination would be solidified by ISS to eliminate the potential for migration, contamination remaining in the subsurface soil would require long-term management. Alternative 2 (site cover) would be the least effective and impermanent as higher levels of contamination would require long-term management.

4. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

Alternative 5 would result in the most reduction in toxicity, mobility and volume, because it would involve the complete removal of all impacts above the unrestricted SCOs but would provide little additional TMV benefit compared to the high cost. Alternative 4 would result in slightly less reduction in volume because soil containing lower levels of contamination would remain at the site. Alternative 3 would result in a reduction in mobility to a similar degree because of the soil solidification. Alternative 2 would not involve any reduction of toxicity, mobility, or volume.

5. Short-term Impacts and Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

Alternative 2 would have the fewest short-term impacts as there are no intrusive activities, only the installation of a cover system. Alternatives 3 and 4 will have short-term impacts resulting from increased on-site construction activities, either the ISS or the excavation. However, there are methods available to control these impacts reliably and effectively. Alternative 5 would involve significant short term impacts due to the removal and restoration of the flood control structure to enable excavation of the impacted soils underneath. Alternative 5 would also require the greatest number of truck trips as compared to the other alternatives.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Alternative 2 would be most implementable, because it involves the least intrusive site work, with little uncertainty with regard to the construction methods to be utilized. Alternative 4 would rank as next most implementable, because soil removal will use conventional technologies which are widely available. Alternative 3 would be slightly less implementable compared to Alternative 4 because ISS involves specialized equipment and contractors. Alternative 5 would be the most technically and administratively difficult to implement due to the permit requirements to remove and replace a flood control structures within a flood control easement. It would also necessitate managing large volumes of excavated soils and excavation below the water table.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for

each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

Alternative 2 has the lowest capital cost ($99,000) but a relatively high present value of annual cost ($305,000) but this remedy does not address the MGP-impacted material at the site. Alternative 3 has a lower present worth cost ($1,420,000) then the other two active remedies (4 and 5) but alternative 3 leave behind a solidified material that will require continued monitoring and maintenance. Alternative 5 is the least cost effective as its high cost of $21,600,000 and would not have a commensurably increase in the value of added public health or environmental protection. Alternative 4 is the most cost-effective option as it provides for the current and widest-range of future land use, and addresses potential exposure issues for surface soil and subsurface soil, and is protective of groundwater. It has a relatively moderate Present Worth cost of approximately $3,100,000.

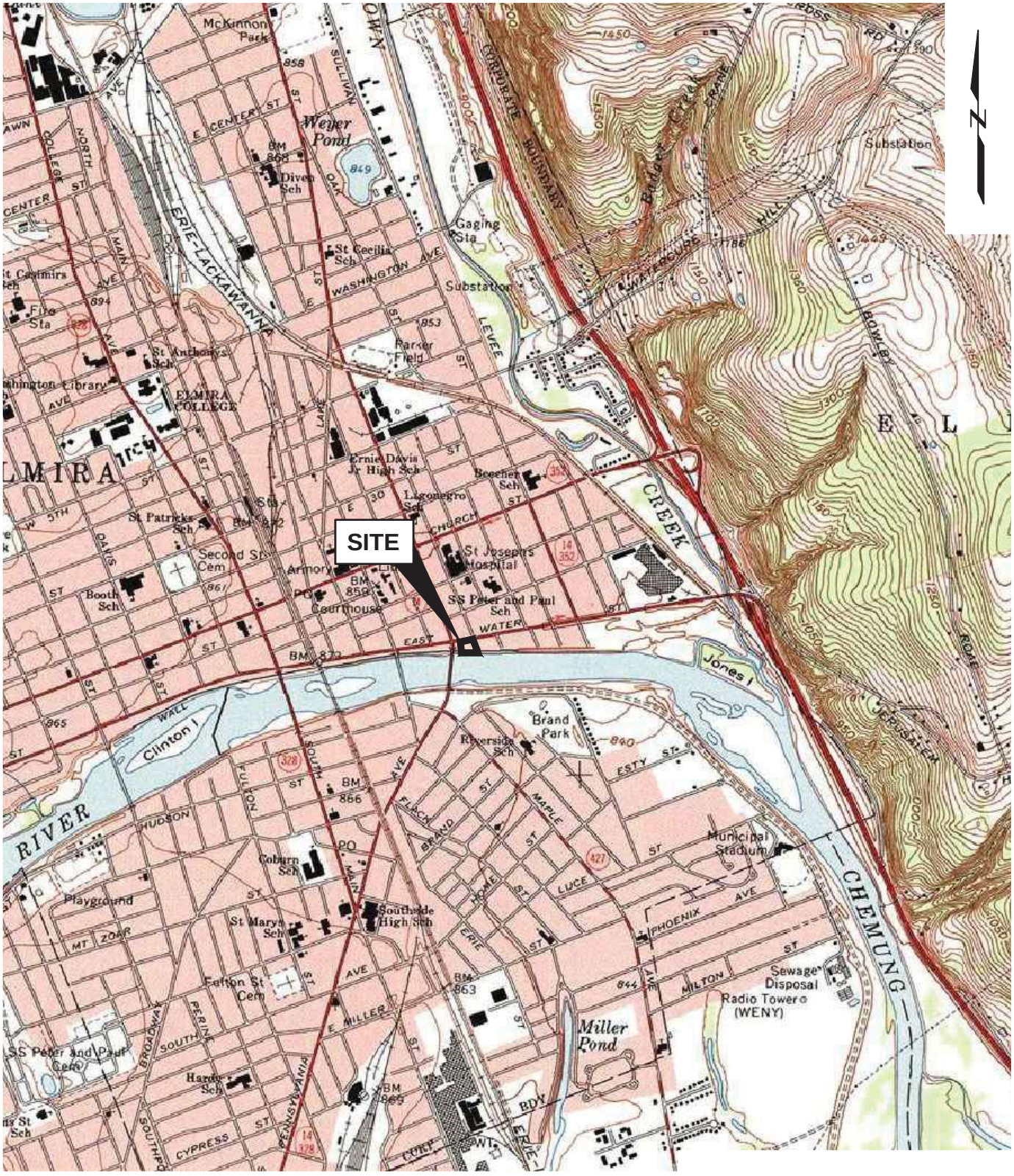
8. Land Use. When cleanup to pre-disposal conditions is determined to be infeasible, the Department may consider the current, intended, and reasonable anticipated future land use of the site and its surroundings in the selection of the soil remedy.

The anticipated use of the site is commercial land use and flood control. Alternative 4 would allow for the significant removal of contamination, would allow for commercial land use, which includes certain recreational uses. Although Alternative 5 would completely remove contamination and would allow for commercial and higher land uses without controls, such higher uses are unlikely in the vicinity of a flood control structure. Alternatives 3 and 2 are less desirable since contamination would remain at the site. However, with the proper site management commercial use of the site is feasible.

The final criterion, Community Acceptance, is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

9. Community Acceptance. Concerns of the community regarding the investigation, the evaluation of alternatives, and the PRAP were evaluated. A responsiveness summary has been prepared that describes public comments received and the manner in which the Department addressed the concerns raised.

Therefore, Alternative 4 (figure 7) has been selected because, as described above, it satisfies the threshold criteria and provides the best balance of the balancing criterion.



SOURCE:

U.S.G.S. TOPOGRAPHIC MAP ELMIRA, NY 1969, CREATED WITH TOPO!
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Elmira Water Street MGP Site Elmira, New York	GEI	SITE LOCATION
NYSEG Binghamton, New York		Fig. 1

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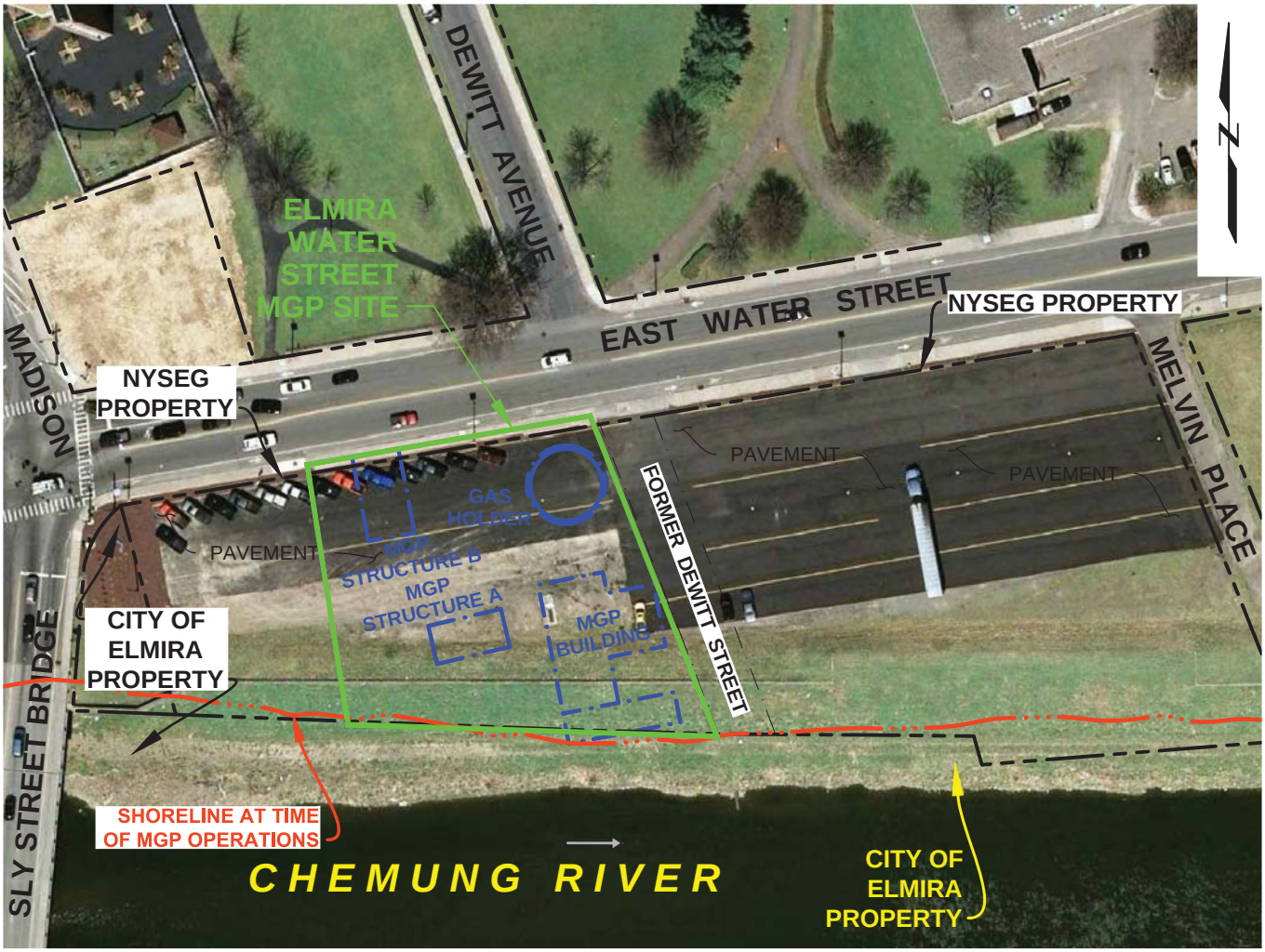

0 100' 200'

SCALE: 1" = 100'

SOURCES

1. AERIAL PHOTOGRAPH FROM GOOGLE-IMAGERY COPYRIGHT 2011 GEOEYE, NEW YORK GIS.
2. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.

LEGEND:

- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- HISTORICAL MGP FEATURE
- FORMER ROADWAY

Elmira Water Street MGP Site Elmira, New York	GEI Consultants	SITE LOCATION
NYSEG Binghamton, New York		Fig. 2

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Sample Designation	SS-1
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3.1
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-2
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	Yes
TPAH17 mg/kg	5.4
Ex. Metals UR SCOs	Yes
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-3
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	2.5
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-4
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	Yes
TPAH17 mg/kg	9.1
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-5
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3.3
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-6
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3.3
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-7
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3.7
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-8
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3.9
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-9
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3.4
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-10
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	2.9
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-11
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	3
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

Sample Designation	SS-12
Ex. SVOC UR SCOs	Yes
Ex. SVOC CM SCOs	No
TPAH17 mg/kg	4.4
Ex. Metals UR SCOs	No
Ex. Metals CM SCOs	No
Ex. TCN UR SCOs	No
Ex. TCN CM SCOs	No

MADISON

EAST WATER STREET

NYSEG

ELMIRA WATER STREET MGP SITE

NYSEG PROPERTY

PAVEMENT

MGP STRUCTURE B

GAS HOLDER

MGP STRUCTURE A

MGP BUILDING

FORMER DEWITT STREET

MELVIN PLACE

CITY OF ELMIRA PROPERTY

SLY STREET BRIDGE

SHORELINE AT TIME OF MGP OPERATIONS

SS1 SS2 SS3 SS4 SS5 SS6 SS7 SS8 SS9 SS10 SS11 SS12

CHEMUNG RIVER

CITY OF ELMIRA PROPERTY

N

LEGEND:

- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- HISTORICAL MGP FEATURE
- FORMER ROADWAY
- ▲ SS12 — SURFACE SOIL SAMPLE
- SCOs — SOIL CLEANUP OBJECTIVES
- PAH — POLYCYCLIC AROMATIC HYDROCARBONS
- CN — CYANIDE
- mg/kg — MILLIGRAMS PER KILOGRAM
- SVOC — SEMIVOLATILE ORGANIC

SOURCES

1. AERIAL PHOTOGRAPH FROM GOOGLE-IMAGERY COPYRIGHT 2011 GEOEYE, NEW YORK GIS.
2. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.

0 50' 100'

SCALE: 1" = 50'

Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

SURFACE SOIL (0-2") LOCATIONS AND RESULTS (mg/kg)

APRIL 2013

Fig. 3

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Location	SB-6 (14-15)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	ND
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	TP-2 Bottom (13')	TP-2 E. Wall Side (6')
Ex. UR - VOC	No	No
Ex. CM - VOC	No	No
TBTEX	ND	ND
Ex. UR - SVOC	Yes	Yes
Ex. CM - SVOC	Yes	Yes
TPAH17	90.3	82.1
Ex. UR - Metals	No	Yes
Ex. CM - Metals	No	Yes
Ex. UR - TCN	No	No
Ex. CM - TCN	No	No

Location	TP-1 Outside E. Well (12'-13')
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	0.05
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB-7 (14-15)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	0.0024
Ex. UR - SVOC	Yes
Ex. CM - SVOC	Yes
TPAH17	2,118.20
Ex. UR - Metals	Yes
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB-10 (9)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	ND
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	TP-4 Bottom (8')	TP-4 Side (3')
Ex. UR - VOC	No	No
Ex. CM - VOC	No	No
TBTEX	ND	ND
Ex. UR - SVOC	No	No
Ex. CM - SVOC	No	No
TPAH17	ND	0.26
Ex. UR - Metals	No	No
Ex. CM - Metals	No	No
Ex. UR - TCN	No	No
Ex. CM - TCN	No	No

Location	MW-1 (14-15)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	ND
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	TP-6 Bottom (6')	TP-6 E.Side (3')
Ex. UR - VOC	No	No
Ex. CM - VOC	No	No
TBTEX	ND	ND
Ex. UR - SVOC	No	No
Ex. CM - SVOC	No	No
TPAH17	2.74	1.08
Ex. UR - Metals	No	Yes
Ex. CM - Metals	No	No
Ex. UR - TCN	No	No
Ex. CM - TCN	No	No

Location	MW-5 (14-15)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	0.05
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB-12 (14-15)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	ND
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	TP-5 E.Bottom (7')	TP-5 E.Side (3')	TP-5 W.Bottom (7')	TP-5 W.Side (3')
Ex. UR - VOC	No	No	No	No
Ex. CM - VOC	No	No	No	No
TBTEX	ND	ND	ND	ND
Ex. UR - SVOC	Yes	Yes	No	Yes
Ex. CM - SVOC	Yes	Yes	No	Yes
TPAH17	110.4	18.9	ND	15.3
Ex. UR - Metals	Yes	No	Yes	Yes
Ex. CM - Metals	No	No	No	No
Ex. UR - TCN	No	No	No	No
Ex. CM - TCN	No	No	No	No

Location	SB18/TW-1 (12-13)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	0.00044
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	0.008
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

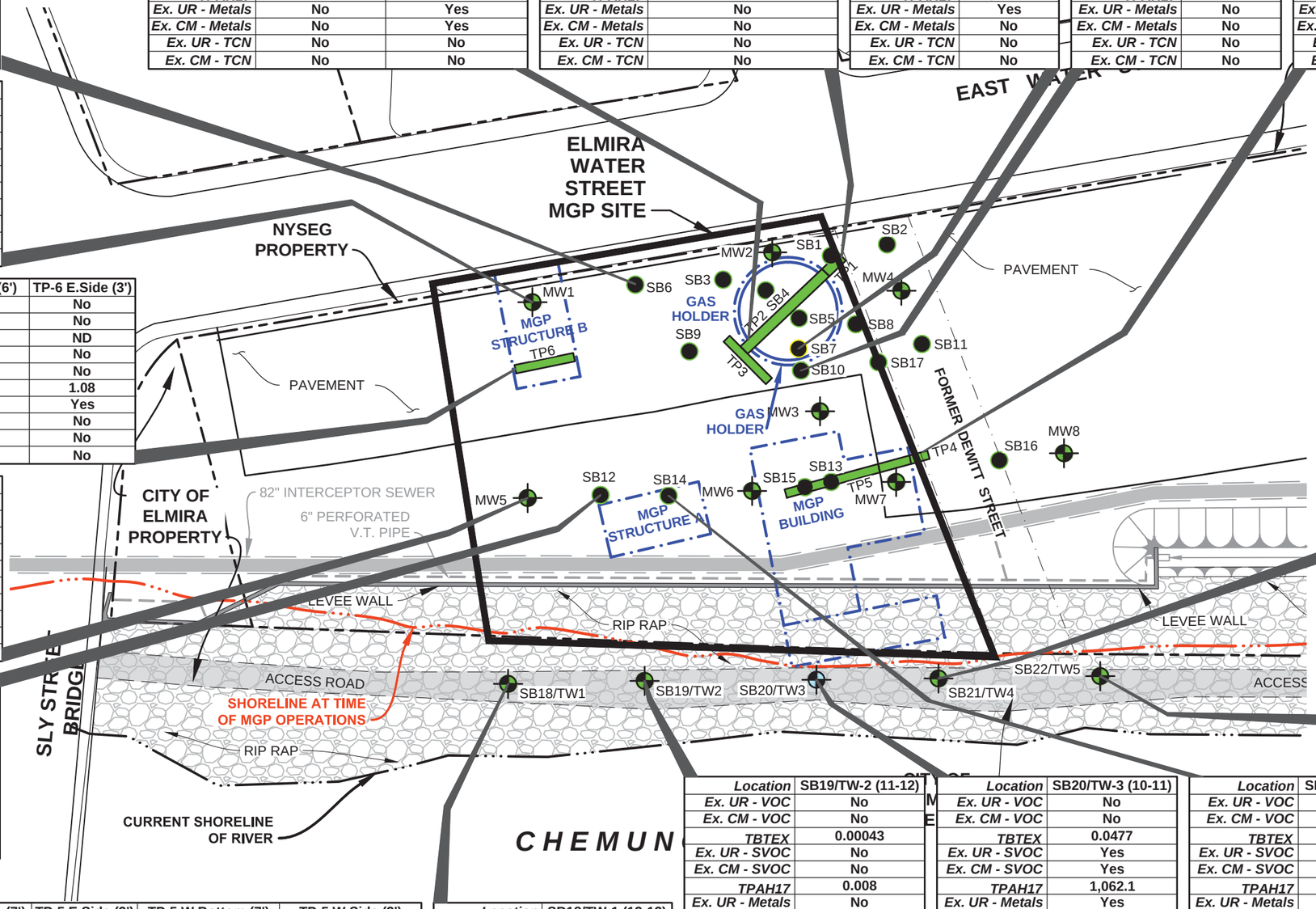
Location	SB19/TW-2 (11-12)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	0.00043
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	0.008
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB20/TW-3 (10-11)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	0.0477
Ex. UR - SVOC	Yes
Ex. CM - SVOC	Yes
TPAH17	1,062.1
Ex. UR - Metals	Yes
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB-14 (14-15)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	0.13
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB21/TW-4 (12-13)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	ND
Ex. UR - SVOC	No
Ex. CM - SVOC	No
TPAH17	0.7
Ex. UR - Metals	No
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No

Location	SB22/TW-5 (11-12)
Ex. UR - VOC	No
Ex. CM - VOC	No
TBTEX	0.00051
Ex. UR - SVOC	Yes
Ex. CM - SVOC	Yes
TPAH17	25.1
Ex. UR - Metals	Yes
Ex. CM - Metals	No
Ex. UR - TCN	No
Ex. CM - TCN	No



LEGEND

- MGP SITE BOUNDARY
- HISTORICAL MGP FEATURE
- MW1 — MONITORING WELL
- SB2 — SOIL BORING
- TP1 — TEST PIT
- HYDROCARBON STAIN OR ODOR
- PETROLEUM IMPACTS STAINING & ODOR
- NO OBSERVED IMPACTS
- EX. — EXCEEDANCE
- UR — UNRESTRICTED
- CM — COMMERCIAL

0 50' 100'

SCALE: 1" = 50'

Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

SUBSURFACE SOIL RESULTS
0-15 FEET BGS (mg/kg)
MAY 2013

Fig. 4

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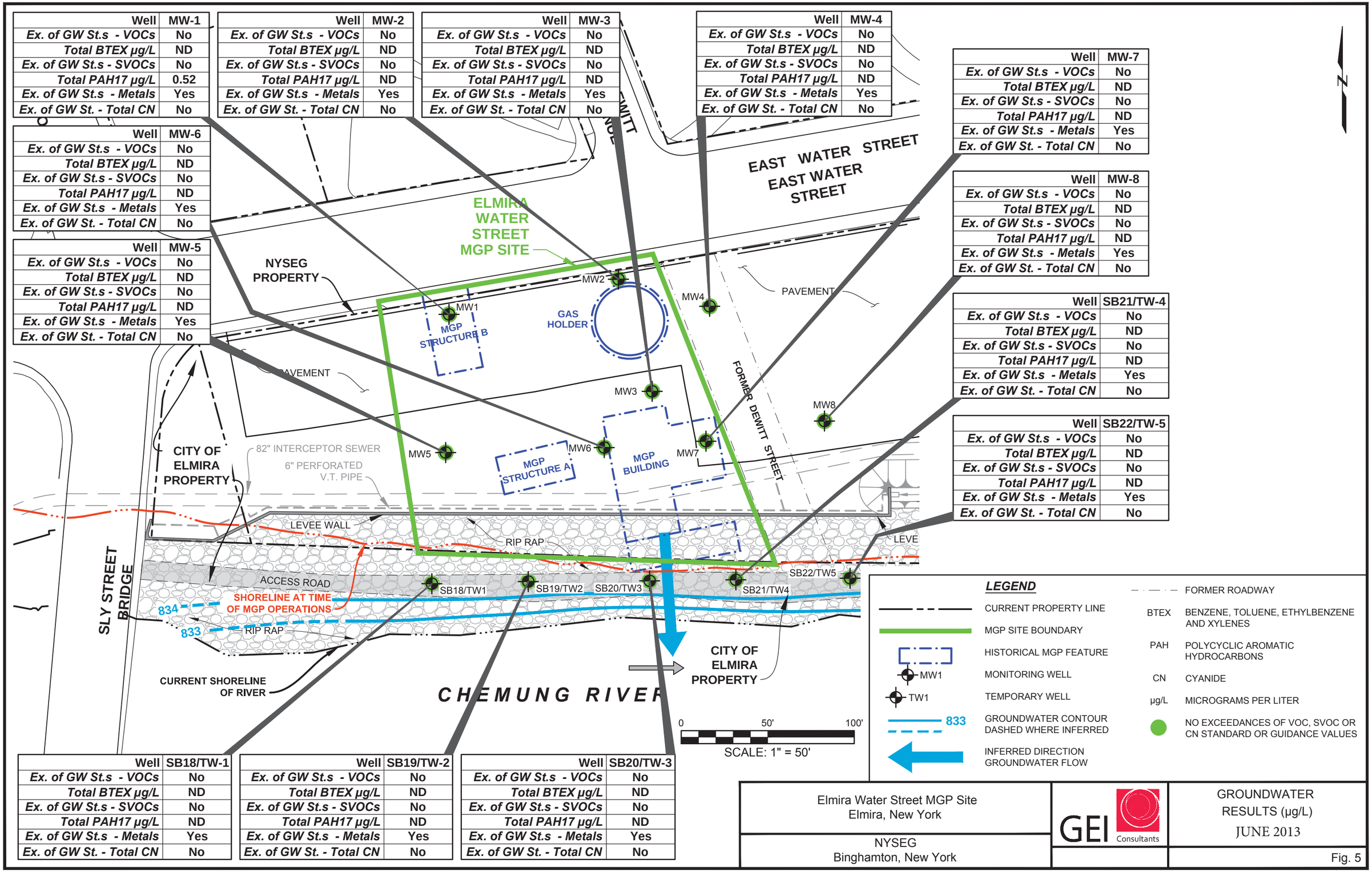

Well	MW-1
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	0.52
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-2
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-3
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-4
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-6
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-5
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-7
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	MW-8
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	SB21/TW-4
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	SB22/TW-5
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	SB18/TW-1
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	SB19/TW-2
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

Well	SB20/TW-3
Ex. of GW St.s - VOCs	No
Total BTEX µg/L	ND
Ex. of GW St.s - SVOCs	No
Total PAH17 µg/L	ND
Ex. of GW St.s - Metals	Yes
Ex. of GW St. - Total CN	No

LEGEND

- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- HISTORICAL MGP FEATURE
- MW1 — MONITORING WELL
- TW1 — TEMPORARY WELL
- 833 — GROUNDWATER CONTOUR DASHED WHERE INFERRED
- INFERRED DIRECTION GROUNDWATER FLOW
- FORMER ROADWAY
- BTEX — BENZENE, TOLUENE, ETHYLBENZENE AND XYLENES
- PAH — POLYCYCLIC AROMATIC HYDROCARBONS
- CN — CYANIDE
- µg/L — MICROGRAMS PER LITER
- NO EXCEEDANCES OF VOC, SVOC OR CN STANDARD OR GUIDANCE VALUES

Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

GROUNDWATER RESULTS (µg/L)
JUNE 2013

Fig. 5

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Sample	SD4 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	0.0009
TPAH14	3.2
TPAH17	3.9
TPAH34	6.5

Sample	SD5 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	ND
TPAH14	5.9
TPAH17	7.1
TPAH34	12.9

Sample	SD6 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	ND
TPAH14	4.5
TPAH17	5.4
TPAH34	6.5

Sample	SD7 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	1.1
TPAH17	1.3
TPAH34	1.7

Sample	C3 (1-1.5)
Ex. ERL	Yes
Ex. ERM	Yes
BTEX	ND
TPAH14	8.9
TPAH17	10.4
TPAH34	13.0

Sample	SD8 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	ND
TPAH14	2.1
TPAH17	2.4
TPAH34	2.8

Sample	SD9 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	0.001
TPAH14	1.1
TPAH17	1.4
TPAH34	2.1

Sample	C5 (3.5-4)
Ex. ERL	Yes
Ex. ERM	No
BTEX	ND
TPAH14	3.5
TPAH17	4.3
TPAH34	6.4

Sample	SD10 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	0.0013
TPAH14	1.5
TPAH17	2.0
TPAH34	2.7

LEGEND

- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- HISTORICAL MGP FEATURE
- SW1 — SURFACE WATER SAMPLE
- NO OBSERVED IMPACTS
- SD9 — SEDIMENT SAMPLE (inches)
- C1 — SEDIMENT CORE (feet)
- T1 — PROBE TRANSECT

N

Sample	C1 (1.5-2)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	0.1
TPAH17	0.2
TPAH34	0.2

Sample	SD3 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	NA
TPAH14	0.8
TPAH17	1.0
TPAH34	1.2

Sample	SD2 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	NA
TPAH14	0.9
TPAH17	1.2
TPAH34	1.5

Sample	SD1 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	NA
TPAH14	0.4
TPAH17	0.5
TPAH34	0.6

Sample	C6 (1-1.5)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	1.3
TPAH17	1.5
TPAH34	1.9

Sample	SD21 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	0.0009
TPAH14	1.6
TPAH17	1.9
TPAH34	2.8

Sample	SD23 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	0.0010
TPAH14	ND
TPAH17	ND
TPAH34	0.03

RIP RAP

MGP BUILDING

SHORELINE AT TIME OF MGP OPERATIONS

SB18/TW1 SB19/TW2 SB20/TW3 SB21/TW4 SB22/TW5

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 T20 T21 T22

SW1 SW2 SW3

SD1 SD2 SD3 SD4 SD5 SD6 SD7 SD8 SD9 SD10 SD11 SD12 SD13 SD14 SD15 SD16 SD17 SD18 SD19 SD20 SD21 SD22 SD23 SD24

C1 C2 C3 C4 C5 C6

METAL PIPE

CHEMUNG RIVER

Sample	SD17 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	0.0010
TPAH14	0.2
TPAH17	0.3
TPAH34	0.3

Sample	SD19 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	0.6
TPAH17	0.7
TPAH34	0.7

Sample	SD20 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	NA
TPAH14	0.4
TPAH17	0.5
TPAH34	0.5

Sample	SD11 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	NA
TPAH14	1.3
TPAH17	1.7
TPAH34	2.2

Sample	SD12 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	NA
TPAH14	2.4
TPAH17	3.0
TPAH34	4.5

Sample	SD13 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	0.9
TPAH17	1.2
TPAH34	1.5

Sample	SD14 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	NA
TPAH14	1.5
TPAH17	1.8
TPAH34	2.2

Sample	SD15 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	0.6
TPAH17	0.8
TPAH34	0.9

Sample	SD16 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	NA
TPAH14	3.3
TPAH17	3.8
TPAH34	4.8

Sample	C2 (1.5-2.0)
Ex. ERL	Yes
Ex. ERM	No
BTEX	ND
TPAH14	2.6
TPAH17	3.1
TPAH34	3.8

Sample	SD18 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	NA
TPAH14	0.2
TPAH17	0.2
TPAH34	0.3

Sample	C4 (1.5-2)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	0.7
TPAH17	0.8
TPAH34	0.9

Sample	SD22 (0-6)
Ex. ERL	Yes
Ex. ERM	No
BTEX	ND
TPAH14	8
TPAH17	9
TPAH34	15

Sample	SD24 (0-6)
Ex. ERL	No
Ex. ERM	No
BTEX	ND
TPAH14	0.2
TPAH17	0.3
TPAH34	0.3

SOURCES

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 40' 80'

SCALE: 1" = 40'

Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

SEDIMENT SAMPLE LOCATIONS AND RESULTS (mg/kg)
SEPTEMBER 2013

Fig. 6

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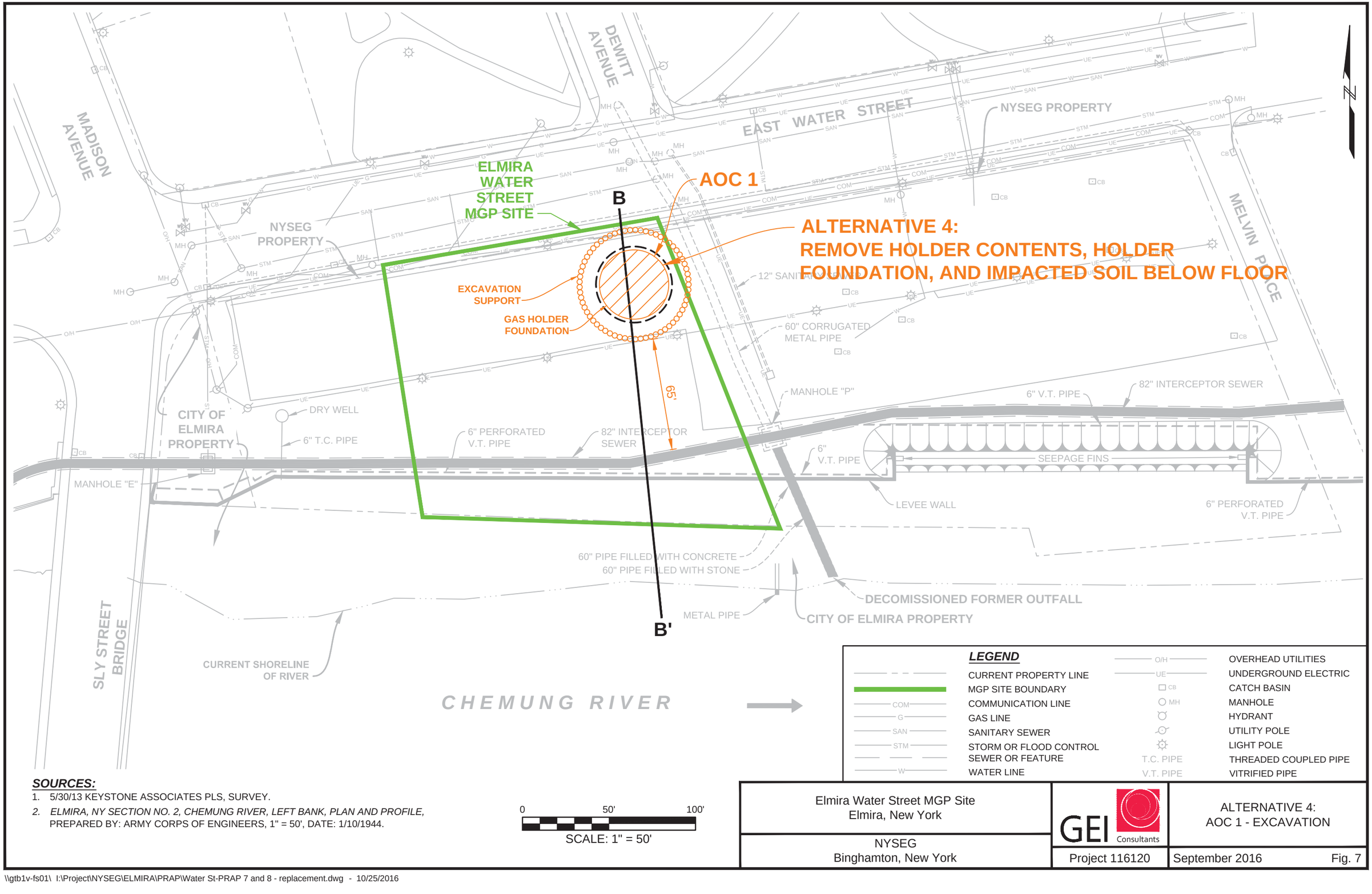

LEGEND

CURRENT PROPERTY LINE	O/H — OVERHEAD UTILITIES
MGP SITE BOUNDARY	UE — UNDERGROUND ELECTRIC
COM — COMMUNICATION LINE	CB — CATCH BASIN
G — GAS LINE	MH — MANHOLE
SAN — SANITARY SEWER	HYDRANT
STM — STORM OR FLOOD CONTROL SEWER OR FEATURE	UTILITY POLE
W — WATER LINE	LIGHT POLE
	T.C. PIPE — THREADED COUPLED PIPE
	V.T. PIPE — VITRIFIED PIPE

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50' 100'

SCALE: 1" = 50'

Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

ALTERNATIVE 4:
AOC 1 - EXCAVATION

Project 116120 | September 2016 | Fig. 7

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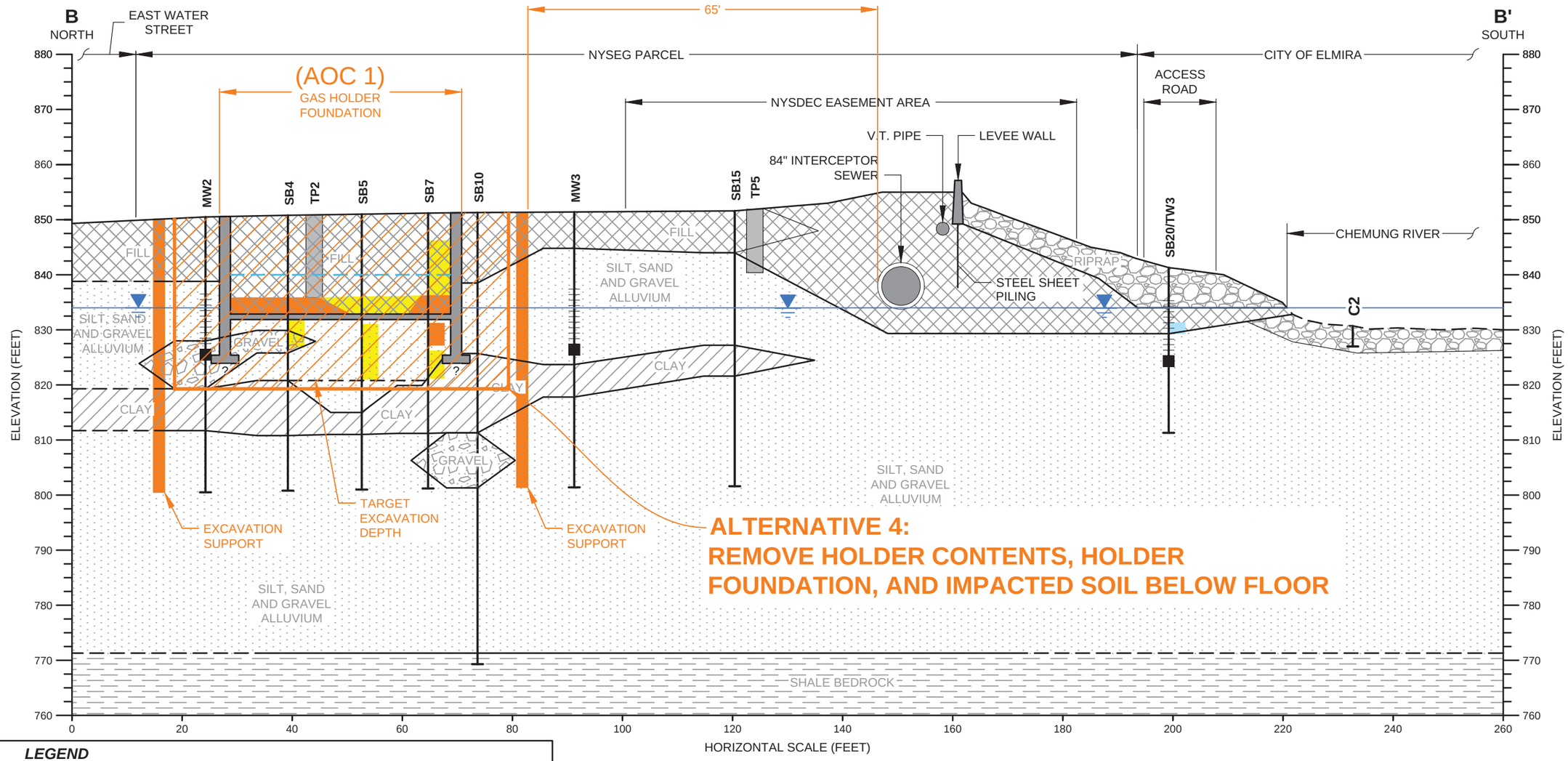

LEGEND

- WATER LEVEL IN GAS HOLDER FOUNDATION
- GROUNDWATER TABLE (JUNE 18, 2013)
- CONTACT
- INFERRED CONTACT
- MW1 — SOIL BORING/WELL IDENTIFICATION
  - SCREEN INTERVAL
  - DNAPL SUMP
  - BOTTOM OF BORING
- GP2 — GEOPROBE BORING / GROUNDWATER SAMPLE
- V.T. PIPE — VITRIFIED PIPE
- TP2 — TEST PIT
- FILL
- SILT, SAND AND GRAVEL ALLUVIUM
- CLAY
- GRAVEL
- SHALE BEDROCK
- HYDROCARBON STAIN OR ODOR
- BLEBS, GLOBS OR SHEEN
- PETROLEUM IMPACTS STAINING AND ODOR

HORIZONTAL SCALE: 1" = 20'

0 20' 40'

0 20' 40'

VERTICAL SCALE: 20'

NOTE: 1x VERTICAL EXAGGERATION

Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

ALTERNATIVE 4:
CROSS SECTION B-B'

Project 116120 | September 2016 | Fig. 8

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APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

NYSEG - Elmira Water St. MGP
State Superfund Project
Elmira, Chemung County, New York
Site No. 808025

The Proposed Remedial Action Plan (PRAP) for the NYSEG - Elmira Water St. MGP site was prepared by the New York State Department of Environmental Conservation (the Department) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on February 27, 2017. The PRAP outlined the remedial measure proposed for the contaminated soil and groundwater at the NYSEG - Elmira Water St. MGP site.

The release of the PRAP was announced by sending a notice to the public contact list, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on March 23, 2017, which included a presentation of the remedial investigation, feasibility study (RI/FS) for the NYSEG - Elmira Water St. MGP as well as a discussion of the proposed remedy. The meeting provided an opportunity for the public to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the PRAP ended on March 30, 2017.

This responsiveness summary responds to all questions and comments raised during the public comment period. The following are the comments received at the public meeting, with the Department's responses:

COMMENT 1: How many Manufactured Gas Power Plant (MGP) sites are there in New York and how does the contamination at this site compare?

RESPONSE 1: There are approximately 230 MGP sites identified in New York State that require some type of investigation or remediation. New York State Electric and Gas (NYSEG) is addressing 33 under a consent order with the Department. The nature and extent of MGP related contamination noted at the Elmira MGP Site is limited to the former subsurface gas holder structure and the contamination does not appear to have migrated beyond the holder. This MGP site is minimally contaminated in comparison to some other MGP site in the New York State.

COMMENT 2: Can contamination from the on-site source area reach the Chemung River via groundwater?

RESPONSE 2: The remedial investigation did not identify migration of MGP contamination to the Chemung River via groundwater or any medium. The subsurface contamination is limited to the former subsurface gas holder structure at a depth of over 10 feet below grade. The investigation only found groundwater contamination directly within the former holder, and monitoring wells

installed between the holder and the river did not show any site-related contamination. The remedy will eliminate the source of the contamination via excavation and off-site disposal. The removal will include the gas holder structure, its contents, and any impacted soil underneath the gas holder. This will ensure that site-related contamination will not impact the groundwater or the Chemung River in the future. The remedy requires post-remediation groundwater monitoring to ensure that the remedy remains protective of human health and environment.

COMMENT 3: When describing subsurface contamination what is a bleb?

RESPONSE 3: Blebs are small globules of the coal tar or oil that are noted by the field geologist when they describe the appearance of the sample from a soil boring. The presence of blebs is a visual indication of the extent of soil contamination. Generally, blebs observed at MGP sites are brown to black oil globules and usually have a petroleum-like odor.

COMMENT 4: Has anyone become ill from contamination from an MGP site?

RESPONSE 4: The primary contaminants of concern associated with MGP sites are poly aromatic hydrocarbon (PAHs) and benzene, ethylbenzene, toluene, and xylene (BETX). Exposure to these contaminants may result in health effects; specifically, odors associated with MGP waste may result in acute health effects such as respiratory irritation or headaches. However, people are not expected to come in contact with site-related contaminants at this site in its current state and measures will be in place during the remedial activities to minimize the potential for exposure during construction activities.

The potential for exposure to site-related contaminants is evaluated at each regulated former MGP site throughout the State and actions are implemented to reduce exposure if necessary.

COMMENT 5: What is the annual cost of the proposed remedy and what does it include?

RESPONSE 5: The remedy requires NYSEG to comply with the provisions of a Site Management Plan (SMP) to ensure that the remedy continues to remain effective and protective of human health and the environment. The $12,000 annual cost to comply with the SMP for this site includes inspection/maintenance of the site cover, groundwater sampling, reporting and certification to the Department. For the purposes of estimating, the total cost of the remedy, the ‘Present Worth’ cost, includes the cost of design and construction as well as the annual operating costs for 30 years of maintenance.

COMMENT 6: How does the proposed Site Management Plan address soil vapor intrusion?

RESPONSE 6: Following remedy implementation the Department, in consultation with the NYSDOH, will review and approve a Site Management Plan (SMP). The remedy includes a provision for evaluation of the potential for soil vapor intrusion for any future buildings that are developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion.

COMMENT 7: Can the site be used as a farmers market and/or a community garden and what can the site be used for after the remedial action is complete?

RESPONSE 7: The proposed remedy imposes an institutional control (IC) in the form of an environmental easement (EE). The EE to be placed on the site will restrict the use of the site to commercial and industrial land uses, which would prevent the use of the site for agricultural purposes such as a community garden. However, raised bed gardening may be permitted if the soil is placed above the cover system and they are controlled and monitored by a single entity (e.g., the City). The site could be used as farmers market provided that there is no penetration of the site cover system.

COMMENT 8: What is the next phase of the project and what is the schedule?

RESPONSE 8: The next phase of the project will consist of preparing the remedial design for Department review and approval. Once the remedial design is approved, NYSEG will construct the remedy. The remedy construction is currently scheduled for 2021.

APPENDIX B

Administrative Record

Administrative Record

NYSEG - Elmira Water St. MGP
State Superfund Project
Elmira, Chemung County, New York
Site No. 808025

1. Proposed Remedial Action Plan for the NYSEG - Elmira Water St. MGP site, dated February 27, 2017 prepared by the Department.

2. Order on Consent D0-0002-9309, between the Department and NYSEG, March 1994.

3. Remedial Investigation Work Plan, February 2013.

4. Remedial Investigation Report (RIR), August 2014.

5. Feasibility Study, November 2015

6. Feasibility Study addendum, October 2016.

7. Citizen Participation Plan, January 2012.

Appendix D

Field Sampling Plan

GEI Consultants

Consulting
Engineers and
Scientists

Appendix D

Field Sampling Plan

Elmira Water Street MGP Site
Elmira, New York
NYSDEC Site # 808025

Submitted to:
NYSEG
18 Link Drive, P.O. Box 5224
Binghamton, NY 13902-5224

Submitted by:
GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

Project #: 1704633-1.2

Table of Contents

Figure

Appendices

Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
CAMP	Community Air Monitoring Plan
COC	Constituent of Concern
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc., P.C.
GPS	Global Positioning System
HASP	Health and Safety Plan
HSA	Hollow-Stem Auger
ID	Inner Diameter
IDW	Investigation-Derived Waste
MGP	Manufactured Gas Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSEG	New York State Electric and Gas Corporation
PAH	Polycyclic Aromatic Hydrocarbon
PID	Photo-ionization Detector
PDI	Pre-Design Investigation
PPE	Personal Protection Equipment
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RD	Remedial Design
RQD	Rock Quality Designation
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compound
TIC	Tentatively Identified Compound
TPH	Total Petroleum Hydrocarbon
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound

1. Introduction

This Field Sampling Plan (FSP) presents the methods and procedures to be used for performing the Pre-Design Investigation (PDI) field tasks at the Elmira Water Street Manufactured Gas Plant (MGP) site located in the City of Elmira, New York.

1.1 Overview of Field Activities

The following will be performed during the PDI:

- Utility Locating and Mapping
- Geotechnical Soil Borings
- Waste Pre-Characterization Borings
- Bedrock Coring
- Piezometer Installation
- Borehole Abandonment
- Vibration Monitoring
- Hydraulic Testing
- Levee I-Wall and Interceptor Sewer Reconnaissance
- Surveying

2. Field Activities

The methods and procedures to be used, and field activities to be performed for the PDI are described below.

2.1 Site Hazards

Potential on-site surface hazards, such as traffic, sharp objects, overhead power lines, and energized areas will be identified prior to initiation of the fieldwork. The potential hazards at the site will be identified during a site reconnaissance by the project team on or before the first day of the investigation field activities. Additional safety measures necessary for the activities performed during the investigation are described in the site-specific Health and Safety Plan (HASP).

2.2 Field Books

Field activities will be documented in field books. Entries will be of sufficient detail to provide a comprehensive daily record of significant events, observations, and measurements. The field book will provide a legal record of the activities conducted at the site.

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Site Manager while field work is in progress.
- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of field work.
- Erroneous entries made while field work is in progress will be corrected by the field person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections necessary after departing the field will be made by the person who entered the original information. Corrections will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.

At a minimum, daily field book entries will include the following information:

- Location of field activity
- Date and time of entry
- Names and titles of field team members on site and site contacts
- Names, titles of any site visitors, as well as the date and time entering and leaving the site

- Weather information, for example: temperature, cloud coverage, wind speed, and direction
- Purpose of field activity
- A detailed description of the field work conducted
- Sample media (soil, etc.)
- Sample collection method
- Number and volume of sample(s) taken
- Description of sampling point(s)
- Preservatives used
- Analytical parameters
- Date and time of collection
- Sample identification number(s)
- Sample distribution (e.g., laboratory)
- Field measurements made during soil screening with the photo-ionization detector (PID)
- Reference information for maps, sketches, and photographs of the sampling site(s)
- Information pertaining to sample documentation such as:
    - Dates and method of sample shipments
    - Chain-of-custody record numbers
    - Federal Express or UPS air bill numbers

2.3 Underground Utilities

Underground utilities will be identified prior to initiation of drilling and other subsurface work. Utility mark-out procedures are described in Appendix A1 - GEI SOP PM-001. The underground utility tasks are summarized as follows:

- Exploration points will be flagged or marked-out with white paint.
- Dig Safely of New York (800) 272-4480 will be contacted to initiate the locating activities.
- New York State law requires that Dig Safely of New York be notified at least two working days, and not more than 10 working days, before subsurface work is performed.
- Companies and municipalities with subsurface utilities present will locate and mark-out all subsurface utility lines.

A utility locating subcontractor will also be used to assist with the utility locating task.

2.4 Soil Borings and Subsurface Soil Sampling

Subsurface soil borings will be advanced to collect geotechnical data and to obtain waste characterization samples. The following will be used during installation of the soil borings:

- Field book
- Project plans
- PPE in accordance with the HASP
- Stakes, flagging and marking paint
- Plastic bags for soil screening samples
- Tape measure
- Decontamination supplies
- Water level indicator
- PID with a 10.2 or 10.6 eV lamp
- Camera
- Clear tape, duct tape
- Laboratory sample bottles
- Coolers and ice
- Shipping supplies

2.4.1 Overburden Drilling and Geologic Logging Methods

Soil borings will be advanced by a driven casing or hollow-stem auger (HSA) method. Soil samples will be collected using split-spoon samplers. GEI SOP SM-001 for split-spoon sampling is included in Appendix A2. A borelog will be prepared for each soil boring. An example borelog is included in GEI SOP-003 in Appendix A3.

2.4.2 Overburden Soil Classification

The methods to be used for soil classification are provided in Appendix A3 – GEI SOP SM-003 - Soil Classification. The number and frequency of samples to be collected from each boring and the associated waste characterization and geotechnical analytical parameters are summarized in Table 1 in the PDI Work Plan. GEI's Soil Description key is included in Appendix A3.

2.5 Bedrock Coring and Logging Method

Bedrock cores will be collected during the PDI. GEI SOP SM-006 provides the methods to be used to collect and log the rock core. The SOP is included as Appendix A4.

2.6 Piezometer Installation

Two vibrating wire piezometers will be installed in one of the boreholes advanced during the geotechnical drilling task. The piezometers will be diaphragm-type piezometer tips which will be fastened to a sacrificial PVC tremie pipe and lowered into the borehole. The lower tip will be placed about 5 feet above the bedrock. The upper tip will be placed about 10 feet below the groundwater table. The entire borehole will be grouted with a cement-bentonite grout. Additional information, including a piezometer construction figure, is included in GEI SOP GW-013 – Appendix 5.

2.7 Borehole Abandonment

All soil borings (except the boring for the piezometers) will be filled with cement / bentonite grout. Borings will be filled using a cement/bentonite grout mixture with the following specifications:

- Bentonite will be powdered sodium montmorillonite furnished in moisture resistant sacks without additives.
- Cement shall be a low-alkaline Portland cement, Type I in conformance with ASTM C-150 and without additives.
- The cement/bentonite grout mixture will generally consist of:
    - Three sacks (94 pounds) of Type I Portland cement
    - 14 pounds of granular bentonite (5% mix)
    - 25 gallons of water

The cement will be mechanically mixed with water from a potable water source. Bentonite will be added to ensure a lump-free consistency. The mixture will be pumped through a tremie pipe as the drill tooling is being withdrawn.

2.8 Hydrology Characterization

The hydrology evaluation will include slug tests, borehole permeability tests, and single well pump tests.

2.8.1 Slug Tests

The methods to be used for the slug tests are provided in GEI SOP GW-010 which is included as Appendix A6. A slug test data form is included in the Appendix.

2.8.2 Borehole Permeability Tests

Falling-head permeability tests will be performed during the soil borings advanced for the geotechnical evaluation. The methods to be used for the borehole permeability tests are provided in GEI SOP GW-011, which is included as Appendix A7.

2.8.3 Drawdown Pumping Tests

Short-duration step draw down tests will be performed at MW1, MW2, MW3, and MW4. The wells will be gauged at "normal" static water level prior to the tests. Water level measurements will be made they day before, ½ hour prior to installing the pump, and immediately before beginning the tests, after static water level has returned / equilibrated.

Pumping will be accomplished using Whale pumps extracting approximately 1-2 gallons per minute. The pump will be placed as far below the static water level as possible without placing it within the screened interval of the well. This will allow the maximum possible drawdown while maintaining the greatest degree of well efficiency.

Immediately on starting the pump, the water levels will be manually gauged with a water level indicator meter to get a sense of how rapidly drawdown occurs. Gauging will assess whether the target pumping rates are feasible. If drawdown is very rapid, the pump will be adjusted to achieve target drawdown; or if not feasible, the pump may need to be changed to a peristaltic pump. Drawdown may continue to increase at a slow rate during pumping at constant rate. Measurements will be made over the test duration and recorded for the drawdown process.

The well will be pumped at a low constant rate until the drawdown stabilizes, or for 30 minutes if drawdown does not stabilize. The pumping rate is then increased to a higher constant rate, and the rate maintained until drawdown stabilizes once more; or for a minimum of 30 minutes. This process is repeated through at least three steps. If stabilization is achieved during any step, the pumping rate will be maintained for at least 10 minutes after stabilization, before moving to the next step.

Because step drawdown tests are of relatively short duration, drawdown may not stabilize even after 30 minutes. As specified above, a 30-minute cycle will be completed unless drawdown approaches the pump intake. If drawdown approaches the pump intake or well runs dry, the step will be repeated at a lower pumping rate at which drawdown data was not obtained.

The pumping rate will be held as constant as possible during each step. The pumping rate should be monitored every 5 to 10 minutes throughout each phase of the step drawdown test, and the rate maintained within 10 percent of its starting value. The monitoring frequency will be more frequent at the front end, when more drawdown is expected – pumping rates decrease when pumping against greater heads if the control setting is not increased to compensate. Rate changes with time will be recorded so that the pumping rates can later be summarized in hydrographs.

After completing pumping tests, the pump will be shut off and the monitoring will be performed every minute (if possible) during recovery until the water level rises to at least

75% of the original level. Measurements will be recorded in the field book for evaluation during the remedial design.

2.9 Background Vibration Monitoring

Vibration monitoring will be performed to collect baseline information on the typical level of vibrations experienced by structures near the site. Vibrations will be monitored continuously during the duration of the PDI which is estimated to be 1 week.

While the vibration monitor is recording potential sources of vibration will be recorded during the monitoring program. This includes the obvious sources (e.g., drill rig activities and large passing trucks), but also less obvious sources such as potential disturbance of the monitoring device from wind activity, which could cause the monitor to record a significant event. This information will be recorded in the field book.

One vibration monitoring device will be placed on the NYSDEC FPP Flood Wall. The location selected will be to the south of the gas holder foundation, as near to the holder foundation as possible.

2.9.1 Materials

The vibration monitor will be an Instantel Micromate seismograph with ISEE Triaxial Geophones. The seismograph/geophone unit will be calibrated by the manufacturer prior to delivery. The seismograph will be installed in a NEMA 4X enclosure.

2.9.2 Installation

For the PDI background monitoring, the unit will be set on the FPP wall. It will not be bolted to the concrete wall. It will be anchored to the wall with sufficient weights to hold the unit on the wall for the duration of the test period. Other locations may be tested as determined by senior GEI geotechnical staff.

Photo: Typical Seismograph Installation on horizontal surface

2.9.3 Data Collection

Seismographs will be controlled by version 10.72 of Instantel's THOR software. The software is used to pre-program the seismographs, manage recorded events, monitors, as well as customize report content. The monitoring will be performed by recording peak particle velocity along three orthogonal axes the seismograph location, as well as the frequency of the vibration. The seismograph will be programmed to perform continuous monitoring in histogram combination-mode, which will create a waveform during the histogram recording if a vibration exceeds the threshold level. This waveform will be saved as a separate file. The field and instrument data information will be included in a remedial design memorandum.

2.10 PDI Reconnaissance

The PDI includes two reconnaissance tasks. One task will be to observe the condition of the NYSDEC flood control I-Wall. The second will be to observe the condition of the City of Elmira interceptor sewer. The information obtained will then be used in the remedial design process. A second reconnaissance and documentation tasks will be performed for these features, prior to remedial construction, to document feature conditions before the intrusive remedial activities begin.

2.10.1 I- Wall Reconnaissance

The reconnaissance will consist of visual observations of the exterior of the wall to document the current existing conditions and visual defects. The reconnaissance will be performed by staff utilizing a digital camera and hand-written field notes. The assessment will include the above-grade portion of the concrete wall. Results will be presented in a design condition report, which will consist of a written summary and annotated photographs.

2.10.2 City of Elmira Interceptor Sewer

If a video survey of the corrugated metal pipe (CMP) interceptor sewer cannot be coordinated with the City of Elmira Department of Public works, then GEI will subcontract this work to a utility locating subcontractor. The subcontractor will provide the camera equipment, and other items that are necessary to perform the work.

The two manholes that access the sewer near the remedial area will be opened. The conditions of the manhole shafts down to the sewer will be observed and photographed remotely. GEI staff will not enter the manhole structures. The invert of the pipe will be determined at both locations. The condition and contents (if any) of the Interceptor pipe will then be documented remotely with the video camera.

The results of the photography and the video will be requested from the City, or provided to GEI in an electronic form (CD-ROM) by the subcontractor. The information obtained will be used in the remedial design.

2.11 Air Monitoring

2.11.1 Introduction

Two types of air monitoring will be performed during the site investigation: 1) work zone monitoring for protection of the workers performing the site investigation, and 2) community air monitoring at the perimeter of the work site for protection of the local community.

2.11.2 Breathing Zone Air Monitoring During Drilling and Sampling

Monitoring of air in the breathing zone within the work site will be conducted periodically during drilling and sampling activities.

A PID will be used to monitor for VOCs or other organic vapors in the breathing zone and borehole, and to screen the samples.

Additional air monitoring may be required as specified in the site-specific HASP.

The PID readings will be recorded in the field book during drilling activities. The procedure for the PID operation and calibration is included in the HASP. Note that equipment calibration will be performed as often as needed to account for changing conditions or instrument readings. The minimum frequency of calibration is specified in the HASP; more frequent calibration will be performed if spurious readings are observed or there are other problems with the instruments.

2.11.3 Community Air Monitoring

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

The procedures and action levels for community air monitoring are presented in the CAMP that has been prepared for the RD at the Elmira Water Street MGP Site.

2.12 Field Instruments and Calibration

Field analytical equipment will be calibrated prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Instrument calibrations will be documented in the project field book and in an instrument calibration log. Records of all instrument calibration will be maintained by the Field Team Leader. Copies of all of the instrument manuals will be maintained on site by the Field Team Leader, and changes to instrumentation will be noted in the field log book.

The following field instruments will be used during the investigation:

- PID
- Particulate monitors

2.13 Field Equipment Decontamination and Management of Investigation-Derived Waste

2.13.1 Decontamination Area

A temporary decontamination area lined with polyethylene sheeting will be constructed for personal decontamination, and for decontamination of the drilling equipment.

2.13.2 Equipment Decontamination

The following procedures will be used to decontaminate equipment used during the PDI activities:

- Drilling equipment, including the drilling rig; augers; bits; rods; tools; split-spoon samplers; soil core collection tubes and tremie pipes will be cleaned with a high-pressure washing unit before beginning work.
- Tools, drill rods, samplers, and augers will be placed on polyethylene plastic sheets following pressure washing.
- Augers, samplers, rods, and tools will be decontaminated between each drilling location.
- The back of the drill rig and all tools, augers, and rods will be decontaminated at the completion of the work and prior to leaving the site.

2.13.3 Sampling Equipment Decontamination

Required materials:

- Potable water
- Phosphate-free detergent (such as Alconox™ or Simple Green™)
- Dei-ionized water
- Aluminum foil
- Plastic/polyethylene sheeting
- Plastic buckets and brushes
- Personal protective equipment (PPE) in accordance with the HASP

2.13.4 Procedures

Prior to sampling, non-dedicated sampling equipment (bowls, spoons, interface probes, etc.) will be washed with potable water and a phosphate-free detergent (such as Alconox™). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, etc. The sampling equipment will then be rinsed with potable water followed by a de-ionized water rinse. Between rinses, equipment will be placed on polyethylene sheets or aluminum foil, if necessary. Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

2.14 Management of Investigation-Derived Waste

For the drilling task, investigation-derived waste (IDW) will be managed according to the methods provided in GEI SOP SC-003, and the methods described below. The SOP is included as Appendix A8. The preliminary location of the decontamination area is shown on Figure 4.

2.14.1 Decontamination Fluids and Development and Purge Water

Hot-water pressure wash, decontamination, and development and purge water will be collected in 55-gallon drums or a bulk tank. The storage drums or tank will be labeled as "pending analysis – investigation-derived residual decontamination water" and temporarily stored on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

2.14.2 Drill Cuttings

Drill cuttings will be contained in 55-gallon drums or in a covered roll-off container. The drums or covered roll-off container will be labeled as "pending analysis – investigation-derived residual – soil from drill cuttings". If drums are used, they will be temporarily stored on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

2.14.3 Personal Protective Equipment

PPE will be placed in 55-gallon drums, a lined cardboard yard box, or the covered roll-off container for proper disposal.

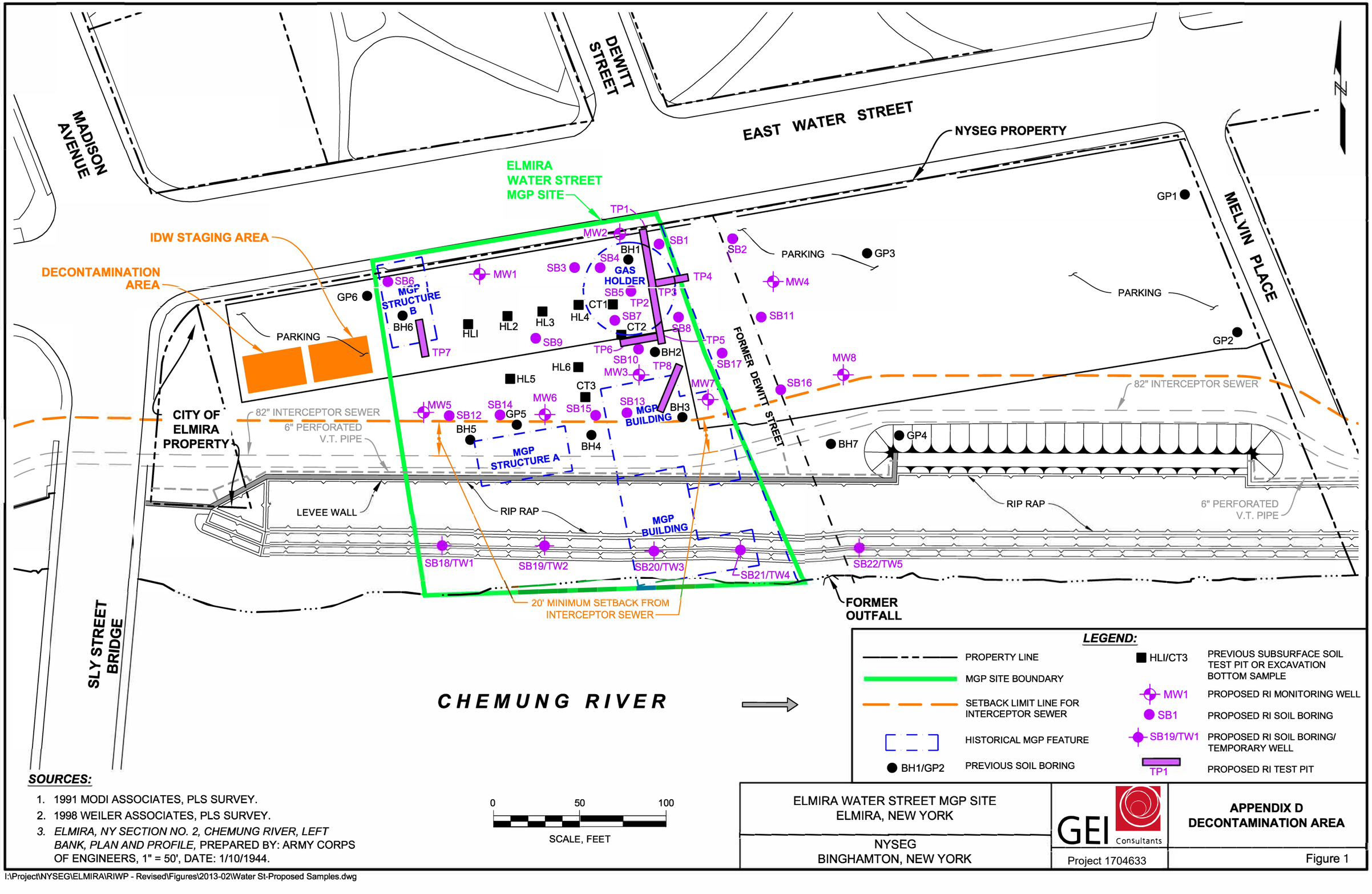
2.14.4 Dedicated Sampling Equipment

Used sampling equipment will be placed in the 55-gallon drums for disposal.

2.15 Surveying

A survey of the as-built PDI exploration locations, existing utilities, and important site features not surveyed during the RI will be performed at the end of the field activities by a PLS. Horizontal locations will be reported in the applicable New York State plane horizontal coordinates (North American Horizontal Datum 1983 [NAD83], NYS Central Zone), and latitude and longitude coordinates. Elevation data will be reported in North American Vertical Datum 1988 [NAVD88].

Figure



SOURCES:

1. 1991 MODI ASSOCIATES, PLS SURVEY.
2. 1998 WEILER ASSOCIATES, PLS SURVEY.
3. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50 100

SCALE, FEET

LEGEND:

PROPERTY LINE	HLI/CT3 — PREVIOUS SUBSURFACE SOIL TEST PIT OR EXCAVATION BOTTOM SAMPLE
MGP SITE BOUNDARY	MW1 — PROPOSED RI MONITORING WELL
SETBACK LIMIT LINE FOR INTERCEPTOR SEWER	SB1 — PROPOSED RI SOIL BORING
HISTORICAL MGP FEATURE	SB19/TW1 — PROPOSED RI SOIL BORING/ TEMPORARY WELL
BH1/GP2 — PREVIOUS SOIL BORING	TP1 — PROPOSED RI TEST PIT

ELMIRA WATER STREET MGP SITE
ELMIRA, NEW YORK

NYSEG
BINGHAMTON, NEW YORK

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Project 1704633

APPENDIX D
DECONTAMINATION AREA

Figure 1

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Appendix A1

GEI SOP PM-001
Utility Mark-Out

STANDARD OPERATING PROCEDURE

PM-001 Utility Markout and Clearance

1. Objective

Describe typical utility markout/clearance procedures prior to and during excavation. All markout procedures should be performed in accordance with local and state regulations.

Many states, by law, require that utility companies are notified before excavation begins. Actual procedures and requirements differ by state. City/state government may have additional requirements for utility markout procedures. Check the requirements in the locality before beginning. Also check with the GEI project manager to determine whether it is most appropriate for GEI or the drilling/excavation subcontractor to handle mark out and clearance.

2. Execution

Public Utility Markouts

- The drilling/excavation locations should be marked with white paint, stakes, or flags.
- The contractor should call the appropriate one call communication network for the state the work is being conducted in. Refer to the Reference section in this SOP for contact information. Contractors shall provide all necessary information to the one call system. Sample location maps may be provided to clarify sampling locations. The contractor shall provide GEI with the utility clearance ticket number.
- If necessary, contact the municipalities or other utility owners to mark their water, sewer, or other lines if they do not belong to the one call system. The contractor should keep a record of these calls.
- Utility plans, if available, should be obtained from the property owner or municipal offices.
- Prior to excavation, a visual check should be made that all utilities companies and municipalities have marked their locations. This includes looking for signs that a utility exists, and verifying that the markings agree with a visual check. If they do not, contact the appropriate utility to remark their locations.
- Utilities will generally only markout and clear utilities in roadways or other public property up to the property boundary. Owners of fiber optic cables, natural gas pipelines, and other high hazard utilities will often markout on private property if requested. The contractor should request this. See section on private utility clearance below.
- Public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation should adopt the American Public Works Association (APWA) Uniform Color Code using ANSI standard Z535.1 Safety Colors for temporary marking and utility identification, as follow:

The APWA Uniform Color Code

1. **White** – Proposed Excavation
2. **Pink** – Temporary Survey Markings
3. **Red** – Electric Power Lines, Cables, Conduit and Lighting Cables
4. **Yellow** – Gas, Oil, Steam, Petroleum & Gaseous Material
5. **Orange** – Communications, Alarm or Signal Lines, Cables or Conduit
6. **Blue** – Potable Water
7. **Purple** – Reclaimed Water, Irrigation and Slurry Lines
8. **Green** – Sewers and Drain Lines

However, not all organization do use these colors. Make sure the color scheme is understood.

- The excavator/contractor and consultant begins work on the scheduled work date and time (if all the facility operators have responded) taking care to find and preserve any markings that have been made.
- If markings may be disturbed during work, establish offset marks to create reference points for the underground utilities. Take photographs of the markings before starting work.
- When digging near a buried utility, the excavator/contractor and consultant should be aware of their proximity to the utility and use caution.
- If there is uncertainty about the accuracy of the markings or there are too many utilities in a given location to excavate or drill safely, consideration should be given to hand-digging the first few feet, vacuum excavation, or use of a utility location company as detailed below in Private Utility Markouts.
- Some clients may require hand or vacuum clearance to a minimum depth. Check with the GEI project manager.
- If exposing a utility, the excavator/contractor should provide proper support and protection for the utility to prevent damage. Contact the utility operator for support, guidance, or assistance.
- When the excavation is complete, the excavator/contractor should provide proper backfill for any utilities that have been exposed.

Private Utility Markouts

- Utility markouts on private property should follow the steps outlined above in public utility markouts with the additions below.
- If work is conducted on private property where public utilities may not provide markouts and the property owner cannot provide accurate utility plans, it is

recommended to use a company to determine the utility locations using one or more of the following technologies:

i. Electro-Magnetic (EM) device: This technology uses an electro-magnetic field in the subsurface to accurately locate metallic lines or non-metallic lines incorporating a metallic trace wire along their surface. The field is created either by direct contact to the pipe or tracewire, or by an induced current via radio waves.
ii. Sewer Sonde: For non-metallic lines where internal access is possible (such as clean-out ports in a sewer), a beacon or 'sonde' that emits a signal to the surface receiver as it is snaked through the pipe provides the same accuracy as the EM detector. If the internal condition of the pipe is desired, a camera can be deployed instead of a simple sonde.
iii. Ground Penetrating Radar (GPR): This technology involves radar waves reflecting to a surface receiver which provides a visual real-time map of the subsurface by which anomalies (such as pipes or tanks) may be detected. It has limitations in clay or wet soils and requires a skilled operator for interpretation. GPR should be considered for high risk utilities (e.g. PVC natural gas lines without trace wire) where line-of-sight project from site entry point to a kiosk or other building is uncertain.

- Utility markout on private property should include clearance for other types of underground structures such as underground storage tanks, septic systems, utility or access tunnels, and in-ground irrigation systems.

3. Limitations

- Markout notification time usually does not include holidays. Make sure holidays are considered and markout time is scheduled accordingly. Do not conduct excavation or drilling prior to the required wait time. Do not mark excavation locations using spray paint if it is raining or snowing enough so that the paint markings will be washed away. Consider using long stakes instead of paint if snow is predicted. Excavations within the tolerance zone should be performed with non-powered hand tools until the marked utility is exposed. The tolerance zone may be determined by the utilities, law or codes.
- When excavating close to an underground utility, it is good practice for the contractor/excavator to have a spotter assist and guide the machine operator.
- Take care not to damage the conduit or protective coating of a utility. If the excavator/contractor damages this, leave the damaged utility exposed and immediately call the utility owner.
- If contact to a gas utility occurs, notify police, fire, and emergency personnel, and evacuate employees and general public. No attempt should be made to tamper with or correct the damaged utility.

4. References

Connecticut
Name: Call-Before-You-Dig (CBYD)
Telephone: 1-800-922-4455
Website: www.cbyd.com
Wait time after notification: 2 business days (excluding holidays)
Expiration of markout: 30 days

Massachusetts, Maine, New Hampshire, Rhode Island and Vermont
Name: Dig Safe
Telephone: 1-888-DIG-SAFE or 811
Website: www.digsafe.com
Wait time after notification:
MA, ME, NH, and RI: 3 business days (excluding holidays)
VT: 2 business days (excluding holidays)
Expiration of markout: 30 days

New York State
Name: Dig Safely New York
Telephone: 1-800-962-7962
Website: www.digsafelynewyork.com
Wait time after notification: 2 business days (excluding holidays)
Expiration of markout: 30 days

New York City/Long Island
Name: New York City One Call Center
Telephone: 1-800-272-4480
Website: www.nycli1calldsi.com
Wait time after notification: 2 to 10 days (excluding holidays)
Expiration of markout: 30 days

New Jersey
Name: New Jersey One Call
Telephone: 1-800-272-1000
Website: www.nj1-call.org
Wait time after notification: 2 business days
Expiration of markout: 45 days

5. Attachment

Attachment A – Standard Utility Color Codes

6. Contact

Brian Conte
Anne Leifer

SOP PM-001

Attachment A – Standard Utility Color Codes

Color Code	Utility Description
Red	Electric
Yellow	Gas-Oil
Orange	Communications
Blue	Water
Green	Sewer
White	Proposed Excavation

GEI Consultants

Appendix A2

GEI SOP SM-001
Split-Spoon Sampling

STANDARD OPERATING PROCEDURE

SM-001 Soil Sampling Techniques Including Split-Spoon

1. Objective

Describe standard procedures for the collection of surface and subsurface soil samples.

The definition of "surface" soil varies considerably between regulatory organizations. Surface soils may be classified as soils between the ground surface and 2 inches below ground surface, ground surface and 6 inches below ground surface, and even as much as ground surface and 24 inches below ground surface.

The definition of subsurface soil will vary in relation to the definition of surface soil. In general, subsurface soil is everything deeper than surface soil.

Refer to state-specific regulations for the definitions of surface and subsurface soils.

2. Execution

2.1. Surface Soil Sampling

Collection of surface soil samples can be accomplished with tools such as spades, shovels, trowels, scoops, etc. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required.

- Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
- Using a decontaminated stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
- If volatile organic compound (VOC) analysis is to be performed, transfer the sample directly into an appropriate labeled sample container with a stainless steel lab spoon, small diameter core device, or equivalent and secure the cap tightly.
- Place the remainder of the sample into a decontaminated stainless steel, plastic, or other appropriate container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
- Either place the sample into appropriate labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the container and mix thoroughly.
- When compositing is complete, place the sample into appropriate labeled containers and secure the caps tightly.

2.2. Sampling with Hand Augers and Thin Wall Tube Samplers

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are generally better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and generally cannot be used below a depth of approximately three feet.

2.2.1 Auger Sampling

- Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
- Attach the decontaminated auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
- Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
- After reaching the desired depth, carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole.

2.2.2 Thin-Walled Core Sampling

- Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
- Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
- Remove the tube sampler, and unscrew the drill rods.
- Remove the cutting tip and the core from the device.
- Discard the top of the core (approximately 1 inch), as this may represent material knocked down from the sides of the boring and not the layer of interest. Place the remaining core into the appropriate labeled sample container.

One type of thin-wall sampler is depicted in Attachment A (this is typically used with a mechanical drill rig).

For either method, If VOC analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, small diameter core sampler, or equivalent and secure the cap tightly. VOC samples should be collected first to minimize the potential for losing volatiles prior to sample collection.

Place the remainder of the sample into a stainless steel, plastic, or other appropriate container and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the container and mix thoroughly.

When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow previous steps, making sure to decontaminate the auger and tube sampler between samples.

Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

2.3. Sampling at Depth with a Split-Spoon (Barrel) Sampler

Split-spoon sampling is generally used with a mechanical drill rig to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split-spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split-spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted. A diagram of the split-spoon sampler assembly is provided as Attachment A.

When split-spoon soil sampling is performed to gain geologic information, work should be performed in accordance with ASTM D1586-08a, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". The following procedures are used for collecting soil samples with a split-spoon:

- Select the size (length and diameter) of split-spoon sampler based on the amount of soil that is needed for characterization. The ASTM standard for N-values is 1 3/8 - inch I.D (2-inch O.D.). Specify spoon size and basket type to driller prior to mobilization to the site. Split spoon samplers are typically available in 1 3/8 – and 3 – inch I.D. sizes. A larger barrel may be necessary to obtain the required sample volume. Note on the boring log where larger split spoon barrels are used because the ASTM standard penetration test does not apply when driving split spoons larger than 1 3/8 I.D. (2-inch O.D.).

- Select a soft or stiff basket for the spoon (a softer basket generally works better for loose or soft material).
- Prior to hammering the split spoon to collect the sample, verify that the split-spoon is seated at the beginning of the desired sample interval. If it is seated above the interval, have driller clean out the hole prior to sampling. Record all depth measurements relative to ground surface.
- Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top. See diagram in Attachment A.
- Place the sampler in a perpendicular position on the sample material.
- For all soil samples, use a 140-lb hammer falling 30 inches to drive the sampler, unless conditions necessitate using a 300-lb hammer.
- Record in the site fieldbook or on field data sheets the length of the tube used to penetrate the material being sampled, the split-spoon inside and outside diameters, and the hammer weight,
- Count and record the number of blow counts per 6-inch increments (confirming blow counts with driller if necessary).
- Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The length of recovery and soil type should be recorded on the boring log. If a soil sample is desired, a decontaminated stainless steel knife or spatula should be used to divide the tube contents in half, longitudinally. If possible, avoid collecting soil that has come in contact with the walls of the spoon, and soil at the top of the spoon.
- Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.
- Note any material in the nose (shoe) of the spoon.
- Immediately collect a sample for VOCs (if required by the site-specific field sampling plan) by collecting soil from the entire length of the split spoon, unless otherwise specified by the project manager. When the most impacted interval is sampled for laboratory analysis, screen the spoon with the field instrument first, then collect the soil sample for VOC analysis from the appropriate interval.

3. Limitations

- Weather conditions (e.g., frozen ground) may prevent the collection of samples and should be considered prior to sample collection.
- Tools plated with chrome or other materials should not be used.
- Be aware of local laws regarding subsurface utility clearance prior to conducting subsurface investigations. Contact DigSafe or local utility companies as required.
- Be aware of the length of the drill string, the sample depth, and the required stickup of the drill string to ensure accurate sample interval measurement.
- If drilling with hollow-stem augers, the removal of the drill string from the hole, prior to attaching the split-spoon sampler, may cause soils to be sucked up

into the augers (blow-in running sands). Upon recovery, determine if there is blow-in in the split spoon sampler. In general, blow-in is more unconsolidated than the rest of the sample and lacks stratification (do not include blow-in for recovery of sample collection).

- If soils consist of loose sands or soft clay, the drill string and sampler may advance slightly under its own weight, giving a false depth for soil collection.
- Never sample more than two spoons consecutively without advancing the augers unless material is tight. Do not let the split spoon penetrate more than it can hold.
- In many instances, groundwater will fill the auger and the split-spoon.

4. References

ASTM D1586-08a, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". 2008.

United States Environmental Protection Agency, SOP 2012 "Soil Sampling", Revision 0.0, February 18, 2000.

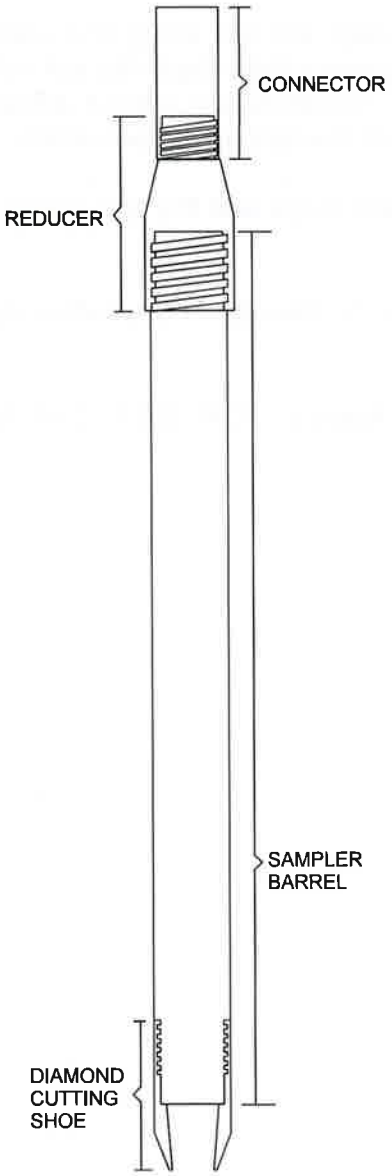
5. Attachments

Attachment A - Sampler Design Assembly

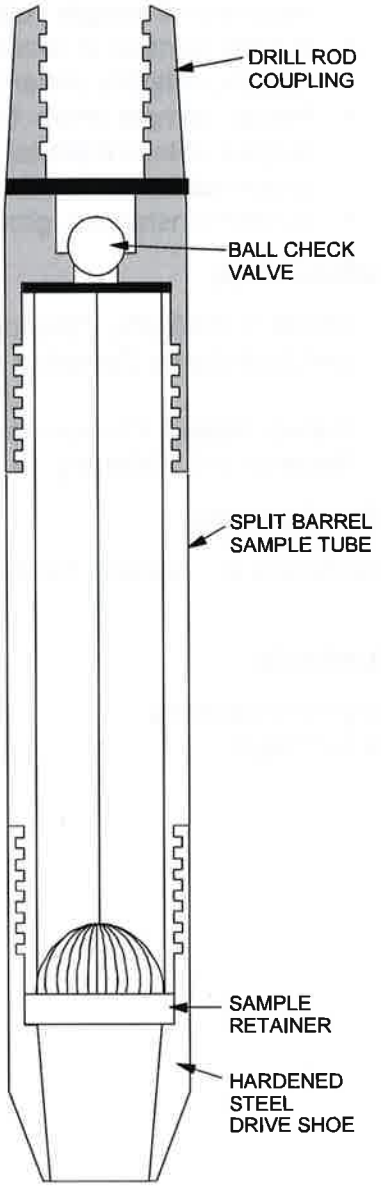
6. Contacts

Gary Fuerstenberg
Mark Ensign

THIN WALL HQ CORE SAMPLER
(2" width x 60" length)



SPLIT-SPOON SAMPLER
(2" width x 24" length)



STANDARD OPERATING PROCEDURES SM-001	GEI Consultants	**THIN WALL AND SPLIT-SPOON SAMPLERS**
NEW ENGLAND AND ATLANTIC REGIONS	June 2011	Attachment A

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Appendix A3

GEI SOP SM-003
Soil Classification

STANDARD OPERATING PROCEDURE

SM-003 Classification of Soil Samples in the Field

1. Objective

Describe methods to classify soil samples collected in the field in a consistent manner.

2. Execution

- Describe soil samples according to *ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* and Attachments A and B. This standard is the basis for the Unified oil Classification System.
- Identify and record the soil in terms of the major and minor constituents (i.e., sand gravel, silt, clay), Unified Soil Classification Symbol, sample structure, plasticity and dilatancy for fine-grained soils, color, local or geologic name if known (e.g., Boston Blue Clay or glacial till), odor, presence of iron or other staining, and presence of organic matter, shells, debris, or other unusual characteristics of the same.
- If a soil split-spoon sample contains more than one soil type (for example, the upper portion is silty sand and the lower portion is clay) describe each type separately.
- Record sampler type, blow counts, soil description, etc. on the boring log (see Attachment C).
- GEI consistently applies one modification to the ASTM standard: Use "widely graded" and "narrowly graded" instead of "well-graded" and "poorly graded," respectively.

3. Limitations

Certain projects or clients will require the use of other classification systems. Other classification systems should not be used unless specifically required by the client. If the client requires that we use the Burmister method, obtain the details from the client. An example breakdown is shown below, but some clients (MassDOT, for example) have their own breakdown.

- "and" = 35-50%
- "some" = 20-35%
- "little" = 10-20%
- "trace" = 1-10%

- Describing soil samples is often difficult during cold or wet weather. Make sure your field notes describe these conditions. When possible, collect archive samples and verify sample descriptions in the office.

- The ASTM Standard Practice for Classification of Soils for Engineering Purposes (D2487) may be used in conjunction with the Visual-Manual Method to confirm the soil classification. D2487 includes laboratory testing.

4. References

ASTM D2487-06e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM, 2006.

ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM, 2009.

Field Guide for Soil and Stratigraphic Analysis, Midwest Geosciences Group Press, 2001-2005.

Coarse-Grained Soils Visual-Manual Descriptions, GEI Consultants, Soil Description Chart.

Fine-Grained Soils Visual-Manual Descriptions, GEI Consultants, Soil Description Chart.

5. Attachments

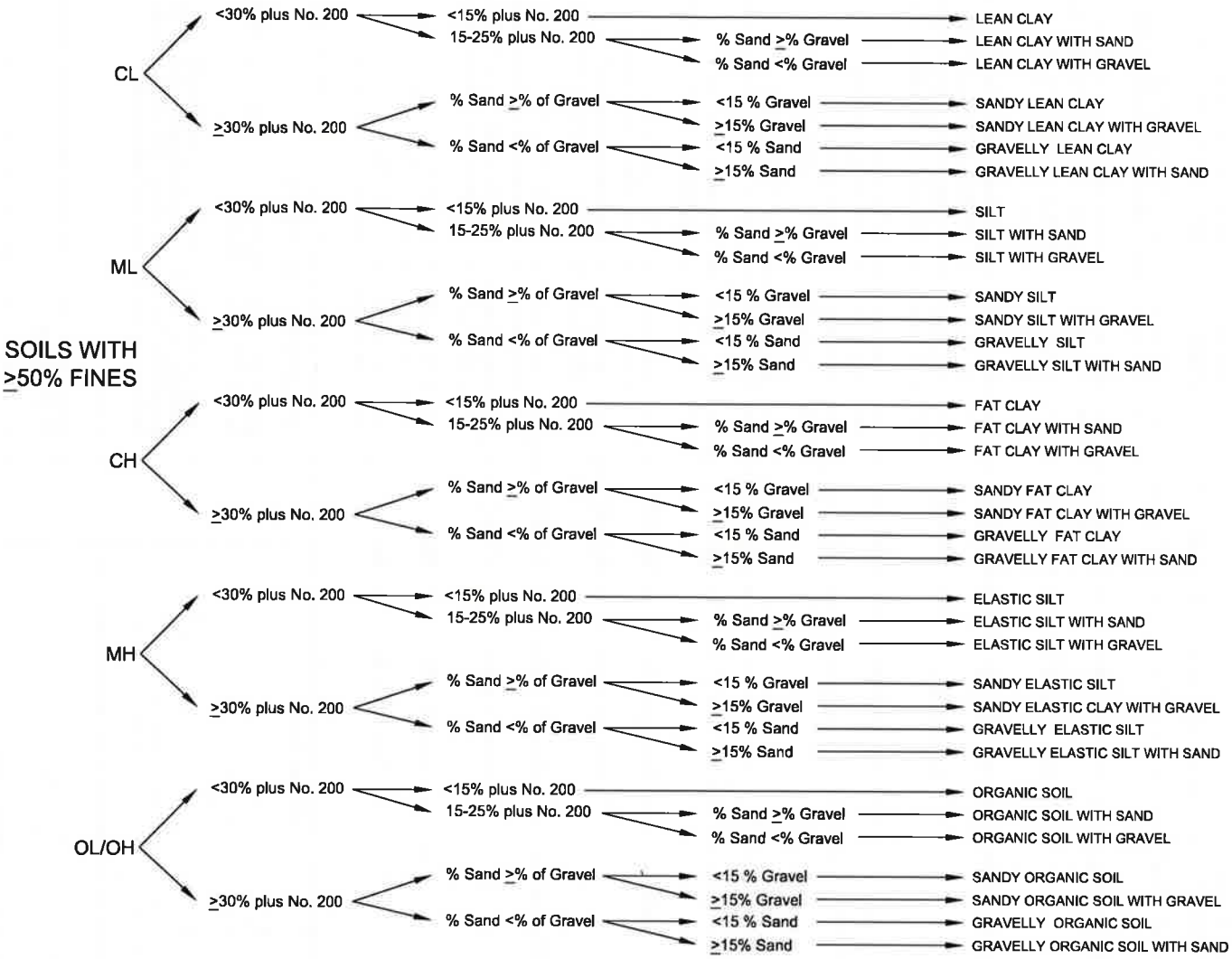
Attachment A – GEI Soil Description Charts (2007)
Attachment B – Visual Manual Descriptions with example boring log
Attachment C – Describing the Plasticity of Soil Samples

6. Contacts

Lynn Willey
Cathy Johnson

GEI Consultants

FINE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS



ID OF INORGANIC FINE SOILS FROM MANUAL TESTS

Symbol	Name	Dry Strength	Dilatancy	Toughness*
ML	Silt	None to low	Slow to rapid	Low or thread cannot be formed
CL	Lean Clay	Medium to high	None to slow	Medium
MH	Elastic Silt	Low to medium	None to slow	Low to medium
CH	Fat Clay	High to very high	None	High

1. GROUP NAME and (SYMBOL)
2. Describe fines, sand, and gravel components, in order of predominance. Include plasticity of fines. Include percentages of sand and gravel.
3. Color
4. Sheen, odor, roots, ash, brick, cementation, torvane and penetrometer results, etc.
5. "Fill," local name or geologic name, if known

PEAT

Peat refers to a sample composed primarily of vegetable matter in varying stages of decomposition. The description should begin: PEAT (PT) and need not include percentages of sand, gravel or fines.

CRITERIA FOR DESCRIBING PLASTICITY

Description	Criteria
Nonplastic ML	A 1/8-in. (3 -mm) thread cannot be rolled at any water content
Low Plasticity ML, MH	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit *
Medium Plasticity MH, CL	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High Plasticity CH	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

* Toughness refers to the strength of the thread near plastic limit. The lump refers to a lump of soil drier than the plastic, similar to dry strength.

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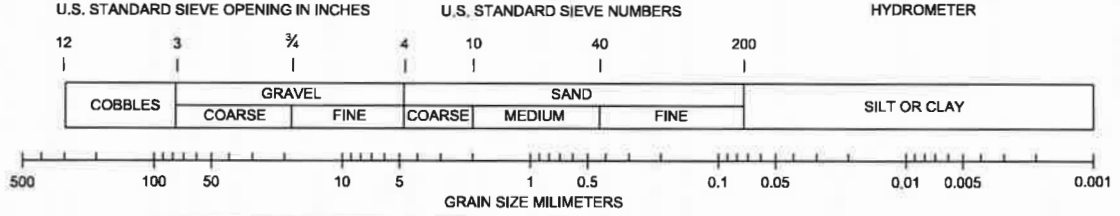
COARSE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS

TYPICAL SOIL COLORS

- YELLOW
- OLIVE
- LIGHT BROWN
- BROWN
- REDDISH BROWN
- RED
- GRAY
- BLACK

GROUP SYMBOL	GROUP NAME
SOILS WITH <50% FINES	
GRAVEL (% Gravel > % Sand)	
GW (WIDELY GRADED, ≤5% Fines)	<15% Sand → WIDELY GRADED GRAVEL; ≥15% Sand → WIDELY GRADED GRAVEL WITH SAND
GP (NARROWLY GRADED, ≤5% Fines)	<15% Sand → NARROWLY GRADED GRAVEL; ≥15% Sand → NARROWLY GRADED GRAVEL WITH SAND
GW-GM (WIDELY GRADED, ~10% Fines, Fines = ML or MH)	<15% Sand → WIDELY GRADED GRAVEL WITH SILT; ≥15% Sand → WIDELY GRADED GRAVEL WITH SILT AND SAND
GW-GC (WIDELY GRADED, ~10% Fines, Fines = CL or CH)	<15% Sand → WIDELY GRADED GRAVEL WITH CLAY; ≥15% Sand → WIDELY GRADED GRAVEL WITH CLAY AND SAND
GP-GM (NARROWLY GRADED, ~10% Fines, Fines = ML or MH)	<15% Sand → NARROWLY GRADED GRAVEL WITH SILT; ≥15% Sand → NARROWLY GRADED GRAVEL WITH SILT AND SAND
GP-GC (NARROWLY GRADED, ~10% Fines, Fines = CL or CH)	<15% Sand → NARROWLY GRADED GRAVEL WITH CLAY; ≥15% Sand → NARROWLY GRADED GRAVEL WITH CLAY AND SAND
GM (≥15% Fines, Fines = ML or MH)	<15% Sand → SILTY GRAVEL; ≥15% Sand → SILTY GRAVEL WITH SAND
GC (≥15% Fines, Fines = CL or CH)	<15% Sand → CLAYEY GRAVEL; ≥15% Sand → CLAYEY GRAVEL WITH SAND
SAND (% Sand ≥ % Gravel)	
SW (WIDELY GRADED, ≤5% Fines)	<15% Gravel → WIDELY GRADED SAND; ≥15% Gravel → WIDELY GRADED SAND WITH GRAVEL
SP (NARROWLY GRADED, ≤5% Fines)	<15% Gravel → NARROWLY GRADED SAND; ≥15% Gravel → NARROWLY GRADED SAND WITH GRAVEL
SW-SM (WIDELY GRADED, ~10% Fines, Fines = ML or MH)	<15% Gravel → WIDELY GRADED SAND WITH SILT; ≥15% Gravel → WIDELY GRADED SAND WITH SILT AND GRAVEL
SW-SC (WIDELY GRADED, ~10% Fines, Fines = CL or CH)	<15% Gravel → WIDELY GRADED SAND WITH CLAY; ≥15% Gravel → WIDELY GRADED SAND WITH CLAY AND GRAVEL
SP-SM (NARROWLY GRADED, ~10% Fines, Fines = ML or MH)	<15% Gravel → NARROWLY GRADED SAND WITH SILT; ≥15% Gravel → NARROWLY GRADED SAND WITH SILT AND GRAVEL
SP-SC (NARROWLY GRADED, ~10% Fines, Fines = CL or CH)	<15% Gravel → NARROWLY GRADED SAND WITH CLAY; ≥15% Gravel → NARROWLY GRADED SAND WITH CLAY AND GRAVEL
SM (≥15% Fines, Fines = ML or MH)	<15% Gravel → SILTY SAND; ≥15% Gravel → SILTY SAND WITH GRAVEL
SC (≥15% Fines, Fines = CL or CH)	<15% Gravel → CLAYEY SAND; ≥15% Gravel → CLAYEY SAND WITH GRAVEL



1. GROUP NAME and (SYMBOL)
2. Structure , if any. (stratified layer thicknesses, lenses, varves, gradational changes)
3. Describe sand, gravel and fines components, with percentages, in order of predominance. Include max gravel size. For test pits give percent cobbles and boulders, by volume, and include max size.
4. Color
5. Sheen, odor, roots, ash, brick, cementation, reaction with HCL, etc.
6. "Fill," local name or geologic name, if known

Describing the Plasticity of Soil Samples
M. Paster – November 2008

References ASTM D 2487 – Soil descriptions – lab
ASTM D 2488 – Soil descriptions – field
ASTM D 4318 – Atterberg limits testing

GEI Practice for Boring and Test Pit Logs

Describe the fines as:

Non-plastic
Low plasticity (The GEI laminated sheets incorrectly use "slightly plastic" for "low plasticity.")
Medium plasticity
High plasticity

Example: ~25% low plasticity fines

Toughness and dry strength:

You should use these tests to help decide how plastic the fines are. Record the results in the remarks column of the field log, but not in the soil description and not necessarily in the typed log.

On final logs, if Atterberg limits tests have been performed:

Do not use the descriptive terms non-plastic, low plasticity, etc. for samples on which Atterberg limits tests have been run. Instead, just give the percentage of fines and then report the actual Atterberg limits at the end of the description.

For example, the end of a silty sand description might be:
. . . ~25% fines, ~10% gravel max size ½ inch, gray. PL=23, LL=35.

(Atterberg limits tests are performed on the fraction of the sample finer than the No. 40 sieve, not just the fines. So the Atterberg limits data applies to the sample, not just to the fines.)

Hints:

High plasticity soils are rare in New England. If you think it's high plasticity, it's probably medium. Some Boston blue clay and some Connecticut River varved clays are high plasticity, but if you think you've found some, check with the project manager.

In New England, if ~10% fines or more, generally stick with GM, SM, ML, and CL. Occasionally GC, SC, CH. Don't use MH unless you have Atterberg limits data.

Estimating plasticity in the field, GEI guidance based on ASTM D 2488:

Plasticity	1/8-inch thread	Dry strength	Toughness
non	Cannot be rolled at any water content.	Dry specimen crumbles when handled.	Only slight pressure needed to roll thread near plastic limit.
low	Thread can barely be rolled.	Dry specimen crumbles with some finger pressure.	Slight to medium pressure needed to roll thread near plastic limit.
medium	Thread is easy to roll. Not much time needed to reach plastic limit.	Dry specimen crumbles with considerable finger pressure.	Medium pressure needed to roll thread near plastic limit.
high	Takes considerable time rolling and kneading to reach plastic limit.	Dry specimen cannot be broken with finger pressure.	Considerable pressure needed to roll thread near plastic limit.

Non-plastic vs. low plasticity:

ASTM D 2488 (soil descriptions - field) defines non-plastic and low plasticity based on the 1/8-inch thread as shown in the table above.

ASTM D 4318 (Atterberg limits testing) indicates that a sample should be called non-plastic for either of the following cases:

- The liquid limit test (dropping the cup) or the plastic limit test (rolling out the thread) cannot be performed because the plasticity is too low.
- The plastic limit is greater than or equal to the liquid limit.

Unfortunately, there are some soils that are low plasticity based on D 2488 (a thread can be rolled), but are non-plastic based on D 4318 (the liquid limit cannot be measured or PL≥LL).

GEI considers these soils to have low plasticity, because that is how they "look" and "feel." We want to document this information so that other people will have a better feel for what the soil looks like and how it behaves. So, if the soil was low plasticity based on D 2488, but non-plastic based on D 4318, that should be explained in the letter or report, and possibly in a note on the log.

BORING LOCATION Maple Ave Sidewalk
GROUND ELEVATION (NGVD) _____
GROUNDWATER EL. _____ DATE _____

DATE START/FINISH 2/14/07 - 2/15/07
DRILLED BY Geologic: M. Costigan
LOGGED BY T. Kahl/M. Yako TOTAL DEPTH (FT) 25

B101

PG. 1 OF 1

EL. FT.	DEPTH FT.	SAMPLE TYPE and NO.	SAMPLE BLOWS PER 6 IN.	SAMPLE PEN IN.	SAMPLE REC IN.	PID JAR HS / REMARKS	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
	0						FILL	4" pavement
	2.5	S1	13-9 17-14	24	0	0.5 ppm		S1: Redrove 0.5 to 3.5 ft. Recovery 11": WIDELY GRADED SAND (SW) ~85% sand, ~10% gravel to 1", <5% nonplastic fines, brown. Contains brick fragments and ash. Fill.
	5					hard drilling 3 to 4 ft, possible boulder		
		S2	7-7 11-13	24	8	2.0 ppm		S2: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ~65% mostly fine sand, ~25% gravel to 3/4 inch ~10% non-plastic fines, brown. Fill.
	7.5	S3	9-10 2-1	24	16	0.0 ppm		S3 (0-10"): Similar to S2.
	10						ORGANICS	S3 (10"-16")": ORGANIC SILT (OL) ~100% slightly plastic fines, dark gray, organic odor, contains white shell fragments.
	12.5	S4	WOH 1-2 1	24	15	0.0 ppm		
	15					hard drilling at 15.5 ft		S4: Similar to S3, bot 6".
	17.5	S5	20-35 50/3"	15	8	Top of rock ~19 ft. Roller bit to 20 ft.	TILL	S5: SILTY SAND WITH GRAVEL (SM) ~60% mostly fine sand, ~25% slightly plastic fines, ~15% gravel to 1/2 inch, olive. Glacial Till.
	20							
	22.5	C1	RQD 70%	60	54	lost ~10 gallons drill fluid from 23 to 25 ft	ROCK	C1: SCHIST, hard, slight weathering at joint surfaces, joints at ~30 degrees from horizontal and generally parallel to foliation, gray. Marlborough Formation.
	25							Bottom of Boring 25 ft
	27.5							Truck-mounted drill rig. 4-inch casing to 19 ft. Safety-hammer with rope and cathead for SPT. Backfilled with drill cuttings.
	30							

BLOWS PER 6 IN.–140 LB. HAMMER FALLING 30 IN. TO DRIVE A 2.0 IN. OD SPLIT SPOON SAMPLER
PEN–PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC–RECOVERY LENGTH OF SAMPLE
RQD–LENGTH OF SOUND CORES > 4 IN./ LENGTH CORED, %
S–SPLIT SPOON SAMPLE
U–UNDISTURBED SAMPLES, UF–FIXED PISTON UO–OSTERBERG
▽ GROUNDWATER

NOTES:
1: Groundwater at 10 ft depth at start of day 2/15/07.

PROJECT 07999-0
DATE

GEI Consultants

EXAMPLE SOIL DESCRIPTIONS

SANDY SILT (ML) ~60% slightly plastic fines, ~40% mostly fine sand, 1" thick layer of fine to medium sand with <20% fines, gray.

LEAN CLAY (CL) ~90% moderately plastic fines, ~10% fine sand, olive. Boston Blue Clay. Sv = 0.5, 0.5, 0.8 tsf, Qp = 1.0, 1.5, 1.6 tsf

Stratified CLAYEY SAND (SC) and WIDELY GRADED SAND (SW) SC layers 1 to 2 inches thick consist of fine sand with ~30% moderately plastic fines, gray. SW layers 1 to 4 inches thick consist of fine to coarse sand, ~10% gravel to 1/2 inch, <5% fines, brown. Hydraulic Fill.

EXAMPLE ROCK DESCRIPTIONS

(0-9"): GRANITE, hard, one piece, joint surface slightly weathered, pink.
(6-60"): PHYLLITE, joints ~ 45° generally parallel to foliation, 9" to 44" moderate to severe jointing and joint weathering. 44" to 60" single piece, green-gray.

ARGILLITE, medium hard, moderately weathered joints, gray. Cambridge Argillite.

GEOPROBE AND ROTOSONIC

When SPTs are not performed, note sample density (sands) or stiffness (clays) in description.

CRITERIA FOR DESCRIBING DILATANCY OF FINE-GRAINED SOILS

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

SPT: Standard Penetration Test

30-inch drop with 140-lb hammer
1 3/4 to 2 1/4 turns around cathead
2-inch O.D. split spoon sampler

ENV'L TERMINOLOGY FOR SOIL DESCRIPTIONS

- **Ash** - Typically silt-size to medium sand-size.
- Do not use the term "cinders." This is not a technical term. Instead, use "ash," "burnt wood," "burnt material," or a similar term.
- **Coal-like material** - If it looks like coal but you aren't sure.
- **Clinker** - Vitrified (glass-like) or heat-fused material. Often burned impurities in coal. Often looks like pumice, but heavier.
- **Slag** - Similar to clinker, but normally refers to residue from metal ore processing.

- **Sheen** - Iridescent petroleum-like sheen. Not to be used for a "bacterial sheen," which can be distinguished by its tendency to break up on the water surface at angles. Petroleum sheen will be continuous and will not break up.
- **Stained** - Use with a color ("brown-stained") to indicate that the soil is stained a color other than its natural (unimpacted) color.
- **Coated** - Soil grains are coated with NAPL (oil, tar, etc.). There is not enough NAPL to saturate the pore spaces. ("Split spoon sampler coated with brown oil." "Soil grains coated with gray substance with slight gasoline-like odor.")
- **Saturated** - The entire sample pore space is saturated with NAPL. If you use this term, be sure it is not water saturating the pore spaces. Depending on viscosity, the NAPL may drain from a soil sample. ("Sample saturated with green, sticky substance.")
- **Blebs** - Discrete sphericals of NAPL in a soil matrix that was not visibly coated or saturated. ("Occasional blebs of reddish-brown tar.")
- **Oil** - Exhibits a petroleum odor, different from MGP odors.
- **Tar** - Exhibits an MGP odor (e.g. naphthalene-like odor).

- **Odors** - Use terms such as "naphthalene-like odor" or "petroleum-like odor." Use modifiers (strong, moderate, slight) to indicate odor intensity.

Appendix A4

GEI SOP SM-006
Rock Core Logging

STANDARD OPERATING PROCEDURE

SM-006 – Rock Core Logging

1. Objective

Describe bedrock coring procedures and rock core logging.

2. Execution

2.1 Rock Coring and Logging

Prior to beginning drilling activities, complete the header of the boring log to the extent possible. Record the names of the driller and assistant and the types of drilling equipment used for each boring/rock core.

Use double- or triple-tube, swivel-type, split-inner-barrel or solid-inner-barrel core barrels that provide a minimum rock core diameter of 1.75 inches. Wireline equipment is acceptable. Consider whether borehole geophysics may be necessary for bedrock characterization. If so, ensure that the outer diameter of coring tools leaves an adequate diameter bedrock hole to accommodate geophysical tools.

The first core run in each boring should be no longer than 5 feet to help assure optimal recovery. Individual core runs may be increased to as much as 10 feet depending on the recovery and quality of the cored rock, and the difficulty in advancing the core barrel.

If coring progress indicates that a weak or soil-filled zone has been encountered, pull the core barrel and attempt to obtain a split spoon sample in accordance with GEI soil sampling procedure.

Stop coring and pull the core barrel if the barrel appears to be jammed or the normal flow of drill fluid is blocked.

Pack and label cores in boxes in accordance with GEI procedure for Packing and Labeling of Rock Cores.

Measurements of the lengths of drilling tools and core barrels should be made to the nearest 1 inch or 0.10 feet or less. Measurements or calculations of the depth of the borehole and depth of coring intervals should be made to the nearest one foot or less. Measurements of the length of individual core runs and the length of rock core recovered should be made to the nearest 1 inch or 0.1 feet or less.

For each boring, record on the boring log the following:

- Type and size of core barrel used.
- Type and size of casing used through soil.
- Type of drill fluid used if other than plain water.

During coring, record the following information on the log, as applicable.

- Time, in minutes, to advance the core each foot.
- Depth intervals over which some or all drill fluid does not return to the ground surface.
- Observations of unusually hard coring.
- Observations of unusually easy coring, rod drops, possible cavities, etc.

For each core run, record on the field log, as a minimum, the following:

- Core run number (C1, C2, etc.)
- Depth to top of core run
- Length of core run
- Length of rock recovered
- RQD, %. (RQD is the rock quality designation, and is equal to the total length of intact pieces of rock core longer than 4 inches divided by the core barrel penetration)
- Description of rock, including, as appropriate, approximate joint angles, presence of soil filled seams or cavities, color

Complete the log concurrently with drilling procedures (i.e., do not let the driller work faster than your ability to accurately represent the subsurface conditions).

In the appropriate column, record all observations with regard to environmental conditions, including staining, odors, foreign material, and presence of free product.

Information regarding rock coring procedures, including the length of the core run, recovered core length, rock quality designation, and fracture zones should be recorded on the rock core log. Provide rock descriptions, including rock type, hardness, grain size, structure, weathering, and color. Rock core logs should be completed for each core run.

Record relevant drilling observations such as advance rate (minutes per foot), water levels, drilling difficulties, changes in drilling method or equipment, amounts and types of any drilling fluids, running sands, and borehole stability.

Record the procedures and material used to abandon or seal each borehole upon completion. If the borehole is completed as a monitoring well, record the well construction details in accordance with SOP DM-007 Monitoring Well Construction and Installation.

Using the guidance in Attachment A, rock core logs should address:

- Rock Type: Igneous, metamorphic or sedimentary. Consult previous geologic maps published by USGS or State Geological Survey for formation name and general description.
- Rock Color: Use standard color wording; a color chart may be consulted (e.g. Munsell Color Chart).
- Field Hardness: Hard, medium, or soft based on scratch test with steel blade or nail.
- Bedding in Sedimentary Rock: Describe bedding presence, orientation, and type.
- Foliation in Metamorphic Rock: Describe foliation presence, orientation, and type.
- Grain Size Characteristics and Distribution : grain size. Sorting and angularity for sedimentary rocks.
- Weathering: General weathered state of the rock, differentiated from weathering on fractures. In particular, weathering or physical or chemical alteration which may be relevant to shearing or faulting should be thoroughly described.
- Fracturing: Fracture type, as applicable, and fracture surface character. In particular, fractures with features possibly relevant to shearing or faulting should be thoroughly described.
- Special Features: include fossils, marker bed features, vugs, unusual weathering features.
- RQD: as described in Attachments B and C.
- Bedrock Formation Name: As identifiable from geologic literature.
- Depths or depth ranges of any distinctive features should be specified on the log.

2.2 Rock Quality Designation (RQD)

In general, RQD is a modified core recovery percentage in which all the pieces of core which are over 4.0 in. long, are hard and sound, and are counted as recovery and expressed as a percent of the length of core drilled. Since RQD is an interpretive measure of rock quality, there are several factors, such as those listed below, which must be properly evaluated in order for RQD to provide reliable results.

Core Barrel size and Type: RQD is most frequently calculated for N size core or larger, obtained with double-tube core barrels. Smaller diameter cores and single-tube core barrels can reduce apparent rock core quality. RQD should not be calculated for core barrels smaller than N size (1.875 in. diameter). Size and type of core barrels and bits should always be recorded on core boring logs.

Soundness: Pieces of rock core that are not hard and sound should not be counted for the RQD, even if they meet the 4 in. length requirement.

Rock judged to be fresh or slightly weathered is to be included in the RQD count; moderately weathered rock is to be included also, but completely weathered and residual soil is to be disregarded in the RQD count.

Core Recovery: Reliable RQD measurements result when coring is done well and core recovery is at or near 100 percent. As core recovery varies from 100 percent, explanatory notes should be included in order to describe the reason for the variation and the effect on RQD.

Calculating RQD for Portion of Run: RQD is most frequently determined per core run. If the core runs vary greatly in length, RQD can also vary without significant changes in core quality. For instance, if 6.0 in. of poor rock is recovered in a 2.0 ft. core run, the RQD would be 75 percent. If the core run was extended to 5 ft. without encountering additional poor rock, the RQD would be 90 percent. In general, RQD should be based on consistent 5-ft. or 10-ft. long core runs as the Project Manager requests.

Discontinuities: Only natural discontinuities such as joints or shears should be considered when calculating RQD. Breaks in the core which are judged to be due to drilling and handling must be discounted in RQD considerations. Natural discontinuities, nearly parallel to the boring (e.g., vertical joints in a vertical boring) are not counted, if the rock is otherwise good.

3. Limitations

- A separate Field Observation Report should be completed after each day of drilling (see SOP FD-002 Field Observation Report), if requested by the Project Manager.

- Keep boring logs and rock core logs focused on actual observations. Record only factual information on the logs.
- The boring logs should be returned to GEI from the field in a legible form that can be used in a report directly or allow for typed logs in the same format if required for specific projects.

4. References

GEI Geotechnical Manual, dated January, 2004.

ASTM D6032-08 Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core, 2008

ASTM D2113-08, Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation, 2008

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Day, R.W., Geotechnical Engineer's Portable Handbook, McGraw-Hill, 2000.

D.U. Deere and D.W. Deere, The Rock Quality Designation (RQD) Index in Practice, Rock Classification Systems for Engineering Purposes, STP 984, ASTM, 1988,

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Engineering Geology Field Manual, Second Edition, Volume I, U.S. Department of the Interior, Bureau of Reclamation, 1998 Reprinted 2001.

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Field Guide For Rock Core Logging and Fracture Analysis, Midwest Geosciences Group Press, 2005.

Hunt, R.E., Geotechnical Engineering Investigation Handbook, Second Edition, Taylor & Francis Group, LLC, 2005.

U.S. Army Corps of Engineers, Rock Foundations, EM 1110-1-2908, November 30, 1994.

U.S. Army Corps of Engineers, Chapter 4 Borehole Logging, EM 1110-1-4000, November 1, 1998.

Walker, J. D. and Cohen, H.A., The Geoscience Handbook, AGI Data Sheets, Fourth Edition, 2006.

5. Attachments

Attachment A – Guidelines for Rock Description
Attachment B – Guidance for Computation of Rock Quality Designation Soil and Rock Core Log
Attachment C – ASTM D6032-08 Standard Test Method For Determining Rock Quality Designation (RQD) of Rock Core

6. Contact

Melissa Felter
Cathy Johnson

ROCK CLASSIFICATION

GEI Consultants, Inc.

ROCK DESCRIPTION FORMAT	DESCRIPTIVE TERMS		STANDARD DEFINITION
ROCK TYPE	Refer to Quarterly of the Colorado School of Mines, Volume 50, Number 1		
HARDNESS	VERY HARD		Can not be scratched with knife or sharp pick; breaking of hand specimens requires several hard blows of a geologist's hammer.
	HARD		Can be scratched with knife or pick only with difficulty; hard blow(s) of hammer required to break hand specimen
	MEDIUM HARD		Can be scratched with knife or pick up to 1/16 in. deep; hand specimens can be broken with moderate blow with hammer.
	SOFT		Can be readily gouged or grooved with knife or geologist's pick; can be excavated in chips to pieces several inches in size by moderate blows of a pick point; small thin piece can be broken by finger pressure.
	VERY SOFT		Can be carved with knife; can be excavated readily with point of pick; pieces one inch or more in thickness can be broken by finger pressure; can be readily scratched by finger nail.
GRAIN SIZE AND RANGE	IGNEOUS	FINE-GRAINED	Less than 1 mm (f-med sand range)
	METAMORHIC	MEDIUM-GRAINE	1mm to 5mm (med-coarse sand range)
	CRYSTALLINE SED.	COARSE-GRAIN	5mm and greater (fine gravel and larger)
	SEDIMENTARY		Use soil grain size
WEATHERING	FRESH OR UNWEATHERED		Rock fresh, crytals bright, few joints may show staining. Rock rings under hammer if crystalline.
	SLIGHTLY WEATHERED		Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in.(in outcrops). Joints may contain clay. In granitoid rocks, some occ. feldspar crysta are dull and discolored; crystalline rocks ring if struck with hammer.
	MODERATELY WEATHERED		Except for quartz, most of the rock mass shows discoloration and weathering effects; Rock has a dull sound under hammer and shows significant loss of strength as compared with fresh rock.
	SEVERELY WEATHERED		All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. Some fragments of stronger rock are usually left.
	COMPLETELY WEATHERED		Rock is decomposed to a soil. Rock fabric may not be descernible except in scattered locations. Quartz may be present as dikes or stringers.
DISCONTINUITIES (Nature, thickness, and spacing of rock mass defects)	JOINTS		Describe type, openness, spacing, dip angle, weathering
	SPACING		
	VERY CLOSE		Less than 2 inches
	CLOSE		2 inches to1 foot
	MODERATELY CLOSE		1 to 3 feet
	WIDE		3 to 10 feet
	VERY WIDE		Greater than 10 eet
	OTHER COMMON DISCONTINUITIES		
	SHEAR ZONES		
	WEATHERED ZONES		
	INFILLINGS		
	SLICKENSIDES		
	HYDROTHERMAL ALTERATION		
	CAVITIES,VOIDS, VESCICLES		
OTHER	FIELD STRENGH OR HARDNESS TESTS		Schmidt Hammer Tests; Point Load Tests
	ENGINEERING COMMENTS		
	MINERALOGICAL COMPOSITION		
	REACTION TO HCl		
	ROCK QUALITY DESIGNATION		
	ROCK MASS RATING		
STANDARD DEFINITIONS	ROCK QUALITY DESIGNATION (RQD)		RQD is the ratio of the cumulative length of pieces of sou core 4 inches or longer to the total penetration length of the core run. If the core is broken by handling or drilling, (i.e., the fracture surfaces are fresh and/or irregular rather than natural joint surfaces), the broken pieces are fitted together and counted as one piece provide they forn the requisite length of 4 inches.

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ROCK DESCRIPTION FORMAT	DESCRIPTIVE TERMS (See opposite side for definitions)	EXAMPLE DESCRIPTIONS		
		IGNEOUS	SEDIMENTARY	METAMORPHIC
1.ROCK TYPE (CAPITAL LETTERS) (Include definitive adjectives)	(See opposite side)	VESICULAR BASALT	CALCAREOUS SANDSTONE	BIOTITE SCHIST
2.HARDNESS	VERY HARD HARD MEDIUM HARD SOFT VERY SOFT	V. HARD	HARD	MEDIUM HARD TO SOFT
3.GRAIN SIZE AND RANGE (texture, fabric, angularity)	IGNEOUS - FINE, MED.,COARSE SEDIMENTARY - USE SOIL GRAIN SIZE (describe angularity of sedimentary particles)	APHANITIC	FINE GRAINED	FINE TO MED. GRAINED
4. STRUCTURE	FOLIATED STRATIFIED OR BEDDED SCHISTOSE MASSIVE LENSED BANDING LINEATION MICROFOLDING	MASSIVE	ALTERNATING 1 TO 2" THICK LAMINA OF FINE GRAINED, QUARZITIC SANDSTONE AND SANDY SILTSTONE. BEDDING DIPS UNIFORMLY AT 20-25 DEGREES.	WELL DEVELOPED SCHISTOSE TEXTURE; FOLIATION DIPS 25-30 DEGREES.
5.WEATHERING	FRESH OR UNWEATHERED SLIGHTLY WEATHERED MODERATELY WEATHERED SEVERELY WEATHERED COMPLETELY WEATHERED	FRESH	SL. WEATHERED THROUGHOUT.	MOD. WEATHERED CONTAINING 1-2" THICK SEVERELY WEATHERED ZONES
6. DISCONTINUITIES (Nature, thickness, and spacing of rock mass defects)	JOINTS (type,openess,spacing,weathering) SHEAR ZONES INFILLINGS WEATHERED ZONES SLICKENSIDES CAVITIES,VOIDS HYDROTHERMAL ALTERATION	GENERALLY INTACT WITH OCC. RANDOMLY ORIENTED, ROUGH, IRREGULAR JOINTS. SEVERAL SMALL 1/16-1/8" VESCICLES.	MOST JOINTS OCCUR AS SMOOTH, TIGHT, PLANAR, SURFACES ALONG BEDDING AT 2-14" SPACING,DIPPING 20-25 DEGREES. MINOR RUSTY WEATHERING EFFECTS ON JOINT SURFACES.	NUMEROUS OPEN, PLANAR JOINTS ALONG BIOTITE CONCENTATIONS; SPACED 1-3" APART. 1/2 -1" THICK ZONES ABOVE AND BELOW JOINTS WEATHERED TO OR NEARLY TO A SOIL (Silty Sand).
7. COLOR AND RANGE	*******	BLACK	ALTERNATING BROWN AND REDDISH-BROWN LAYERS	GRAY-moderately weathered YELLOW BROWN- severely weathered
8. LOCAL OR GEOLOGIC NAME	(Refer to geologic maps and reports)	HAMPDEN FORMATION	TRIASSIC RED BEDS	HARTLAND FORMATION
9.OTHER	FIELD STRENGH OR HARDNESS TESTS ENGINEERING COMMENTS MINERALOGICAL COMPOSITION REACTION TO HCl ROCK QUALITY DESIGNATION ROCK MASS RATING	RQD = 88%	SL. REACTION TO HCl	SCHMIDT HAMMER REB. NO. = 14

Sample ID	Rock Name	Rock Type	Formation	Location	Distinguishing Features
1	Gneiss	Metamorphic	Unknown	Farmington, NH	compositional layering (alternating light and dark mineral bands), alignment of platy minerals such as mica (muscovite=white, biotite=black), looks like banded granite.
2	Amphibolite	Metamorphic	Marlboro Fm.	Danvers, MA	describes a wide range of metamorphic grades, often have a lot of hornblende and plagioclase, can be dark green in color
3	Mylonite-Phyllonite	Metamorphic	Unknown	Blue Ridge Mts.	phyllite is similar to slate, but has silky rather than dull cleavage surfaces, mylonite-phyllonite is a ductily sheared phyllite look for "smeared" grains in a dark background, often occurs in shear zones
4	Basal Glacial Till	Sedimentary	Unnamed	Prompton, PA	laid down by base of the glacier (a kind of lodgment till vs. ablation till which often implies deposition by melt water), when unlithified-very dense (high blow counts), fabric (slight alignment of grains) with subangular pebbles/cobbles
5	Calc-Silicate	Metamorphic	Patridge Formation	Oakham, MA	metamorphic carbonate with abundant Si, looks like marble, but with more quartz, more defined crystals, low grades can see foliation and bedding, higher grades=more massive crystals
6	Biotite Schist	Metamorphic	Fm. Unknown	Philadelphia, PA	Biotite is black mica, look for alignment of mineral grains in schists, but not necessarily in alt. light or dark layers like gneiss
7	Gray Granite	Igneous	Conway Granite	Conway, NH	interlocking coarse grains/crystals, approximately equal amounts of light and dark minerals, "salt and pepper"

Sample ID	Rock Name	Rock Type	Formation	Location	Distinguishing Features
8	Pink Granite	Igneous	Unnamed Formatio	Burlington, MA	"pink" = K-feldspar, vs. gray granite dominated by white/gray feldspar =plagioclase
9	Pegmatitic Granite	Igneous	Binary Granite	Farmington, NH	grains in excess of 1 cm, interlocking grains, looks like a coarse grained granite
10	Diorite	Igneous	Salem Gabbro-Dior	Woburn, MA	think darker granite, or higher percentage of darker minerals to lighter minerals, coarse grains, more pepper than salt
11	Basalt	Igneous	Dike Rock	Nashua, NH	fine-grained, no foliation or bedding (linear features), denser than sedimentary rocks, often found in dikes
12	Granodiorite	Igneous	Ayer granodiorite	N. Chelmsford, MA	interlocking coarse grains/crystals, larger percentage of lighter grains to darker grains in rock, more salt than pepper
13	Red Shale	Sedimentary	New Haven Arkose	Hartford, CT	pink or red sometimes from K feldspars, very fine grained, bedding sometimes, not esp. dense
14	Argillite	Metamorphic	Cambridge Argillite	South Boston	Slightly metamorphosed mud or siltstone, intermediate between a shale and a slate
15	Conglomerate	Sedimentary	Roxbury Conglome	Newton, MA	clastic instead of interlocking grains (this particular example is slightly metamorphic so it is hard to see the difference between clastic and interlocking or crystalline), large grains in a fine grained matrix
16	Quartzite	Metamorphic	Kittery Formation	Portsmouth, NH	dense, looks like quartz, but generally not as glassy, sometimes semi-concoidal fracture (breaks in a circular pattern)
17	Basalt	Igneous	Unnamed Dike	Kittery, ME	fine-grained, no foliation or bedding (linear features), denser than sedimentary rocks, often found in dikes

Sample ID	Rock Name	Rock Type	Formation	Location	Distinguishing Features
18	Sandstone	Sedimentary	Fm. Unknown	North Carolina	clastic instead of interlocking grains, bedding, harder and denser than shale and limestone
19	Kaolinized Argillite	Metamorphic	Cambridge Argillite	Boston, MA	Kaolinite is a sheet silicate that occurs in clay sized fraction of rocks, soils, sedimentary rocks, and weathered and altered rocks, in this case it is a weathered metamorphic rock, looks like chalk, the term argillaceous refers to rock or sediment containing a significant amount of clay minerals
20	Quartzite	Metamorphic	Berwick Formation	Lowell, MA	dense, looks like quartz, but generally not as glassy, sometimes semi-concoidal fracture (breaks in a circular pattern)
21	Gneiss	Metamorphic	Unknown	Farmington, NH	compositional layering (alternating light and dark mineral bands), alignment of platy minerals such as mica, looks like banded granite.
22	Granite Gneiss	Metamorphic	Collinsville Fm	Southbury, CT	compositional layering (alternating light and dark mineral bands), alignment of platy minerals such as mica, looks like banded granite.
23	Granite-Augen Gneiss	Metamorphic	Fm. Unnamed	Wareham, MA	blastomylonitic texture (smeared/sheared big crystals), larger grains in finer grained material, crystals are often alkali or plagioclase feldspar (light crystal grains in dark background), augen means "eye" in German
24	Muscovite Schist	Metamorphic	Hartland Fm.	Southbury, CT	Muscovite alignment
25	Rhyolite	Igneous	Lynn Volcanics	Lynn, MA	fine-grained, interlocking crystalline texture, often pink or purple, fine grained equivalent of granite

Sample ID	Rock Name	Rock Type	Formation	Location	Distinguishing Features
26	Melaphyre	Igneous	Brighton Melaphyre	Brighton, MA	dark porphyry with feldspar crystals (big light colored crystals in dark matrix), sometimes has funky purple and green hue to it
27	Limestone	Sedimentary	Trenton Group	Hinckley, NY	soft, reacts with HCl, fossils sometimes
28	Black Shale	Sedimentary	Rhode Island Fm.	Brayton Point, RI	less dense than basalt, clastic, bedding sometimes, fossils sometimes
29	Red Shale	Sedimentary	Portland Fm	Holyoke, MA	pink or red sometimes from K feldspars, very fine grained, bedding sometimes, not esp. dense
30	Anthracite Coal, Organic Shale	Sedimentary	Rhode Island Fm.	Brayton Point,RI	not dense, often black, slightly shiny, looks like graphite

Attachment B

Guidance for Computation of Rock Quality Designation

The RQD is equal to the ratio expressed in per cent of the cumulative length of pieces of sound core 4 inches or longer to the total length of the core run.

1. If the core is broken by handling or by the drilling process (i.e., the fracture surfaces are fresh irregular breaks rather than natural joint surfaces), the fresh broken pieces are fitted together and counted as one piece provided that they form the requisite length of 4 inches.

2. Measure all pieces of cores longer than 4 in. except in cases of rock with vertical or near-vertical foliation which splits the rock into two halves, where the RQD measurements shall be 50% of the length of such pieces.

3. Always measure from the center of the high or low angle foliation.

4. The method of measurements in the case of very few pieces of a run smaller than 4" is to try to measure fully the length of rock in each compartment of the box and then deduct from it the total length of the pieces smaller than 4" to obtain the cumulative length of sound core. Conversely, if there are very few pieces of the core longer than 4" in any run, just measure those and add to obtain the cumulative length of sound core.

Boring Information

Northing : 1,282,273 **Easting :** 544,173
Horizontal Datum : NAD27 NY Central Zone
Ground Surface Elev. (ft): 256
Vertical Datum : NGVD29
Rig Type/I.D: Dietrich / BL2

Date Start - End: 8/21/2007 - 8/30/2007
Driller Name: Paul Dickensen
Logged By : Chad Conti
Drilling Company : Boart Longyear
Total Depth (ft) : 195.0

Final Boring Log

Boring No.
B106(MW)
Page 1 of 6

Drilling Information

Hammer Ident: SN I
Auger I.D: 4.25 inch
Auger Head Length: 6 inch
Casing I.D: 4 inch
Drill Rod O.D: 2.625 inch NW
Core Barrel Type: NQ2
Core Barrel I.D/O.D: 2 inch / 3 inch
Core Barrel Length: 13 ft
Drilling Method: 0-10.5 ft HSA, replace HSA with casing, 10.5 ft-195 ft coring (NQ2).

ABBREVIATIONS:

Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2 inch O.D. split spoon sampler.
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Length of Sound Cores>4 in / Pen.,%
HSA = Hollow-Stem Auger
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
NA, NM = Not Applicable, Not Measured
LL = Liquid Limit
PI = Plasticity Index
NV, NP = No value, Non-plastic

Elev. (ft)	Depth (ft)	Sample Info: Type	Sample No.	Rec./ Pen. (in)	Blows per 6 in. or RQD	Coring Time (min/ft)	Drilling Remarks and Engineering Geology Description of Rock Cores and Fractures	Fractures	Graphic Log	Soil-Sample Description Rock-Lithological Description
		X	S1	19/24	3-5-5-5	NA				S1: SILTY SAND (SM); ~65% sand, ~25% fines, ~10% fine gravel; non-plastic fines. Brown with streaks of light brown and yellow. TOPSOIL.
250		X	S2	24/24	1-3-4-5	NA				S2: (0-8") SILTY SAND (SM); ~65% sand, ~25% low plasticity fines, ~10% fine gravel. Brown with areas of rust colored oxidation. (8-24") SANDY LEAN CLAY (CL) 60% clayey fines (LL = 23, PI = 11), 31% mostly fine to medium sand, 9% fine gravel, gray with light brown, dark brown and reddish brown streaks. (Laboratory grain-size and Atterberg limit tests performed.) TOPSOIL.
	10									Approximate top of Oswego Sandstone at 8 ft.
			C1	46/54	60	3 3 3 3 3	Horizontal bedding-parallel fractures along siltstone beds.			C1: SANDSTONE WITH INTERBEDDED SILTSTONE, siltstone layers up to 3", fine-grained, planar fractures generally horizontal, some small cross-bedding in sandstone, fractures spaced 0.5-13", highly fractures zone of siltstone at 26-29.5".
240			C2	119/120	91	3 3 3 3 3 3 3 3 3 3 3	Crossbedding.			C2: SANDSTONE WITH INTERBEDDED SILTSTONE, predominantly sandstone with 5" layer of siltstone at 65" and uneven patches of siltstone throughout. Planar fractures spaced 1"-26", fine-grained, gray-green, hard sandstone, soft siltstone.
	20									
230			C3	121/120	98	3 3 3 4 3 3 3 3 3 3				C3: SANDSTONE WITH INTERBEDDED SILTSTONE, fractured zone of siltstone at 52-54", mottled segment 14-18", sandstone is gray-green, siltstone is gray. Planar fractures horizontal, 13-18" - zone of mottling (siltstone in sandstone).
	30									

Notes: Engineering geology description of rock cores and fractures by Stephen Potts.
Rock is hard, fresh, and unweathered unless otherwise noted.
Methane gas pocket at 130 ft.

Project Name: Nine Mile Point Site Characterization
City/State: Oswego, New York
GEI Project Number: 07223

DRAFT

GEI Consultants

Form 150.1 rev. 1

NINE MILE POINT SITE CHARACTERIZATION 1 NMP GINT LOGS.GPJ GEI DATA TEMPLATE.GDT 3/6/08

Ground Surface Elev. (ft): 256 **Date Start / End:** 8/21/2007 - 8/30/2007
Vertical Datum : NGVD29 **Total Depth (ft) :** 195.0

Final Boring Log

Boring No. **B106(MW)**

Elev. (ft)	Depth (ft)	Type	Sample No.	Rec./ Pen. (in)	Blows per 6 in. or RQD	Coring Time (min/ft)	Drilling Remarks and Engineering Geology Description of Rock Cores and Fractures	Fractures	Graphic Log	Soil-Sample Description Rock-Lithological Description
220	40	C4		120/120	97	3 3 3 3 3 4 3 3 3 3	Siltstone lenses in sandstone.			C4: SANDSTONE WITH INTERBEDDED SILTSTONE AND SHALE, planar fractures, some mottling at sandstone/siltstone contacts, sandstone is hard to medium (in areas of higher silt content), siltstone is soft. Gray-green, fine-grained sandstone; gray to dark gray siltstone, massive bedding in sandstone, fine lamination in siltstone.
210	50	C5		118/120	93	3 3 3 3 3 3 3 3 3 3				C5: SANDSTONE WITH INTERBEDDED SILTSTONE AND SHALE, mottling in top 10", core becomes predominantly siltstone and graywacke at 55" with mottling and possible storm event layers. 2 low angle fractures (~20° at 85"). Bottom 60" becomes siltstone with some shale.
										Top of Oswego Transition Zone at 55 ft.
200	60	C6		120/120	98	3 3 3 3 3 3 3 3 3 3	12-inch-thick shale layer. Cross-bedding.			C6: SILTSTONE WITH GRAYWACKE AND INTERBEDDED SHALE, top 5" silty shale bed. Possible marker bed. Hard to medium sandstones and graywackes, soft siltstone and shale, planar fractures spaced 3-24" and occurring at shale layers.
190	70	C7		121/120	95	3 3 3 3 3 4 4 4 4 4				C7: INTERBEDDED SANDSTONE, SHALE AND SILTSTONE, very disturbed layering with mottling and fossil layer of shell material/trace fossils. Thick sandstone bed at 97-113", otherwise all beds generally interbedded and <2". Sandstone is medium to hard, siltstone and shale are soft. Horizontal - low-angle planar fractures.
										Top of Pulaski Formation - Unit A at 71 ft.
180		C8		119/120	96	3 3 4 3	Bedding-parallel fractures.			C8: INTERBEDDED SANDSTONE AND SILTSTONE WITH SHALE (0-64") Mottling and trace fossils, predominantly siltstone. (64-119") Predominantly sandstone with siltstone and shale interbedded. Fractures planar and generally horizontal.

Notes: Engineering geology description of rock cores and fractures by Stephen Potts.
Rock is hard, fresh, and unweathered unless otherwise noted.
Methane gas pocket at 130 ft.

Project Name: Nine Mile Point Site Characterization
City/State: Oswego, New York
GEI Project Number: 07223

DRAFT

GEI Consultants

Ground Surface Elev. (ft): 256 **Date Start / End:** 8/21/2007 - 8/30/2007
Vertical Datum : NGVD29 **Total Depth (ft) :** 195.0

Final Boring Log

Boring No. **B106(MW)**

Elev. (ft)	Depth (ft)	Sample Info: Type	Sample No.	Rec./ Pen. (in)	Blows per 6 in. or RQD	Coring Time (min/ft)	Drilling Remarks and Engineering Geology Description of Rock Cores and Fractures	Fractures	Graphic Log	Soil-Sample Description Rock-Lithological Description
						3				
	80					4				
						4				
						3				
						3	Well-lithified fossil shell debris.			
						3				
170			C9	119/120	95	4				C9: Similar to C8. Fewer fossiliferous beds, interbedded sandstone, siltstone and shale throughout. Planar fractures, generally horizontal.
						4				
						4				
						3				
	90					4				
						4				
						4				
						3				
						3				
						3				
160			C10	121/120	99	3	Mottled appearance due to clasts of siltstone and sandstone.			C10: ALTERNATING BEDS OF SANDSTONE AND SILTSTONE/SHALE, well-defined layers with mottling throughout, layers range from 2-12" thick, some fossils present, planar, horizontal fractures.
						3				
						3				
						3				
						4				
	100					4				
						3				
						3				
						3				
						3				
										Top of Pulaski Formation - Unit B at 102.5 ft.
150			C11	121/120	96	3				C11: Similar to C10, sandstone becomes predominantly at ~96", planar fractures horizontal, some trace fossils, mottling. Quartz vug at 45", may contain small amount of calcite.
						3				
						3				
						3	Bedding-parallel fractures along siltstone and sandstone contacts.			
						3				
	110					3				
						3				
						3				
						3	Quartz vug.			
						3				
140			C12	121/120	81	3				C12: SANDSTONE WITH INTERBEDDED SILTSTONE AND SHALE from 0-61", siltstone with interbedded shale and sandstone from 61-121", planar fractures generally horizontal, highly fractured zones of shale at 9-11", 40-42", 73-74", 99-101".
						3				
						2				
						2				
						3				
	120					3	Laminated bedding in siltstone.			
						3	Fractured intervals in shale, 2-3 inches thick.			
						3				
						3	Sandstone clasts in siltstone.			
										Top of Pulaski Formation - Unit C at 119.5 ft.

Notes: Engineering geology description of rock cores and fractures by Stephen Potts.
Rock is hard, fresh, and unweathered unless otherwise noted.
Methane gas pocket at 130 ft.

Project Name: Nine Mile Point Site Characterization
City/State: Oswego, New York
GEI Project Number: 07223

DRAFT

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Form 150.2 rev. 1

NINE MILE POINT SITE CHARACTERIZATION 1 NMP GINT LOGS.GPJ GEI DATA TEMPLATE.GDT 3/6/08

Ground Surface Elev. (ft): 256 **Date Start / End:** 8/21/2007 - 8/30/2007
Vertical Datum : NGVD29 **Total Depth (ft) :** 195.0

Final Boring Log

Boring No.
B106(MW)
Page 4 of 6

Elev. (ft)	Depth (ft)	Type	Sample No.	Rec./ Pen. (in)	Blows per 6 in. or RQD	Coring Time (min/ft)	Drilling Remarks and Engineering Geology Description of Rock Cores and Fractures	Fractures	Graphic Log	Soil-Sample Description Rock-Lithological Description
						3				
130	130		C13	110/120	82	3 3 3 3 3 3 4 4 4 3	Methane gas pocket at 130 ft. Water gushing out of casing, readings over 10% LEL. Circulating water brought LEL to safe levels.			C13: SILTSTONE AND SHALE WITH INTERBEDDED SANDSTONE, 20" sandstone bed at 69", planar fractures generally horizontal. One vertical fracture at 6" due to drilling.
120	140		C14	124/120	88	4 4 4 3 3 3 3 3 3 3	Fracture along moderately-dipping bedding plane.			C14: ALTERNATING BEDS OF SANDSTONE AND SILTSTONE/SHALE, beds are ~2-24" thick. Some irregular fractures, fractured zone at 99-103" and driller-created fracture zone at ~118". Fracture at 91" also shows irregular vertical fracture just below.
110	150		C15	121/120	87	3 3 3 4 4 4 3 3 3 3				C15: Similar to C14, planar fractures generally horizontal.
100	160		C16	121/120	100	3 3 3 3 3 3 4 4 4 4	Well-lithified fossil shell debris.			C16: INTERBEDDED SANDSTONE, SILTSTONE AND SHALE, predominantly sandstone, 51"-thick sandstone layer at 47", fossiliferous zones at 4" and 26", planar and horizontal fractures.
										Top of Whetstone Gulf Formation - Unit A at 165 ft.
90			C17	124/120	85	4 4 3				

Notes: Engineering geology description of rock cores and fractures by Stephen Potts.
Rock is hard, fresh, and unweathered unless otherwise noted.
Methane gas pocket at 130 ft.

Project Name: Nine Mile Point Site Characterization
City/State: Oswego, New York
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NINE MILE POINT SITE CHARACTERIZATION 1 NMP GINT LOGS.GPJ GEI DATA TEMPLATE.GDT 3/6/08

Ground Surface Elev. (ft): 256
Vertical Datum : NGVD29
Date Start / End: 8/21/2007 - 8/30/2007
Total Depth (ft) : 195.0

Final Boring Log

Boring No.
B106(MW)

Elev. (ft)	Depth (ft)	Sample Info: Type	Sample No.	Rec./ Pen. (in)	Blows per 6 in. or RQD	Coring Time (min/ft)	Drilling Remarks and Engineering Geology Description of Rock Cores and Fractures	Fractures	Graphic Log	Soil-Sample Description Rock-Lithological Description
						3	Slickensides on moderately-dipping fracture surfaces.			C17: SILTSTONE WITH INTERBEDDED SHALE, predominantly siltstone with interbedded shale and very little interbedded sandstone, highly fractured zone at 15-27" with a fracture set of ~30°, other fractures are planar and horizontal, spaced 1-24", siltstone and shale are soft.
						4				
	170					4	Fractured interval - 1 ft thick.			
						4				
						4				
						4				
						4	Bedding-parallel fractures.			
						4				
80			C18	121/120	92	5				C18: INTERBEDDED SANDSTONE AND SILTSTONE, with shale layers, most fractures are planar and horizontal, 1 vertical fracture filled with calcite at 91-97".
						5				
						5				
						5				
						5				
	180					5				
						5				
						5	Vertical fracture in sandstone. Each end of fracture terminated in siltstone. Calcite filled.			
						5				
						5				
70			C19	120/120	83	5				C19: INTERBEDDED SANDSTONE AND SILTSTONE WITH SHALE, siltstone and shale are dark gray, sandstone in gray. Fractures planar and generally horizontal, vertical fracture at bottom of core was driller-created.
						5				
						5				
						5				
						5				
	190					5				
						5				
						5				
						5				
						5				
						5				
60										End of Boring at 195 feet. Groundwater Monitoring well installed upon completion (screen interval: 172 ft to 192 ft). See separate Groundwater Well Installation Log for details.
							General Comments about Core Samples:			
	200						Not all sub-horizontal bedding-parallel fractures depicted in fractures column.			
							Bedding-parallel fractures are most frequent in shale and siltstone and less common in sandstone.			
50							Vertical fractures occasionally present in sandstone beds.			
	210						Hand pressure produces bedding-parallel fractures in siltstone of Pulaski Formation during handling and transport.			

Notes: Engineering geology description of rock cores and fractures by Stephen Potts.
Rock is hard, fresh, and unweathered unless otherwise noted.
Methane gas pocket at 130 ft.

Project Name: Nine Mile Point Site Characterization
City/State: Oswego, New York
GEI Project Number: 07223

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Form 150.2 rev. 1

NINE MILE POINT SITE CHARACTERIZATION 1 NMP GINT LOGS.GPJ GEI DATA TEMPLATE.GDT 3/6/08

Ground Surface Elev. (ft): 256
Vertical Datum : NGVD29
Date Start / End: 8/21/2007 - 8/30/2007
Total Depth (ft) : 195.0

Final Boring Log

Boring No.
B106(MW)
Page 6 of 6

Elev. (ft)	Depth (ft)	Sample Information: Type	Sample No.	Rec./ Pen. (in)	Blows per 6 in. or RQD	Coring Time (min/ft)	Drilling Remarks and Engineering Geology Description of Rock Cores and Fractures	Fractures	Graphic Log	Soil-Sample Description Rock-Lithological Description
							Rock is hard, fresh, and unweathered unless otherwise noted. Fracture surfaces are generally unweathered unless otherwise noted.			

40 — 220
30 — 230
20 — 240
10 — 250
0

Notes: Engineering geology description of rock cores and fractures by Stephen Potts.
Rock is hard, fresh, and unweathered unless otherwise noted.
Methane gas pocket at 130 ft.

Project Name: Nine Mile Point Site Characterization
City/State: Oswego, New York
GEI Project Number: 07223

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Form 150.2 rev. 1

NINE MILE POINT SITE CHARACTERIZATION 1 NMP GINT LOGS.GPJ GEI DATA TEMPLATE.GDT 3/6/08

Designation: D 6032 – 02 (Reapproved 2006)

Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core[1]

This standard is issued under the fixed designation D 6032; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers the determination of the rock quality designation (RQD) as a standard parameter in drill core logging.

1.2 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D 6026.

1.2.1 The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. How one applies the results obtained using this standard is beyond its scope.

1.3 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound units are approximate.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 653 Terminology Relating to Soil, Rock, and Contained Fluids

D 2113 Practice for Rock Core Drilling and Sampling of Rock for Site Investigation

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D 5079 Practices for Preserving and Transporting Rock Core Samples

D 6026 Practice for Using Significant Digits in Geotechnical Data

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 For terminology used in this test method, refer to Terminology D 653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *core run*—in the most basic usage, the length of the interval measured from the depth each core sample was started to the depth at which drilling stopped and the sample was recovered from the core barrel. If required, the core run can also be defined to cover a specific length or lithology in the core samples.

3.2.2 *drill break*—any mechanical or man-made break in the core that is not natural occurring.

3.2.3 *intact core*—any segment of core between two open, natural discontinuities.

3.2.4 *rock quality designation (RQD)*—a modified core recovery percentage in which all pieces of sound core over 100 mm are counted as recovery.

3.2.5 *sound core*—any core which is fresh to moderately weather and which has sufficient strength to resist hand breakage.

4. Summary of Test Method

4.1 The RQD denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run, as shown in Fig. 1. Rock mechanics judgement may be necessary to determine if a piece of core qualifies as being intact and sound.

5. Significance and Use

5.1 The RQD was first introduced in the mid 1960's to provide a simple and inexpensive general indication of rock mass quality to predict tunneling conditions and support requirements. The recording of RQD has since become virtually standard practice in drill core logging for a wide variety of geotechnical investigations.

5.2 The RQD values provide a basis for making preliminary design decisions involving estimation of required depths of excavation for foundations of structures. The RQD values also can serve to identify potential problems related to bearing capacity, settlement, erosion, or sliding in rock foundations.

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.12 on Rock Mechanics.

Current edition approved May 1, 2006. Published June 2006. Originally approved in 1996. Last previous edition approved in 2002 as D 6032–02.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

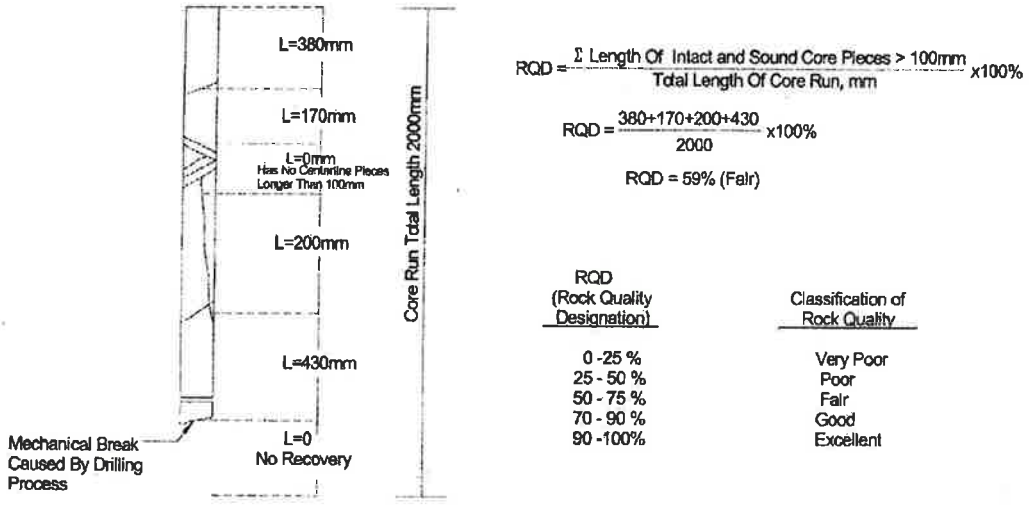

FIG. 1 RQD Logging Center Line Method[1]

The RQD can provide an indication of rock quality in quarries for concrete aggregate, rockfill, or large riprap.

5.3 The RQD has been widely used as a warning indicator of low-quality rock zones that may need greater scrutiny or require additional borings or other investigational work.

5.4 The RQD is a basic component of many rock mass classification systems for engineering purposes.

5.5 Used alone, RQD is not sufficient to provide an adequate description of rock mass quality. The RQD does not account for joint orientation, tightness, continuity, and gouge material. The RQD must be used in combination with other geological and geotechnical input.

5.6 The RQD is sensitive to the orientation of joint sets with respect to the orientation of the core. That is, a joint set parallel to the core axis will not intersect the core, unless the drill hole happens to run along the joint. A joint set perpendicular to the core axis will intersect the core axis at intervals equal to the joint spacing. For intermediate orientations, the spacing of joint intersections with the core will be a cosine function of angle between joints and the core axis.

5.7 Core sizes from BQ to PQ with core diameters of 36.5 mm (1.44 in.) and 85 mm (3.35 in.), respectively, are normally acceptable for measuring RQD as long as proper drilling techniques are used that do not cause excess core breakage or poor recovery, or both. The NX-size (54.7 mm [2.16 in.]) and NQ-size (47.5 mm [1.87 in.]) are the optimal core sizes for measuring RQD. The RQD is also useful for large core diameters provided the core diameter is clearly stated. The RQD calculated for core smaller than BQ may not be representative of the true quality of the rock mass.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D 3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D 3740 provides a means of evaluating some of those factors.

6. Procedure

6.1 Drilling of the rock core should be done in accordance with Practice D 2113. It is important that proper drilling techniques and equipment are used to minimize core breakage or poor core recovery, or both.

6.2 There are several ways to define a core run for calculating RQD. Three of these are: (*1*) a core run is equal to a drill run; (*2*) a change in formation or rock type could constitute an end of a core run; and (*3*) a core run can be a selected zone of concern. In determining a core run it is important to be consistent throughout a drill hole and to document how the core run was defined.

6.3 Retrieval, preservation, transportation, storage, and cataloging of the rock core should be done in accordance with Practices D 5079. The RQD should be logged on site when the core is retrieved because some rocks can disintegrate, due to poor curatorial handling, slaking, desiccation, stress relief, or swelling, with time. For these rocks it is recommended that the RQD be measured again after 24 h to assist in determining durability.

6.4 Close visual examination of core pieces is required for assessing the type of fracture (that is, natural or drill break). Pieces of core that are moderately or intensely weathered, contain numerous pores, or are friable, or combination thereof, should not be included in the summation of pieces greater than 100 mm (4 in.) for the determination of the RQD. Any rejected piece of core is still included as part of the total length of core run and should be noted in the report.

6.5 Measure all core piece lengths that are intact and greater than 100 mm (4 in.) to the nearest 1 mm (0.04 in.) and record on a RQD data sheet (Fig. 2). Measure such pieces along the centerline of the core as illustrated in Fig. 1[3]

NOTE 2—Centerline measurements ensure that the RQD value resulting from the measurements is not dependent on the core diameter. Centerline measurements also avoid unduly penalizing resulting RQD values for cases where fractures parallel the core axis. Any other method used for accounting for fractures parallel to the core axis, while not advocated by this test method and in the literature, must be clearly stated.[4,5]

6.6 Only those pieces of rock formed by natural fractures (that is, joints, shear zones, bedding planes, or cleavage planes that result in surfaces of separation) shall be considered for RQD purposes. The core pieces on either side of core breaks caused by the drilling process shall be fitted together and counted as one piece. Drilling breaks are usually evident by rough fresh surfaces. In some cases it may be difficult to differentiate between natural fractures and drilling breaks. When in doubt, count a fracture as a natural fracture. If for some reason there is not 100 % core recovery for a drill run, the length of core left in the borehole should be taken into account by adding it to the run in which it was cored rather than the run in which it was retrieved.

6.7 Record the top and bottom depths of each core run.

6.8 Sketch core features such as natural fractures, drilling breaks, lost core, highly weathered pieces, and so forth (see Fig. 1).

6.9 Include remarks concerning judgement decisions such as whether a break in a core is a natural fracture or a drilling break or why a piece of core longer than 100 mm (4 in.) was not considered to be intact.

6.10 Record the sum of intact core pieces longer than 100 mm (4 in.) long, and calculate the RQD value for the core run being evaluated.

6.11 Indicate the rock quality description for the core run using the rock quality table in Fig. 1.

7. Calculation

7.1 Calculate as a percentage, the RQD of a core run as follows:

$$\text{RQD} = \frac{[\Sigma\text{length of intact and sound pieces} > 100\text{ mm (4 in.)}]\times 100\ \%}{\text{total core run length, mm}} \quad (1)$$

In accordance with Practice D 6026, record the result to the nearest one percent.

8. Report

8.1 A typical report may include the following:

8.1.1 Source of sample including project name, location, and, if known, storage environment. The location may be specified in terms of borehole number and depth of core runs from the collar of the hole.

8.1.2 Description of drilling equipment, method, personnel, and hole orientation.

8.1.3 Physical description of core runs including diameter, rock type and location and orientation of discontinuities, such as, apparent weakness planes, bedding planes, schistosity, and large inclusions or inhomogeneities, if any.

8.1.4 Date of RQD calculations and sketches and/or photographs of core runs.

8.1.5 General indication of any conditions, observations, and assumptions relevant to the RQD values or calculations.

8.1.6 Include a table of RQD values and/or copies of any RQD data forms or sketches.

8.1.7 Report the rock quality classification for the core run using the table in Fig. 1.

9. Precision and Bias

9.1 *Precision*[6]—A round-robin study of the RQD index of cores of four selected types of sedimentary rock (anhydrite/calcite, calcareous shale, limestone, and anhydrite) with four replications per rock type was conducted in accordance with Practice E 691 by eight experienced participants.[7] The repeatability and reproducibility statistics reported in Table 1 refer to within-participant and between-participant precision, respectively. The probability is approximately 95 % that two results obtained by the same participant on the same material will not differ by more than the repeatability limit r. Likewise, the probability is approximately 95 % that two results obtained by different participants on the same material will not differ by more than the reproducibility limit R. The precision statistics are calculated from the following equation:

$$r = 2(\sqrt{2})s_r \quad (2)$$

where s_r = repeatability standard deviation, and

$$R = 2(\sqrt{2})s_R \quad (3)$$

where s_R = reproducibility standard deviation.

NOTE 3—Some combinations of the means and r and K can result in KQD limits that exceed 100 % because the RQD values have been assumed to be normally distributed which may not reflect the actual underlying distribution of the RQD values.

9.2 *Bias*—There is no accepted reference value for this test method; therefore, bias cannot be determined.

10. Keywords

10.1 classification; index; logging; quality; rock; rock core

[3] Deere, D. U., and Deere, D. W., "The Rock Quality Designation (RQD) After Twenty Years," *Rock Classification Systems for Engineering Purposes, ASTM STP 984*, 1988, pp. 91–101.

[4] Deere, D. U., and Deere, D. W., " Rock Quality Designation (RQD) Index in Practice," *Contract Report G1–89–1* , Department of the Army Corps of Engineers, 1989.

[5] Bieniawski, Z.T., "Exploration for Rock Engineering" *Proceeding of the Symposium on Exploration for Rock Engineering,* November 1976, Johannesburg, A.A., Balkema, Rotterdam.

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: ISRD18–1015.

[7] Pincus, H. J., and Clift, S. J., *Interlaboratory Testing Program for Rock Properties: Repeatability and Reproducibility of RQD Values for Selected Sedimentary Rocks*, PCN: 33-000011-38, ASTM Institute of Standards Research, 1994.

RQD DATA SHEET			
Project:			Date:
Core Box I.D. no.:		Recorder(s):	
Total Length of Core Run, mm (in):		Checker(s):	
Core Diameter, mm (in):		Date Checked:	
Depth, m (ft)	Sketch or Photographic Image of Core	Length of Each Sound Piece of Core > 100 mm (4-inch)	Remarks
• Lengths of Sound Pieces of Core > 100 mm (4-in):			
$RQD\ (\%) = \frac{\text{• Lengths of Sound Pieces of Core > 100 mm (4-in)} * 100\%}{\text{Total Length of Core Run, mm (in)}}$			
RQD (%) =		Rock Classification:	
Page ____ of ____			

FIG. 2 RQD Data Sheet

TABLE 1 RQD Index of Cores of Sedimentary Rock

Material (Rock Type)	Mean RQD, $\bar{x}$, %	Repeatability, r, % [A]	Reproducibility, R, % [A]
Anhydrite/calcite	86	28	28
Calcareous shale	60	32	40
Limestone	92	14	14
Anhydrite	86	20	20

[A] The numbers in the r and R columns are not to be taken as percentages of the means, but are applied as plus or minus terms to the respective means.

SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the last edition (1996) that may impact the use of this standard.

(1) Added to Section 1 required statement about significant figures and Practice D 6026.
(2) Added Terminology D 653, Practices D 3740, and D 6026
(3) Added Terminology Section , and renumbered subsequent sections.
(4) Added Note 1 in Significance and Use Section, referencing Practice D 3740, and renumbered subsequent notes.
(5) In Section 4.1 defined method as applicable to drill holes in any orientation and added the word "sound" between "intact rock". Changed "Engineering judgement" to Rock mechanics judgement" so that both the engineering and geological considerations were included.
(6) In Calculation Section, added the sentence: "In accordance with Practice D 6026, record the result to the nearest one percent.
(7) In Calculation Section, Note 2, corrected typographical error in a symbol and the abbreviation for RQD. Took out confusing discussion of vertical fractures since it pertains to any fracture that parallels the core axis and added references used to support this section.
(8) In Section 6.1 added words "and equipment" with "proper drilling techniques."
(9) In Section 6.3 added the influence of curatorial handling.
(10) Added Report Section and renumbered accordingly.
(11) Figure 1 — Added "Centerline Method" to title, added "intact and sound" to the formula and changed "Description of Rock Quality" to "Rock Quality Classification."
(12) Figure 2 — Fixed heading to include more relevant background data, added the words "intact and sound" to the formula, changed meters to millimeters, and added place to put the rock quality classification.

Appendix A5

GEI SOP GW-013
Piezometer Installation

Attachment A

Pressure calculation and Temperature correction Sheet

Vibrating Wire Piezometer

Pressure = (Initial Reading – Current Reading) x Linear Gage Factor

Or

$P = (R_0 - R_1) \times G$

Temperature Correction = (Current Temp. – Initial Temp.) x Thermal Factor

Or

$P_T = (T_1 - T_0) \times K$

Corrected Pressure = Pressure + Temperature Correction

Or

$P_{corrected} = ((R_0 - R_1) \times G) + ((T_1 - T_0) \times K)$

1	2	3

Note: If the Linear Gage Factor with the units of psi/digit and the Thermal Factor with the units of psi/°C are used, the calculated pressures will be in units of psi. To convert from psi to feet of water, multiply by 144 and divide by 62.4.

Estimated water pressure at piezometer tip = height of water above tip x unit wt. of water
Unit weight of water = 62.4 lb/ft^3

Note: The height of water must be in units of feet. The water pressure will be in units of feet of water.

Calculation Results:

1.) Initial Calculation – Planned installation depth:

Temperature-corrected pressure head: _____

Estimated water pressure at piezometer tip: _____

2.) Second Calculation – Raise piezometer 5 to 10 feet:

Temperature-corrected pressure head: _____

Estimated water pressure at piezometer tip: _____

3.) Third Calculation – Lower piezometer back to planned installation depth:

Temperature-corrected pressure head: _____

Estimated water pressure at piezometer tip: _____

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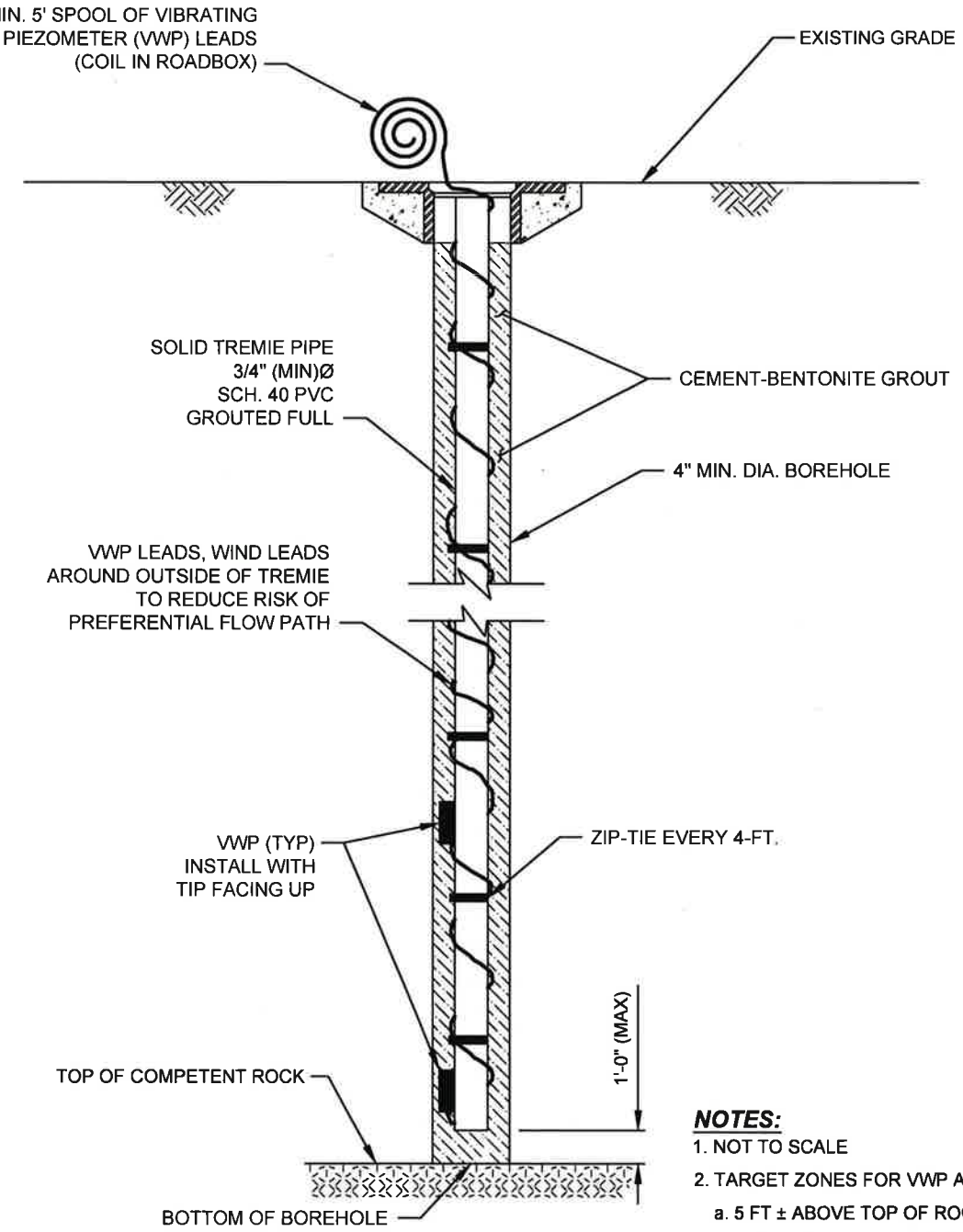

NOTES:

1. NOT TO SCALE
2. TARGET ZONES FOR VWP ARE:
   a. 5 FT ± ABOVE TOP OF ROCK
   b. 10 FT ± BELOW GROUNDWATER TABLE
3. ACTUAL VWP LOCATIONS WILL BE SELECTED BASED ON FIELD OBSERVATIONS DURING DRILLING PROGRAM.

Elmira Water Street MGP Site Elmira, New York	GEI Consultants	VIBRATING WIRE PIEZOMETER DETAIL
NYSEG Binghamton, New York	Project 1704633	April 2018 Fig. 1

\\geiconsulta B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\Miscellaneous\1704633_MISC_PIEZ.dwg - 4/17/2018

VW Piezometer

52611099

This equipment should be installed, maintained, and operated by technically qualified personnel. Any errors or omissions in data, or the interpretation of data, are not the responsibility of Durham Geo Slope Indicator (DGSI). The information herein is subject to change without notification.

SLOPE INDICATOR
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E-mail: solutions@slope.com
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Contents

Introduction

Applications

The VW piezometer is sealed in boreholes and embedded in fills to measure pore-water pressures. It can also be placed in standpipes and wells to measure water levels. Typical applications include:

- Monitoring dewatering schemes for excavations and underground openings.
- Monitoring ground improvement techniques such as vertical drains, sand drains, and dynamic compaction.
- Monitoring pore pressures to determine safe rates of fill or excavation.
- Investigating the stability of natural and cut slopes.
- Monitoring the performance of earthfill dams and embankments.
- Monitoring seepage and ground water movement in embankments, land fill dikes, and dams.
- Monitoring water levels in wells, standpipes, lakes, reservoirs, and rivers.

Theory of Operation

The VW piezometer converts water pressure to a frequency signal via a diaphragm and a tensioned steel wire. The piezometer is designed so that a change in pressure on the diaphragm causes a change in tension of the wire.

When excited by a magnetic coil, the wire vibrates at its natural frequency. The vibration of the wire in the proximity of the magnetic coil generates a frequency signal that is transmitted to the readout device. The readout device processes the signal and displays a reading.

Calibration factors, which establish a relationship between pressure applied to the diaphragm and the frequency signal returned to the readout device, are used to convert Hz readings to engineering units.

Installation

Installation Tips

Here are some installation tips.

Sensor Care

- Handle the piezometer with care.
- If you are working in cold weather, do not allow a water-filled piezometer or a saturated filter to freeze.

Cable Care

- Store cable where it is dry and safe from rodents and traffic.
- Handle cable carefully. Don't lay the cable across roads with traffic. Avoid dragging cable over rocks and sharp surfaces. Do not pull hard on the cable, since this may damage the conductors.
- Mark cables carefully for positive identification later.
- Protect the ends of signal cables so that water cannot enter the cable jacket. Cables should be terminated above ground level at a waterproof box or with waterproof connectors.
- If drill casing is used to hold the borehole open, it must be pulled out as backfill is placed. Use care when pulling casing so that you do not twist and damage the signal cable.

Saturating Filters

Most VW piezometers are supplied with filters that have a pore size of 50 to 60 microns. These filters pass both air and water, so they do not require elaborate saturation procedures. Pull off the filter, fill the piezometer with water, and replace the filter.

If your piezometer was supplied with a high-air entry filter, please refer to Appendix 2.

Obtaining Initial Readings

Drilling a borehole and backfilling it temporarily changes the pore-water pressure in the ground, so readings that are taken immediately after installation will not be good datum readings.

Recovery of the natural pore-water pressure may take a few hours to a few weeks, depending on the permeability of the soil. Recovery is signalled by stable readings over a period of a few days. A datum reading can then be obtained.

Borehole Installation (Grout-In Method)

This method is reliable and quick. It also works well for installing multiple piezometers in one borehole or installing piezometers along with inclinometer casing.

1. Drill the borehole below the required depth of the piezometer. Flush the borehole with water or biodegradable drilling mud.
2. Prepare the piezometer: Submerse the piezometer in a bucket of clean water, pull off the filter to allow air to escape from the piezometer, then replace the filter.
3. Tie the piezometer to its own signal cable, so that you can lower it, filter-end up, into the borehole. You may need to add weight (a bag of sand, etc). If the piezometer is installed with inclinometer casing, tape it, filter-end up, to the casing.
4. Back-fill the borehole with grout. Use either of the mixtures below as a starting point for your grout mix. Mix cement with water first, and then add the bentonite. Adjust the amount of bentonite to produce a grout with the consistency of heavy cream. If the grout is too thin, the solids and the water will separate. If the grout is too thick, it will be difficult to pump.

Grout Mix for Hard and Medium Soils		
Materials	Weight	Ratio by Weight
Portland cement	94 lb (1 bag)	1
Bentonite	25 lb (as required)	0.3
Water	30 gallons	2.5
Grout Mix for Soft Soils		
Materials	Weight	Ratio by Weight
Portland cement	94 lb (1 bag	1
Bentonite	39 lb (as required)	0.4
Water	75 gallons	6.6

5. Readings taken immediately after installation will be high, but will decrease as the grout cures. Datum readings can be taken hours to days after installation, depending on the permeability of the soil. The lag time caused by the grout itself is measured in minutes.
6. Terminate the installation as specified. It is important to terminate the cable above ground level in a waterproof enclosure or with a waterproof connector. Protect the installation from construction traffic and mark its location with a stake.

Appendix A6

GEI SOP GW-010
Slug Tests

STANDARD OPERATING PROCEDURE

GW-010 Slug Tests

1. Objective

Describe methods to use slugs, pressure transducers, and data loggers to collect data that will support calculation of horizontal hydraulic conductivity of distinct geologic strata.

General Information

Slug tests are performed on single monitoring wells to estimate the hydraulic conductivity of the aquifer in which the well is screened. The test consists of adding or removing a known volume (slug) to or from the well to instantaneously change the water level. Subsequently, the recovery of the water level back to the static water level is measured. The resulting data are used to determine the hydraulic conductivity of the aquifer test zone using an appropriate analytical method.

Falling head tests can only be performed in fully-penetrating wells (well screened completely below the water table). Rising head tests can be performed in both fully- and partial-penetrating wells.

2. Execution

2.1 Setup

- Determine how water levels will be recorded. If the geologic materials in the test zone are expected to be slightly permeable (e.g., a glacial till or clay), then measurements may be recorded manually with an electronic water level indicator. If the geologic materials in the test zone are expected to be moderately- or highly-permeable (e.g., outwash sands), record measurements using a pressure transducer attached to an automatic data logger.

  The remainder of this SOP assumes that an automatic data logger is being used to measure water levels.

- Check to see if test equipment functions prior to leaving for the site.
- Decontaminate the transducer and cable using alconox and distilled water. Do not use methanol. Do not use transducer in wells containing non-aqueous phase liquid (NAPL).
- Make initial water level measurements
- Test wells in the following order: from the least contaminated to the most contaminated, and from low to high expected permeability, where possible.
- Measure the static water level (i.e., depth to water) in the well to be tested manually using an electronic water level indicator. Record all

measurements taken during the test in the field log book or on the attached log form.

- Install the pressure transducer as far below the deepest point of insertion of the slug bar or bailer as possible. Allow the transducer to thermally equilibrate for 15 to 30 minutes (to allow instrumentation wiring to expand/contract) before measurements are taken.
- Secure the transducer cable at ground surface with tape or weight to keep the transducer at a constant depth.
- Cover sharp edges of the well casing with duct tape to protect the transducer cables.
- Transducer measurement setup: For wells screened in sand and silty sand, a linear setting of one reading per second is generally used. In coarser soil where full recovery may occur over a few seconds, a linear setting for more frequent readings is necessary. If a transducer is used for silt and clay, a linear setting of one reading per minute, or a logarithmic setting, may be used to avoid risk of exceeding the memory capacity of the transducer.

2.2 Field Procedure – Rising Head Test

In this test, a slug is inserted in the well prior to the test and the water level is allowed to return back to static level. The test is then started by removing the slug from the well and immediately measuring rising water levels. In wells where recovery is slow, this test can be performed by pumping or bailing water from the well and immediately starting measurements.

- Record the initial water level and other setup information on the attached form.
- Fully submerge the slug bar or bailer into the water column of the well.
- Allow the water level in the well to return to static condition after both the slug and transducer have been inserted. The transducer readout should indicate the height of water above the transducer.
- When the water level in the well has returned to static condition, start the transducer ("Start Test" if using Win Situ software). Periodically view graphical data during the test, to confirm adequate data collection.
- Rapidly remove the slug bar or bailer from the water column and well. Avoid moving or pulling up the transducer cable when removing the slug.
- Continue recording water levels with the transducer until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until one hour has elapsed. If less than 50 percent recovery has been achieved after one hour, continue to collect measurements every 10 to 20 minutes.
- Where possible, repeat the test to establish the repeatability of measurements and calculated hydraulic conductivity results.
- As soon as practicable, download data stored in the transducer and transfer data.

2.3 Field Procedure – Falling Head Test

In this test, a slug is inserted in the well at the start of the test and the falling water levels are measured immediately. In wells where recovery is slow, this test can be performed by adding water to the well and immediately starting measurements.

- Record the initial water level and other set up information on the attached form.
- Allow the water level in the well to return to static conditions after the transducer has been inserted. The transducer readout should indicate the height of water above the transducer.
- When the water level in the well has returned to a static condition, begin recording transducer readings ("Start Test" if using Win Situ software).
- Fully submerge the slug bar or bailer into the water column of the well.
- Periodically view graphical data during test, to confirm adequate data collection. The transducer should continue to record water levels until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until one hour has elapsed. If less than 50 percent recovery has been achieved after one hour, continue to collect a measurement every 10 to 20 minutes.
- Where possible, repeat the test to establish the repeatability of measurements and calculated hydraulic conductivity results.
- As soon as practicable, download data stored in the transducer and transfer data.

3. Additional Information

- Do not perform hydraulic conductivity tests on wells that have not previously been developed and allowed to equilibrate.
- It is critical to either add or remove the slug to the well as quickly as possible and to start collecting depth-to-water measurements immediately.
- The early-time data is critical because the rate of recovery of head in the well is exponential. Collect measurements frequently at the start of all variable head tests.
- The time required for a slug test to be completed is a function of the volume of the slug, the hydraulic conductivity of the formation, and the type of well completion. The slug volume should be large enough that a sufficient number of water level measurements can be made before the water level returns to equilibrium conditions. Two bailers connected in series can be used to increase the slug volume, provided the water column is deep enough.
- Decontaminate all down well equipment before using it in the well.

- NAPL will damage the transducer. Gauge recovery manually in these instances.
- Where possible, take periodic water level readings manually during recovery. The manual data are used to check for transducer noise or movement.
- If using automatic data loggers, download the data as soon as possible. Batteries in the data loggers may run down and result in a loss of data.
- Be prepared to containerize water generated from rising head tests if the water is contaminated.
- Where possible, take more than one pressure transducer to site. This will provide backup and allow testing of multiple wells simultaneously.

4. Calculations

The simplest interpretations of piezometer recovery are Hvorslev (1951) and Bouwer and Rice (1976). The analyses assume a homogenous, isotropic medium in which soil and water are incompressible. Spreadsheets and software are available to calculate hydraulic conductivity from slug test data according to the methods below.

Hvorslev's expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln (L/R)}{2 L T_0} \qquad for\ L/R > 8$$

where:
K = hydraulic conductivity [ft/sec]
r = casing radius [ft]
L = length of open screen (or borehole) [ft]
R = filter pack (borehole) radius [ft]
T_0 = Basic Time Lag [sec]; value of t on semi-logarithmic plot of H-h/H-H_0 vs. t, where H-h/H-Ho = 0.37
H = initial water level prior to removal of slug
H_0 = water level at t = 0
h = recorded water level at t > 0

(Hvorslev, 1951; Freeze and Cherry, 1979)

The Bouwer-Rice expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln (R_e/R) \ln(h_0/h_t)}{2 L t}$$

where:
r = casing radius [ft]
t = time of drawdown measurement since start of test [sec]

h = drawdown of water in well at time = t [ft]
h_o = drawdown of water in well at t = 0 (initial drawdown) [ft]
L = length of open screen (or borehole) [ft]
R_e = effective radius (radius of influence) [ft]
R = gravel pack radius [ft]

Both the Hvorslev and Bouwer-Rice methods can be applied for partially-penetrating wells. Hvorslev is generally applicable only to fully penetrating wells.

5. References

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Butler, James J., Jr., "The Design, Performance, and Analysis of Slug Tests", Kansas Geological Survey, Lewis Publishers, 1997.
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Fetter, C.W. (1994), Applied Hydrogeology, 3rd edition.

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Hvorslev, M.J., "Time Lag and Soil Permeability In Ground-water Observations," U.S. Army Corps of Engrs. Waterways Experiment Station Bulletin No. 36, 1951.

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U. S. EPA ENVIRONMENTAL RESPONSE TEAM STANDARD OPERATING PROCEDURES SOP: 2046,"Slug Tests" REV: 0.0, 10/03/94

6. Attachments

Attachment A – Slug Test Data Form

7. Contacts

Andy Adinolfi
Saskia Oosting

Attachment A. Slug Test Data Form

SITE ID: _____ SLUG TYPE (solid/bailer/pumped)

LOCATION/WELL ID _____ SLUG DIAMETER: _____

DATE: _____ SLUG LENGTH: _____

FIELD PERSONNEL: _____ METHOD:

_____ RISING HEAD _____

DATALOGGER TYPE: FALLING HEAD _____

_____

_____

COMMENTS:

_____

_____

==========

SETUP

Time _____
Depth to Water - Initial Static (before installing troll/slug) _____
Confirm well recovers to static after installing slug, or note otherwise

_____

==========

MANUAL CONFIRMATORY MEASUREMENTS

ELAPSED TIME (min.)	DTW	ELAPSED TIME	DTW
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Form based on:
USEPA, 1994; Sanders, 1998.

Appendix A7

GEI SOP GW-011
Permeability Testing

STANDARD OPERATING PROCEDURE

GW-011 Constant Head Permeability Testing

1. Objective

Describe procedures for performing constant head borehole permeability testing in granular soils. Constant head permeability testing is used when the soil permeability is sufficiently high for testing to be practical.

2. Execution

- All borehole permeability testing shall be performed below the static groundwater table. As the boring is advanced, attempt to determine the static groundwater level by:
  - Observing the water content of samples collected from the boring to identify the transition from moist to saturated soil.
  - For higher permeable soils, allowing the water level in the borehole to stabilize before performing the test.
  - If the borehole is left open overnight or for an extended period, measure the static groundwater level in the borehole at the beginning of the next day.
  - Measure the water level in nearby observation wells or piezometers.
  - If a well or piezometer is installed in the borehole, measure the water level in the well or piezometer after the water level has stabilized.
- Advance the drill casing to the top of the test zone and clean the borehole to the bottom of the casing.
- Obtain a split spoon sample in the test zone below the bottom of the casing.
- Advance the borehole 2 feet below the bottom of the casing using a side discharge roller bit. The roller bit should be only slightly smaller than the inside diameter of the casing. Record the diameter of the casing and the diameter of the roller bit. Avoid jetting the borehole walls or bottom during cleaning. Continue flushing the borehole until return water is clear.
- Measure the depth to groundwater in the borehole over a 10 to 15 minute period to observe if the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from split-spoon samples to the measured water level in the borehole.
- Using a weighted tape, sound the bottom of the borehole to verify that the hole is cleaned to the correct depth and caving hasn't occurred. If more than 3 inches of wash remains in the borehole, lower the roller bit back to the bottom of the borehole and continue to clean the borehole.
- Measure and record the depth to the bottom of the borehole to the nearest 0.05 feet.
- Determine the length of the test zone (L = distance from the bottom of the casing to the bottom of the borehole) to the nearest 0.05 feet and record on the field form.
- Add clean water to fill the casing.

- Using a calibrated flow meter, adjust the flow rate into the casing so the water level remains within 0.5 inches of the top of the casing. Once the water level has stabilized, take a flow meter reading at the start of the test (time=0). Record the inflow volume at regular intervals (generally 1 minute) for a period of 10 minutes.
- Check the depth to the bottom of the borehole after completion of the test to check for caving.
- Record all measurements and observations on the Borehole Permeability Test Field Data Form.

3. Limitations

Site-specific conditions must be evaluated to determine appropriate test intervals. Test interval shall be determined by the Project Manager or their designee.

4. References

GEI Procedure No. 44, Borehole Permeability Testing in Granular Soils

U.S. Department of the Interior Bureau of Reclamation Ground Water Manual, Chapter 10: Permeability Tests in Individual Drill Holes and Wells.

5. Attachments

Attachment A - GEI Borehole Permeability Test Field Data Form – Constant Head

6. Contacts

Steve Hawkins
Kari Weber

Appendix A8

GEI SOP SC-003
IDW Management

STANDARD OPERATING PROCEDURE

SC-003 Investigation Derived Waste

1. Objective

Describe characterization and management of Investigation Derived Waste (IDW) resulting from site investigation activities.

IDW is solid and/or aqueous waste generated during environmental site investigations.

2. Execution

- Determine the suspected contamination type and impacted media based on previous investigations, available analytical data, and/or site history.
- Consider the following when selecting IDW management option(s):
    - Anticipated volume of IDW to be generated during on-site activities
    - Potential contaminants and their concentrations
    - Proximity to population centers and the potential for unauthorized site access
    - Potential exposures to workers
    - Potential for environmental impacts
    - Community concerns
    - Potential storage areas
    - Regulatory constraints
    - Potential on-site treatment options
    - Duration of storage
    - Client concerns or requirements
- Review IDW Management Options summarized in Attachment A for each media suspected of contamination.
- Select IDW Management Option(s) prior to the commencement of field activities that will generate waste materials.
- Include the selected IDW Management Option(s) in the Field Plan or other project documents.

Considerations and guidelines for IDW management for specific field tasks are provided below.

2.1. Test Pit Excavation

- Segregate contaminated soil from uncontaminated soil using visual and/or field screening methods.
- Use appropriate barrier (such as two layers of 6-ml plastic sheeting) for temporary stockpiling of contaminated soil adjacent to test pit.

- Backfill test pits with uncontaminated soil, unless otherwise directed by project manager.
- If directed by the Project Manager to return contaminated soil to the test pit, backfill soil in the same order as the soil was excavated from the test pit.

2.2. Boring/Monitoring Well Installation

- For auger borings, segregate contaminated soil (determined by visual and/or field screening methods) from uncontaminated soil during drilling. Segregate residual contaminated soil from split-spoon sampling.
- Auger cuttings or sediment generated by drive and wash may be spread around the ground surface at the boring location if it is acceptable to the client and the governing regulatory agency. If not, IDW may be placed in an appropriate area or container pending characterization and appropriate disposal. (A useful rule of thumb is to assume generation of one 55-gallon drum of cuttings for each 20 feet drilled with 7-¼-inch-I.D. augers).
- Segregate contaminated drilling fluid from uncontaminated fluid for rotary wash borings.
- Drilling fluid management options include pouring the drilling fluid on the ground near the boring location, if acceptable to the client and governing regulatory agency, or containerizing the fluid in drums or tanks.

2.3. Well Development/Sampling

Contaminated groundwater removed from wells by pumping or bailing for the purpose of well development and sampling may be poured on the ground near the well, if it is acceptable to the client and the governing regulatory agency. Otherwise, it should be containerized in drums or tanks.

2.4. Decontamination Fluids

Decontamination fluids may be poured on the ground in the vicinity of the well if approved by the project manager. Alternatively, the fluids may be containerized in drums or tanks.

2.5. Disposable Personal Protective Equipment

Disposable personal protective equipment (PPE) should be managed like any other IDW. However, with the clients' and project manager's approval, it may be removed from the site and disposed of as ordinary rubbish if it has not come into contact with contaminated materials.

3. Limitations

- The simplest IDW management option is to return the IDW to its source location.
- However, the selected IDW management options must meet state/federal regulations and have the client's approval. Consult with state/federal policies for IDW-related matters.

- The client is responsible for the disposal of IDW, should disposal be necessary.

4. References

Guide to Management of Investigation - Derived Wastes (April 1992), United States Environmental Protection Agency, Publication 9345.3-03FS.

Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, Publication No. WSC-310-91.

5. Attachments

Attachment A - Summary of Investigation Derived Waste Management Options
Attachment B - CTDEP Waste Guidance

6. Contacts

David Terry
Leslie Lombardo

Attachment A: - SUMMARY OF IDW MANAGEMENT OPTIONS
GEI Consultants, Inc. Standard Operating Procedures
Management of Investigation - Derived Waste

Type of IDW	Generation Processes	Management Options	Remarks
Soil	Boring/monitoring well installation Test pit excavation Soil sampling	Return to source location immediately after generation	Acceptable, if authorized by the client, the governing regulatory agency, and the project manager.
		Spread around boring, test pit, or original source location	Acceptable, if authorized by the client, the governing regulatory agency, and the project manager.
		Containerize and temporarily store on site	Can temporarily store in stockpiles or covered containers (i.e. drums, roll-off containers). Stockpiles must be underlain by plastic sheeting and covered with plastic sheeting. Plastic sheeting must be secure. Storage consistent with state/federal regulations.
		Send to off-site, treatment or disposal facility within appropriate timeframes	Requires proper shipping documents (i.e. manifest, Bill of Lading, etc.), analytical characterization
		Store for future treatment and/or disposal.	Storage consistent with state/federal regulations. If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)
		Store temporarily awaiting laboratory analysis.	Storage consistent with state/federal regulations. Can temporarily store in stockpiles or covered containers (i.e. drums, roll-off containers). Stockpiles must be underlain by plastic sheeting and covered with plastic sheeting. Plastic sheeting must be secure.
Sediment/Sludge	Sludge pit sampling Sediment sampling	Return to source immediately after generation	Acceptable, if authorized by the client, the governing regulatory agency, and the project manager.
		Store temporarily on site.	Storage consistent with state/federal regulations.
		Send to off-site facility within 90 days	Requires manifests, analytical characterization
		Store for future treatment and/or disposal.	Storage consistent with state/federal regulations. If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)

Attachment A: - SUMMARY OF IDW MANAGEMENT OPTIONS
GEI Consultants, Inc. Standard Operating Procedures
Management of Investigation - Derived Waste

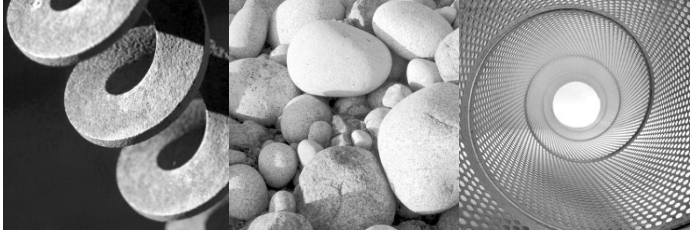
Type of IDW	Generation Processes	Management Options	Remarks
Aqueous liquids (groundwater, surface water, drilling fluids, other wastewater)	Well installation/development Well purging during sampling Ground water discharge - pump tests Surface water sampling	Pour onto ground close to well	Non-hazardous liquids only. Should not exhibit a sheen or separate phase product. Do not discharge to the ground up-gradient of the source location. Ensure that it is permissible by local, state, and Federal regulations Is acceptable to the client, the governing regulatory agency, and the project manager.
		Store temporarily on site	If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)
		Send to off-site commercial treatment unit within appropriate timeframes	Refer to State regulations for appropriate timeframe. Requires appropriate shipping documents (i.e., manifest, Bill of Lading), analytical characterization
		Send to POTW	Obtain appropriate discharge permit(s)
		Store for future treatment and/or disposal.	Storage consistent with state/federal regulations. Consistent with final remedial action
		Discharge to surface water	OK if it complies with state and federal regulations. Obtain appropriate discharge permit(s).
Decontamination fluids	Decontamination of PPE and equipment	Store temporarily on site	If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)
		Send to off-site facility within appropriate timeframes	Requires manifests, analytical characterization
		Store for future treatment and/or disposal. Storage consistent with state/federal regulations.	Consistent with final remedial action
Disposable PPE	Sampling, drilling, and test pit excavation observation, other on-site activities	Store temporarily on site	Dispose of appropriately after characterization
		Place in on-site industrial dumpster	Project-specific determination required – must be acceptable to client and project manager
		Send to off-site facility within 90 days	Project-specific determination required
		Store for future treatment and disposal.	Storage consistent with state/federal regulations. Project-specific determination required

Notes:

1) PPE - personal protective equipment
2) POTW - publicly owned treatment works
3) Generation processes listed here are provided as examples.
   IDW may also be generated as a result of other site activities.
4) RCRA Container/Waste Pile/Tank requirements:
   Containers; 40 CFR 264 Subpart I and 265 Subpart I
   Waste Piles; 40 CFR 264 Subpart L and 265 Subpart L
   Tanks; 40 CFR 264 Subpart J and 265 Subpart J

Appendix E

Quality Assurance Project Plan



GEI Consultants

Consulting
Engineers and
Scientists

Appendix E

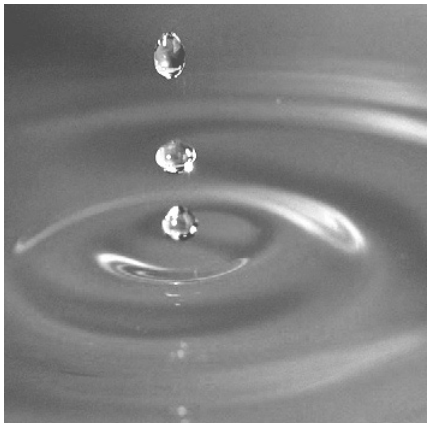
Quality Assurance Project Plan

Elmira Water Street MGP Site
Elmira, New York
NYSDEC Site # 808025

Submitted to:
NYSEG
18 Link Drive, P.O. Box 5224
Binghamton, NY 13902-5224

Submitted by:
GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

Project #1704633-1.2



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Abbreviations and Acronyms

ASP	Analytical Service Protocols
ASTM	American Society for Testing Materials
BTU	British Thermal Unit
CAR	Corrective Action Request
CERCLA	Comprehensive Environmental Response, Compensations and Liability Act
CHMM	Certified Hazardous Materials Manager
CLP	Contract Laboratory Protocol
COC	Compound of Concern
CRQL	Contract Required Quantitation Limits
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GC/MS	Gas Chromatography/Mass Spectroscopy
GEI	GEI Consultants, Inc., P.C.
HASP	Health and Safety Plan
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Sample
LTTD	Low-Temperature Thermal Desorption
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NIST	National Institute of Standards and Technology
NOAA	National Oceanographic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSEG	New York State Electric and Gas Corporation
PAH	Polycyclic Aromatic Hydrocarbons
PAH 34	PAHs defined by EPA for Sediment Toxicity Evaluation
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
P.G.	Professional Geologist
PID	Photo-ionization Detector
PM	Project Manager
PQL	Practical Quantification Limit
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RDWP	Remedial Design Work Plan
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Risk Specific Dose
SC	Site Characterization
SD	Standard Deviation
SOP	Standard Operating Procedures

SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transporation
VOC	Volatile Organic Compound

Quality Assurance Glossary

"Analytical Services Protocol" or "ASP" means the New York State Department of Environmental Conservation (NYSDEC's) compendium of approved United States Environmental Protection Agency (EPA) and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

"Confirmatory sample" means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as "post remediation sample."

"Contract laboratory program" or "CLP" means a program of chemical analytical services developed by the EPA to support Comprehensive Environmental Response, Compensations and Liability Act (CERCLA).

"Data Usability Summary Report, (DUSR)" is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

"Effective solubility" means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

"Environmental Laboratory Accreditation Program" or "ELAP" means a program conducted by the New York State Department of Health (NYSDOH), which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

"Intermediate sample" means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

"Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

"Non-targeted compound" means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

"Practical quantitation level" or "PQL" means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

"PAH" means polycyclic aromatic hydrocarbon as defined by EPA Method 8270C.

"Quality assurance" or "QA" means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

"Quality Assurance Project Plan" or "QAPP" means a document, which presents in specific terms the policies, organization, objectives, functional activities, and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

"Quality control" or "QC" means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

"Semi-volatile organic compound" or "SVOC" means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semi-volatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

"Target analyte list" or "TAL" means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/elements.

"Targeted compound" means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a Gas Chromatography/Mass Spectroscopy (GC/MS) analytical method, which has been tentatively, identified using a mass spectral library search. An estimated concentration of the TIC is also determined.

"Unknown compound" means a non-targeted compound, which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

"Volatile organics" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 8260C or those target compounds identified as volatiles in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

1. Project Description

This Quality Assurance Project Plan (QAPP) specifies the quality control and quality assurance procedures to ensure the generation of statistically valid data. Procedures are equivalent to those specified in the *United States Environmental Protection Agency's QA/R-5 "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," "Test Methods for Evaluating Solid Waste," EPA SW-846, Third Edition*, and its promulgated updates, unless noted otherwise in the following sections.

For the Pre-Design Investigation (PDI) at the Elmira Water Street Manufactured Gas Plant (MGP) site in Elmira, New York, a New York State Department of Health (NYSDOH)-approved Environmental Laboratory Accreditation Program (ELAP) certified laboratory will be utilized for the analysis of the waste characterization samples. A contract laboratory or GEI's geotechnical laboratory will be used for the analyses of the geotechnical samples.

1.1 Introduction

A description of the Elmira Water Street MGP site is included in the Remedial Design Work Plan (RDWP).

1.2 Scope of Work

The scope of work for the PDI is described in the PDI Work Plan.

1.3 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements to ensure that data of known and appropriate quality are obtained during sampling and analysis activities. Data developed during the site investigation will be used to fulfill the overall objectives of the program.

1.3.1 Laboratory Data Quality Levels

There are five analytical levels of data quality which may be used to accomplish specific project objectives. They are designated as follows:

- **Level 1** – Reports include a brief narrative, results and chain of custody documents only.
- **Level 2** – Reports include all of the elements of a Level 1 Report, plus summarized basic batch QC results (i.e. MS/MSD, LCS, MB, etc.). Instrument raw data is not included.

- **Level 3** – Reports include all of the elements of a Level 2 Report, plus forms from the instrument for organics and metals analyses. CLP-type forms are included, without raw instrument data.
- **Level 4** – Reports include all of the elements of a Level 3 Report, and also include all instrument raw data and chromatograms. The report is consistent with full CLP-like data package. It is also consistent with the preparation of a NYSDEC ASP Category B Deliverable Package, which is then used to prepare a NYSDEC Data Usability Summary Report (DUSR).
- **Level 5** – Reports for non-standard analytical methods. Some forensic analyses may be included at this level.
- **American Society for Testing Materials (ASTM) Methods** – Utilized for some waste characterization analyses and the geotechnical samples. Results include some raw data, as applicable for the analyses.

To meet the specific objectives of this project, Level 2 DQOs will be utilized for the waste characterization samples.

ASTM Methods will be used to analyze the geotechnical samples, and also for some of the waste characterization samples that are required by the waste treatment or disposal facilities. A Standard Report will be prepared for the analyses, which is equivalent to a Level 2 Report described above.

1.3.2 Field Data Quality Levels

There are two levels of field data quality which may be used to accomplish specific project objectives. They are designated as follows:

- **Level I** – Field screening or analysis using portable instruments, calibrated to non-compound specific standards.
- **Level II** – Field analysis using portable instruments, calibrated to specific compounds.

Both Level I and Level II analyses will be performed in the field for the PDI, for the field screening of soil samples and the work zone safety and CAMP monitoring (Community Air Monitoring Plan).

2. Project Organization

This PDI will be performed for NYSEG by GEI Consultants, Inc., P.C. (GEI). GEI will arrange for the drilling and analytical services, and will provide an on-site field representative to perform the soil characterization and associated soil sampling.

Key contacts for this project are as follows:

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3. Quality Assurance/Quality Control Objectives for Measurement of Data

3.1 Introduction

The quality assurance and quality control (QA/QC) objectives for all quantitative measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in the following subsections. They are formulated to meet the requirements of the NYSDEC and EPA SW-846.

3.2 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value [EPA, 1987]. Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	Relative percent difference.
V1, V2	=	The two values to be compared.
|V1 - V2|	=	The absolute value of the difference between the two values.
(V1 + V2)/2	=	The average of the two values.

The DQOs for analytical precision, calculated as the RPD between duplicate analyses, are presented in Tables 1 and 2.

3.3 Accuracy

Accuracy is a measure of the degree of agreement between a measured value and the true or expected value of the quantity of concern [Taylor, 1987], or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

- %R = Percent recovery.
- SSR = Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.
- SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.
- SA = Spiked analyte: concentration of the analyte spike

added to the sample.

The acceptance limits for accuracy for each parameter are presented in Tables 1 and 2.

3.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program [EPA, 1987]. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

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

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow EPA-approved procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate, and chain-of-custody procedures are presented in Sections 4 and 5.

3.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid [EPA, 1987]. The QC objective for completeness is the generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.
V = Number of measurements judged valid.
T = Total number of measurements.

3.6 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another [EPA, 1987]. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project.
- Requiring traceability of all analytical standards and/or source materials to the EPA or National Institute of Standards and Technology (NIST).
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable).
- Using standard reporting units and reporting formats including the reporting of QC data.
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate.
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

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

4. Sampling Program

4.1 Introduction

The sampling program was developed to provide analytical and field data that can be used to satisfy the project objectives. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. Sample locations, and the number of environmental and QC samples to be collected, are summarized in Table 2.

4.2 Analytical Methods

The laboratory samples for each media and the chemical analyses to be performed, including the QA/QC samples, are included in Table 2. These analyses are summarized below.

4.2.1 Geotechnical Analyses

Soil samples from each sample interval will be collected during drilling, and each soil strata observed during the drilling program (fill, silt, sand and gravel alluvium, and clay) will have a bulk sample collected and submitted to a geotechnical laboratory for the following analyses:

- **Grain Size – Sieve and Hydrometer** - ASTM D422 and D1140 / T88 - Sieve and Hydrometer if fines > 10%.
- **Atterberg Limits** - ASTM D4318.
- **Moisture (water) Content** - ASTM D2216.

These tests will help to confirm the field soil classification, and will also assist in the estimation of soil parameters that may be used in the design of excavation support. A Level 2 Report will be prepared for the analyses.

4.2.2 Low-Temperature Thermal Desorption Facilities

The waste characterization profile for low-temperature thermal desorption (LTTD) facilities is based on the results of the facility acceptance analyses listed below for LTTD at ESMI's Fort Edward, New York facility. The characterization required by ESMI is summarized below.

Coal Tar / MGP Soils:

- Total Petroleum Hydrocarbons (TPH) – Method 8015 GRO/DRO
- Total Volatile Organic Compounds (VOCs) – Method 8260C

- Total Semi-volatile Organic Compounds (SVOCs) – Method 8270D
- Total Polychlorinated Biphenyls (PCBs) – Method 8080
- Total Metals – Method 6010B
- Total Cyanide – Method 9014A
- Total Sulfide – Method 9030B/9034
- Percent Sulfur – ASTM Method D129-64
- British Thermal Unit (BTU) – ASTM Method D240-87

A Level 2 Report will be prepared for the analyses.

4.2.3 Landfill Facilities

Excavated materials may also be disposed of as non-hazardous material at a landfill facility. To meet the sample requirements of the target landfill facilities, the pre-characterization samples will be analyzed for the following:

- Toxicity Characteristic Leaching Procedure (TCLP) ZHE Extraction –EPA Method 1311;
- TCLP VOC – Method 1311/8260B;
- TCLP SVOC – Method 1311/8270C;
- TCLP Inductively Coupled Plasma (ICP) Metals – Method 6010B;
- TCLP Herbicides – Method 1311/8151A;
- TCLP Pesticides – Method 1311/8081A;
- TPH – 8015 GRO/DRO;
- VOCs Target Compound List (TCL) – Method 8260C;
- SVOCs TCL – Method 8270D;
- Total Cyanide – Method 9014A;
- PCBs – Method 8082;
- Reactive Sulfide – Method 7.3.4.1;
- Reactive Cyanide – Method 7.3.3.2;
- Ignitability – Method 1010/Flashpoint;
- Corrosivity / pH – Method 9045;
- Total Residue/Percent Solids – ASTM D-2216-90; and

- Target Analyte List (TAL) Metals – 6000-7000 Method Series.

A Level 2 Report will be prepared for the analyses.

4.3 Sample Container Preparation and Sample Preservation

Sample containers delivered to the field will be new and certified clean by the selected laboratory. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged, and the appropriate chemical preservatives will be added. The types of containers are shown in the attached tables. However, all containers sent by the laboratory will be finalized by the laboratory prior to shipment.

Samples shall be preserved according to the preservation techniques listed in the attached tables. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4° ± 2° C with ice, and delivered to the laboratory within 48 hours of collection under chain-of-custody. Chain-of-custody procedures are described in Section 5.

4.4 Sample Holding Times

The sample holding times for organic and inorganic parameters and the TCLP analyses are listed in the attached tables.

4.5 Field Quality Control Samples

Field QC samples will consist of a sample duplicates that will be collected to assess field sampling performance.

The duplicates will consist of:

a. **Coded field duplicate** - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are duplicate samples. This will eliminate any possible bias that could arise. The coded field duplicates will be taken at a frequency of one duplicate per 20 field samples.

5. Sample Tracking and Custody

5.1 Introduction

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the chain-of-custody and transfer of samples will be trained on the purpose of the chain-of-custody and specific procedures prior to implementation.

Evidence of sample traceability and integrity is developed by implementation of, and adherence to, the chain-of-custody procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is presented in Figure 1. A sample is considered to be in a person's custody if the sample is:

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

5.2 Field Sample Custody

A chain-of-custody record (Figure 2 or equivalent) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the chain-of-custody must be completed for each sample set collected.

The chain-of-custody lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The chain-of-custody also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the chain-of-custody record will be sent with each sample.

The REMARKS space on the chain-of-custody is used to indicate if the sample is an MS/MSD, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and equipment blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and

the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper air bill number on the top of the chain-of-custody. Errors will be crossed out with a single line in ink and initialed and dated by the author.

One copy of the chain-of-custody is retained by sampling personnel and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The chain-of-custody seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample(s) will not be analyzed.

5.3 Laboratory Sample Custody

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the chain-of-custody record and record the date and time received.
- Care will be exercised to annotate any labeling or description errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.
- The samples will be stored in a secured area and, if required, stored at a temperature of 4°± 2° C.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis and final storage for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

6. Calibration Procedures

6.1 Field Instruments

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the FSP. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader in a notebook. Copies of all the instrument manuals will be maintained on site by the Field Team Leader. Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photo-ionization detector and explosimeter) are provided in the Health and Safety Plan. More frequent calibration may be needed depending on conditions encountered in the field.

6.2 Laboratory Instruments

The laboratory will follow all calibration procedures and schedules as specified in the sections of the EPA SW-846 and NYSDEC and subsequent updates as they apply to the instruments used for the analytical methods.

7. Analytical Procedures

7.1 Introduction

Samples will be analyzed according to methods approved by the July 2005 NYSDEC Analytical Services Protocol (ASP) program or EPA SW-846 "*Test Methods for Evaluating Solid Waste,"* November 1986, 3rd edition, and subsequent updates [EPA, 1986].

ASTM methods will be used for the geotechnical analyses and some of the waste characterization samples.

The methods to be used for the laboratory analysis of soil samples are listed in Table 2. These methods were selected because they attain the DQOs required for the project, and the quantitation limits that are listed in the attached tables.

The Project Manager shall ensure that laboratories (primary or subcontracted) generating data in support of NYSEG remediation and investigative projects maintain the relevant state and federal government regulatory accreditations, certifications, and/or registrations to perform the required analyses.

8. Data Reduction, Assessment, and Reporting

8.1 Data Reduction

Data collected during the field investigation will be reduced in accordance with NYSDEC protocols. The procedures for identification and quantification of the analytes will be specified in the July 2005 NYSDEC ASP or EPA SW-846 *"Test Methods for Evaluating Solid Waste,"* November 1986, 3rd edition and subsequent updates and peer reviewed by laboratory supervising personnel.

8.2 Data Usability Summary Report

DUSRs will not be required for the PDI analytical packages. Level 2 Reports are sufficient to provide the waste characterization data to the landfill or treatment facilities, and also for the geotechnical analyses.

8.3 Data Validation

Validation will not be performed for the PDI analytical packages.

8.4 Data Reporting

The data package provided by the laboratory will contain all items discussed above for a Level 2 report. Data quality issues will be discussed in a case narrative included with the data report. The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

One copy of the analytical data packages in an electronic disk deliverable format will be provided by the laboratory approximately 30 days after receipt of a complete sample delivery group.

8.4.1 NYSDEC Data Submittal

The NYSDEC has implemented an Environmental Information Management System (EIMS). The EIMS uses the database software application EQuIS™ from EarthSoft® Inc.

The data submitted to the DER will be in the NYSDEC-approved Electronic Data Deliverable (EDD). New data will be submitted on a continuous basis immediately after data validation occurs but in no event more than 90 days after the data has been submitted to the Consultant. The EDD format will be provided by the NYSDEC.

9. Internal Quality Control Checks and Frequency

9.1 Quality Assurance Batching

Each set of up to 20 samples submitted to the laboratory will be analyzed concurrently with associated calibration standards, method blanks, MS/MSD or laboratory duplicates, and QC check samples (if required by the protocol). Note that the MS/MSD samples will be provided with the field samples and identified by the field personnel.

9.2 Calibration Standards and Surrogates

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the EPA or NIST, or other similar nationally-recognized program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard working solutions are replaced monthly or more frequently, based upon data indicating deterioration. No stock or working standard will be used past the manufacturer's expiration date.

9.3 Organic Blanks and Matrix Spike

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives". The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO^4$. The matrix spike is generated by addition of analyte and surrogate standards to a designated field sample.

10. Quality Assurance Performance Audits and System Audits

10.1 Introduction

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the project quality assurance officer (QAO). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate QA management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 System Audits

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory QC procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected, additional audits may occur.

10.3 Performance Audits

The laboratory is required to perform periodic analyses of Performance Evaluation samples to maintain accreditation and/or state regulatory certifications. Performance Evaluation samples are obtained from an EPA-approved vendor or a state agency and must be analyzed by the laboratory at least semi-annually.

10.4 Formal Audits

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that QA requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be out of compliance shall be identified at exit interviews conducted with the involved management. Compliance deviation will be logged, and documented through audit findings which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within 15 days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

11. Preventive Maintenance Procedures and Schedules

11.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce downtime, if any. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 Schedules

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

12. Corrective Action

12.1 Introduction

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

12.2 Procedure Description

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader, and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined to be deficient
- When equipment or instrumentation is found to be faulty
- When samples and analytical test results are not clearly traceable
- When QA requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/field comparison studies
- As required by EPA SW-846

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with QA requirements will be documented. Corrective actions will be mandated through audit finding sheets

attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to QA functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 3 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions were implemented and effective, documented, and approved.

References

EPA, 1986. SW-846 "Test Method for Evaluating Solid Waste," dated November 1986 and subsequent updates. U.S. Environmental Protection Agency, Washington, D.C.

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EPA, 2001. CLP Organics Data Review and Preliminary Review based on CLP/SOW OLM04.2. SOP No. HW-6, Revision 12 dated September 2005. EPA Region II.

EPA, 2005. Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW - ILM05.3. SOP No. HW-2, Revision 13, dated January 1992. EPA Region II.

NYSDEC, Analytical Services Protocol, July 2005.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan.

Tables

Table 1
Quality Control Limits for Soil Samples

Laboratory Accuracy and Precision							
Analytical Parameters	**Analytical Method[a]**	**Matrix Spike (MS) Compounds**	**MS/MSD[b] % Recovery**	**MS/MSD RPD[c]**	**LCS[d] % Recovery**	**Surrogate Compounds**	**Surrogate % Recovery**
VOCs (e)	8260B	1,1-Dichloroethane	70-142	22	70-142	Toluene-d8	71-125
		Trichloroethene	79-121	24	79-121	p-Bromofluorobenzene	72-126
		Benzene	78-122	25	78-122	1,2-Dichloroethane-d4	64-126
		Toluene	74-123	25	74-123		
		Chlorobenzene	79-118	25	79-118		
SVOCs (f)	8270C	Phenol	36-110	25	36-110	Nitrobenzene-d5	35-113
		2-Chlorophenol	38-104	26	38-104	2-Fluorobiphenyl	43-119
		1,4-Dichlorobenzene	34-120	30	34-120	p-Terphenyl-d14	51-125
		N-Nitroso-di-n-propylamine	46-120	20	46-120	Phenol-d5	36-116
		1,2,4-Trichlorobenzene	39-105	24	39-105	2-Fluorophenol	30-107
		4-Chloro-3-methylphenol	49-125	20	49-125	2,4,6-Tribromophenol	46-129
		Acenaphthene	53-119	16	53-119		
		4-Nitrophenol	44-137	25	44-137		
		2,4-Dinitrotoluene	55-125	19	55-125		
		Pentachlorophenol	33-136	27	33-136		
		Pyrene	51-133	25	51-133		
PCBs	8082A	PCB 1016	59-154	50	59-154	Decachlorobiphenyl	34-148
		PCB 1260	51-179	50	51-179	Tetrachloro-m-xylene	35-134
Pesticides	8081A	4,4'-DDD	45 - 129	18	45 - 129	DCB Decachlorobiphenyl	42 - 146
		4,4'-DDE	49 - 120	16	49 - 120	Tetrachloro-m-xylene	37 - 136
		4,4'-DDT	47 - 145	17	47 - 145		
		Aldrin	35 - 120	24	35 - 120		
		alpha-BHC	49 - 120	19	49 - 120		
		alpha-Chlordane	45 - 120	13	45 - 120		
		beta-BHC	46 - 120	17	46 - 120		
		delta-BHC	45 - 123	14	45 - 123		
		Dieldrin	47 - 120	13	47 - 120		
		Endosulfan I	29 - 125	16	29 - 125		
		Endosulfan II	39 - 121	17	39 - 121		
		Endosulfan sulfate	43 - 120	14	43 - 120		
		Endrin	44 - 127	19	44 - 127		
		Endrin aldehyde	33 - 120	23	33 - 120		
		Endrin ketone	50 - 150	14	50 - 150		
		gamma-BHC (Lindane)	50 - 120	20	50 - 120		
		gamma-Chlordane	51 - 120	14	51 - 120		
		Heptachlor	47 - 120	16	47 - 120		
		Heptachlor epoxide	44 - 122	17	44 - 122		
		Methoxychlor	46 - 152	14	46 - 152		
		Chlordane (technical)	51 - 120	14	51 - 120		
		Toxaphene	47 - 120	16	47 - 120		
Inorganics (i)	6010B and 7471A (metals)	Inorganic Analyte	75-125 (j)	20 (k)	80-120	NA	NA
	9012 A (Total Cyanide)		75-125 (j)	20 (k)	80-120	NA	NA
	9016 (Free Cyanide)		75-125 (j)	20 (k)	80-120	NA	NA

(a) Analytical Methods: NYSDEC ASP-CLP Methods with Category B data deliverables, NYSDEC, 2000 and EPA SW-846, 3rd edition, Revision 1, November 1990,
(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) Target Compound List Volatile Organic Compounds
(f) Target Compound List Semi-Volatile Organic Compounds
(g) Limits are advisory only
(h) Target Analyte List Inorganics (metals and cyanide)
(i) Matrix spike only
(j) Laboratory duplicate RPD
NA - Not Applicable

Table 2
Summary of Sampling and Analytical Program

Matrix	Parameter	Analytical Method	Field Samples		Total
			Field Samples	Field Duplicate	
Soil Boring - LTTD Waste Pre-Characterization	Total Petroleum Hydrocarbons (TPH)	Method 8015 GRO/DRO	19	1	20
	Total Volatile Organic Compounds (VOCs)	Method 8260C	19	1	20
	Total Semi-volatile Organic Compounds (SVOCs)	Method 8270D	19	1	20
	Total Polychlorinated Biphenyls (PCBs)	Method 8080	19	1	20
	Total Metals	Method 6010B	19	1	20
	Total Cyanide	Method 9014A	19	1	20
	Total Sulfide	Method 9030B/9034	19	1	20
	Percent Sulfur	ASTM Method D129-64	19	1	20
	British Thermal Unit (BTU)	ASTM Method D240-87	19	1	20
Soil Boring - Landfill Waste Pre-Characterization	TCLP ZHE Extraction	EPA Method 1311;	19	1	20
	TCLP VOC	Method 1311/8260B;	19	1	20
	TCLP SVOC	Method 1311/8270C;	19	1	20
	TCLP Inductively Coupled Plasma (ICP) Metals	Method 6010B;	19	1	20
	TCLP Herbicides	Method 1311/8151A;	19	1	20
	TCLP Pesticides	Method 1311/8081A;	19	1	20
	TPH	8015 GRO/DRO;	19	1	20
	VOCs Target Compound List (TCL)	Method 8260C;	19	1	20
	SVOCs TCL	Method 8270D;	19	1	20
	Total Cyanide	Method 9014A;	19	1	20
	PCBs	Method 8082;	19	1	20
	Reactive Sulfide	Method 7.3.4.1;	19	1	20
	Reactive Cyanide	Method 7.3.3.2;	19	1	20
	Ignitability	Method 1010/Flashpoint;	19	1	20
	Corrosivity / pH	Method 9045;	19	1	20
	Total Residue/Percent Solids	ASTM D-2216-90	19	1	20
	Target Analyte List (TAL) Metals	EPA 6000-7000 Method Series.	19	1	20
Soil Boring - Geotechnical Analyses	Grain Size – Sieve and Hydrometer	ASTM D422 and D1140 / T88 - Sieve and Hydrometer	3	1	4
	Atterberg Limits	ASTM D4318	3	1	4
	Moisture (water) Content	ASTM D2216	3	1	4

Table 3
Soil and Hazardous Characteristics

Analysis [b]	Bottle Type	Preservation [a]	Holding Time [b]
Volatile Organic Compounds (VOCs)	4 ounce wide-mouth clear glass w/ teflon-lined cap	Cool to 4°±2°C	14 days
Semi-Volatile Organic Compounds (SVOCs)	8 ounce wide-mouth clear glass w/ teflon-lined cap	Cool to 4°±2°C	7 days to extraction 40 days to analysis
PCBs	8 ounce wide-mouth clear glass w/ teflon-lined cap	Cool to 4°+2°C	7 days to extraction 40 days to analysis
Pesticides	8 ounce wide-mouth clear glass jar	Cool to 4°+2°C	7 days to extraction 40 days to analysis
Herbicides	8 ounce wide-mouth clear glass jar	Cool to 4°+2°C	7 days to extraction 40 days to analysis
TAL Metals	4 ounce wide-mouth clear glass jar	Cool to 4°±2°C	6 months, except mercury (28 days)
Total Cyanide	4 ounce wide-mouth clear glass jar	Cool to 4°±2°C	14 days
Free Cyanide	4 ounce wide-mouth amber glass jar	Cool to 4°+2°C	NA
TCLP Organic Compounds	8 ounce wide-mouth clear glass w/ teflon-lined cap	Cool to 4°±2°C	See Table 4
TCLP Metals	4 ounce wide-mouth clear glass	Cool to 4°±2°C	See Table 4
Corrosivity	4 ounce wide-mouth clear glass	Cool to 4°±2°C	2 days
Ignitability	4 ounce wide-mouth clear glass	Cool to 4°±2°C	NA
Reactive Cyanide	4 ounce wide-mouth clear glass	Cool to 4°±2°C	14 days
Reactive Sulfide	4 ounce wide-mouth clear glass	Cool to 4°±2°C	7 days

(a) All samples to be cooled during collection and transport.
(b) Days from date of sample collection.
NA Not Applicable

Table 4
Toxicity Characteristics Leaching Procedure Sample Holding Times

Analytical Parameter	From: Sample Collection To: TCLP Extraction*	From: TCLP Extraction To: Preparative Extraction	From: Preparative Extraction To: Determinative Analysis
Volatiles	14 days	NA	14 days from date of TCLP extraction
Semi-Volatiles	14 days	7 days	40 days
Mercury	28 days	NA	28 days from the date of TCLP extraction
Metals (except Mercury)	180 days	NA	180 days

NA Not Applicable

*Times shown are from verified time of sample receipt.

Table 5
TCLP
Practical Quantitation Limits (PQLs)

TCLP VOLATILE	Analysis	Water (ug/L)
Benzene	8260B	5
Carbon Tetrachloride	8260B	5
Chloroform	8260B	5
1,2-Dichlorethane	8260B	5
1,1-Dichloroethene	8260B	5
2-Butanone	8260B	100
Tetrachloroethene	8260B	5
Trichloroethene	8260B	5
Vinyl Chloride	8260B	100

TCLP SEMI-VOLATILE	SW-846 Analysis	Water (ug/L)
2-Methylphenol	3510 / 8270C	10
3 & 4-Methylphenol	3510 / 8270C	10
1,4-Dichlorobenzene	3510 / 8270C	10
2,4-Dinitrotoluene	3510 / 8270C	10
Hexachlorobutadiene	3510 / 8270C	10
Hexachloroethane	3510 / 8270C	10
Hexachlorobenzene	3510 / 8270C	10
Nitrobenzene	3510 / 8270C	10
Pentachlorophenol	3510 / 8270C	50
Pyridine	3510 / 8270C	ND
2,4,5-Trichlorophenol	3510 / 8270C	10
2,4,6-Trichlorophenol	3510 / 8270C	10

TCLP METALS	SW-846 Analysis	Water (mg/L)
Arsenic	3010 / 6010	0.05
Barium	3010 / 6010	0.002
Cadmium	3010 / 6010	0.004
Chromium	3010 / 6010	0.007
Lead	3010 / 6010	0.04
Selenium	3010 / 6010	0.07
Silver	7760 / 6010	0.007
Mercury	7470	0.0002

ND - Not Determined

Table 6
Field and Character Lengths for Disk Deliverable

Description	Length	Format
Field Sample ID (as shown on COC)	15	Character
CAS. No. (including -'s)	10	Character
Parameter Name	31	Character
Concentration	13	Numeric
Qualifier	4	Character
Units	8	Character
SDG	8	Character
Lab Sample ID	15	Character
Date Sampled (from COC)	D	Date
Matrix (soil/water/air)	5	Character
Method Detection Limit	13	Numeric
Method Code	8	Character
Lab Code	6	Character

Table 7A
Project Quantitation Limits
Soil

		Quantitation Limits		New York State Standard or Guidance Values
Analysis/Compound	**Method**	**Water (ug/L)**	**Soil/Sediment (ug/Kg)**	**Water (ug/L)**
Volatile Organics				
1,1,1-Trichloroethane	8260B	1.0	5	5
1,1,2,2-Tetrachloroethane	8260B	1.0	5	5
1,1,2-Trichloroethane	8260B	1.0	5	1
1,1,2-Trichloro-1,2,2-trifluord	8260B	1.0	5	5
1,1-Dichloroethane	8260B	1.0	5	5
1,1-Dichloroethene	8260B	1.0	5	5
1,2-Dibromoethane	8260B	1.0	5	NL
1,2-Dichlorobenzene	8260B	1.0	5	3
1,2-Dichloroethane	8260B	1.0	5	0.6
1,2-Dichloropropane	8260B	1.0	5	1
1,2-Dibromo-3-chloropropan	8260B	1.0	5	0.04
1,2,4-Trichlorobenzene	8260B	1.0	5	5
1,3-Dichlorobenzene	8260B	1.0	5	3
1,4-Dichlorobenzene	8260B	1.0	5	3
2-Butanone (MEK)	8260B	5.0	5	50
2-Hexanone	8260B	5.0	5	50
4-Methyl-2-pentanone(MIBK	8260B	5.0	5	NL
Acetone	8260B	5.0	20	50
Benzene	8260B	1.0	5	1
Bromodichloromethane	8260B	1.0	5	50
Bromoform	8260B	1.0	5	50
Bromomethane	8260B	1.0	5	5
Carbon Disulfide	8260B	1.0	5	60
Carbon Tetrachloride	8260B	1.0	5	5
Chlorobenzene	8260B	1.0	5	5
Chloroethane	8260B	1.0	5	5
Chloroform	8260B	1.0	5	7
Chloromethane	8260B	1.0	5	5
Cyclohexane	8260B	1.0	5	NL
cis-1,2-Dichloroethene	8260B	1.0	5	5
cis-1,3-Dichloropropene	8260B	1.0	5	0.4
Dibromochloromethane	8260B	1.0	5	5
Dichlorodifluoromethane	8260B	1.0	5	5
Ethylbenzene	8260B	1.0	5	5
Isopropylbenzene	8260B	1.0	5	5
Methyl acetate	8260B	1.0	5	NL
Methylene Chloride	8260B	1.0	5	5
Methylcyclohexane	8260B	1.0	5	NL
Methyl tert-butyl ether	8260B	1.0	5	10
Styrene	8260B	1.0	5	5
Tetrachloroethene	8260B	1.0	5	5
Toluene	8260B	1.0	5	5
trans-1,2-Dichloroethene	8260B	1.0	5	5
trans-1,3-Dichloropropene	8260B	1.0	5	0.4
Trichloroethene	8260B	1.0	5	5
Trichlorofluoromethane	8260B	1.0	5	5
Vinyl Chloride	8260B	1.0	5	2
Xylenes(total)	8260B	3.0	15	5

NL = Not Listed

Note: RLs and MDLs are subject to change due to % moisture, matrix interference, and dilution factors

Table 7B
Project Quantitation Limits
Soil and Groundwater SVOCs

Analysis/Compound	Method	Quantitation Limits Water (ug/L)	Quantitation Limits Soil (ug/Kg)	New York State Standard or Guidance Values Water (ug/L)
Semi-Volatile Organics				
1,1'-Biphenyl	8270C	10	330	5
2,2'-oxybis(1-chloropropane)	8270C	10	330	5
2,4,5-Trichlorophenol	8270C	10	330	1
2,4,6-Trichlorophenol	8270C	10	330	1
2,4-Dichlorophenol	8270C	10	330	1
2,4-Dimethylphenol	8270C	10	330	1
2,4-Dinitrophenol	8270C	50	1600	1
2,4-Dinitrotoluene	8270C	10	330	5
2,6-Dinitrotoluene	8270C	10	330	5
2-Chloronaphthalene	8270C	10	330	10
2-Chlorophenol	8270C	10	330	1
2-Methylnaphthalene	8270C	10	330	NL
2-Methylphenol	8270C	10	330	1
2-Nitrolaniline	8270C	50	1600	5
2-Nitrophenol	8270C	10	330	1
3,3'-Dichlorobenzidine	8270C	50	1600	5
3-Nitroaniline	8270C	50	1600	5
4-Bromophenyl-phenyl ether	8270C	10	330	NL
4-Chloro-3-methylphenol	8270C	10	330	NL
4-Chloroaniline	8270C	10	330	5
4-Chlorophenyl phenyl ether	8270C	10	330	NL
4-Methylphenol	8270C	10	330	1
4-Nitroaniline	8270C	50	1600	5
4-Nitrophenol	8270C	50	1600	1
4,6-Dinitro-2-methylphenol	8270C	50	1600	NL
Acenaphthene	8270C	10	330	20
Acenaphthylene	8270C	10	330	NL
Acetophenone	8270C	10	330	NL
Anthracene	8270C	10	330	50
Atrazine	8270C	10	330	7.5
Benzo(a)anthracene	8270C	10	330	0.002
Benzo(a)pyrene	8270C	10	330	ND
Benzo(b)fluoranthene	8270C	10	330	0.002
Benzo(g,h,i)perylene	8270C	10	330	NL
Benzo(k)fluoranthene	8270C	10	330	0.002
Benzaldehyde	8270C	10	330	NL
bis(2-Chloroethoxy) methane	8270C	10	330	5
bis(2-Chloroethyl) ether	8270C	10	330	1
bis(2-ethylhexyl)phthalate	8270C	10	330	5
Butyl benzyl phthalate	8270C	10	330	50
Caprolactum	8270C	10	330	NL
Carbazole	8270C	10	330	NL
Chrysene	8270C	10	330	0.002
Di-n-butyl phthalate	8270C	10	330	50
Di-n-octyl phthalate	8270C	10	330	NL
Dibenz(a,h)anthracene	8270C	10	330	NL
Dibenzofuran	8270C	10	330	NL
Diethyl phthalate	8270C	10	330	50
Dimethyl phthalate	8270C	10	330	50
Fluoranthene	8270C	10	330	50
Fluorene	8270C	10	330	50
Hexachlorobenzene	8270C	10	330	0.4
Hexachlorobutadiene	8270C	10	330	0.5
Hexachlorocyclopentadiene	8270C	50	1600	5
Hexachloroethane	8270C	10	330	5
Indeno(1,2,3-cd)pyrene	8270C	10	330	0.002
Isophorone	8270C	10	330	50
N-Nitroso-n-propylamine	8270C	10	330	50
N-nitrosodiphenylamine	8270C	10	330	50
Naphthalene	8270C	10	330	10
Nitrobenzene	8270C	10	330	0.4
Pentachlorophenol	8270C	50	1600	1
Phenanthrene	8270C	10	330	50
Phenol	8270C	10	330	1
Pyrene	8270C	10	330	50

ND = Non-detect
NL = Not Listed
Note: RLs and MDLs are subject to change due to % moisture, matrix interference, and dilution factors

Table 7C
Project Quantitation Limits
Soil PCBs, Metals and Cyanide, Pesticides, and Herbicides

		Quantitation Limits		New York State Standard or Guidance Values
Analysis/Compound	**Method**	**Water (µg/L)**	**Soil/Sediment (mg/kg)**	**Water (µg/L)**
Metals				
Antimony	6010B	10	1	3
Arsenic	6010B	10	1.0	25
Barium	6010B	200	2.00	1,000
Beryllium	6010B	4	0.40	3
Cadmium	6010B	5	0.50	5
Chromium	6010B	5	0.50	50
Copper	6010B	25	2.5	200
Lead	6010B	3	0.3	25
Mercury	7470A/7471A	0.2	0.037	0.7
Nickel	6010B	40	4.00	100
Selenium	6010B	5	0.5	10
Silver	6010B	5	0.50	50
Thallium	6010B	10	1.0	0.5
Zinc	6010B	20	2.0	2,000
Vanadium	6010B	50	5.00	NL
Cobalt	6010B	50	5.00	NL
Aluminum	6010B	200.00	20	NL
Calcium	6010B	5000.0	500	NL
Iron	6010B	100.00	10	300
Magnesium	6010B	5000.0	500	35,000
Manganese	6010B	15	1.50	300
Potassium	6010B	5000.0	500	NL
Sodium	6010B	5000.0	500	20,000
Cyanide (Total)	9012A	10	1.0	200
Free Cyanide	9016	1.1	0.62	NA

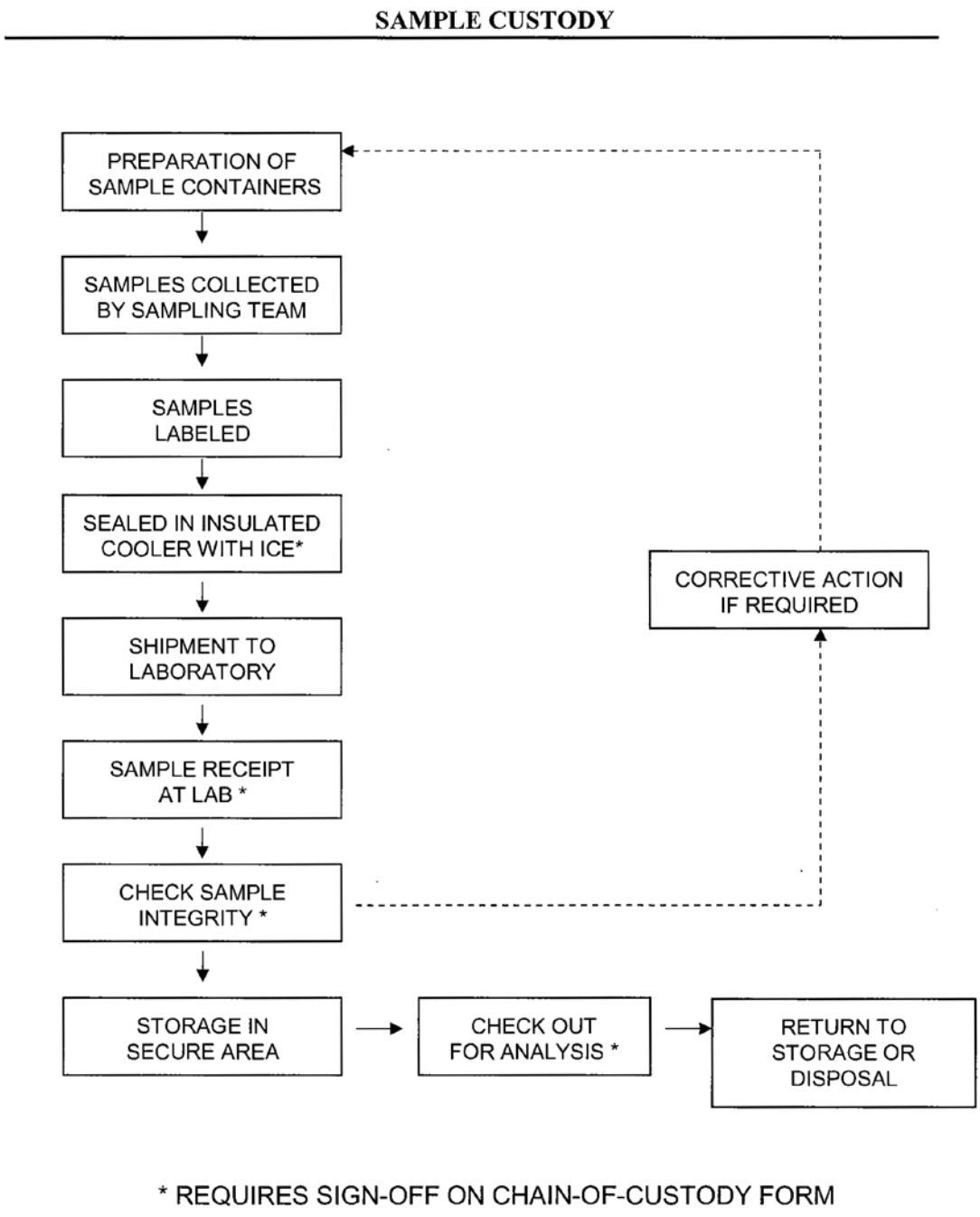
Analysis/Compound	**Method**	**Water (µg/L)**	**Soil/Sediment (mg/kg)**	**Water (µg/L)**
PCBs				
Aroclor 1016	8082	0.176	0.049	0.09
Aroclor 1221	8082	0.176	0.049	0.09
Aroclor 1232	8082	0.176	0.054	0.09
Aroclor 1242	8082	0.176	0.540	0.09
Aroclor 1254	8082	0.25	0.049	0.09
Aroclor 1260	8082	0.25	0.117	0.09
Aroclor 1262	8082	0.25	0.529	0.09
Aroclor 1268	8082	0.25	0.053	0.09

Analysis/Compound	**Method**	**Water (µg/L)**	**Soil/Sediment (mg/kg)**	**Water (µg/L)**
Pesticides				
4,4'-DDD	8081A	0.05	0.0016	0.15
4,4'-DDE	8081A	0.05	0.0016	0.10
4,4'-DDT	8081A	0.05	0.0016	0.10
Aldrin	8081A	0.05	0.0016	NA
alpha-BHC	8081A	0.05	0.0016	0.20
alpha-Chlordane	8081A	0.05	0.0016	NL
beta-BHC	8081A	0.05	0.0016	NL
delta-BHC	8081A	0.05	0.0016	NL
Dieldrin	8081A	0.05	0.0016	0.002
Endosulfan I	8081A	0.05	0.0016	42
Endosulfan II	8081A	0.05	0.0016	42
Endosulfan sulfate	8081A	0.05	0.0016	42
Endrin	8081A	0.05	0.0016	NA
Endrin aldehyde	8081A	0.05	0.0016	NA
Endrin ketone	8081A	0.05	0.0016	NA
gamma-BHC (Lindane)	8081A	0.05	0.0016	0.20
gamma-Chlordane	8081A	0.05	0.0016	NL
Heptachlor	8081A	0.05	0.0016	0.40
Heptachlor epoxide	8081A	0.05	0.0016	0.2
Methoxychlor	8081A	0.05	0.0016	40
Chlordane (technical)	8081A	0.5	0.0167	NL
Toxaphene	8081A	0.5	0.0167	3

Analysis/Compound	**Method**	**Water (µg/L)**	**Soil/Sediment (mg/kg)**	**Water (µg/L)**
Herbicides				
2,4,5-T	8151A	0.5	0.0167	35
2,4-D	8151A	0.5	0.0167	70
Dalapon	8151A	0.5	0.0167	NA
Dichlorprop	8151A	0.5	0.0167	NA
Dinoseb	8151A	0.5	0.0167	0.007
Pentachlorophenol	8151A	0.5	0.0167	1
Picloram	8151A	0.5	0.0167	0.5
Silvex (2,4,5-TP)	8151A	0.5	0.0167	0.05

Figures

FIGURE 1


SAMPLE CUSTODY
PREPARATION OF SAMPLE CONTAINERS
SAMPLES COLLECTED BY SAMPLING TEAM
SAMPLES LABELED
SEALED IN INSULATED COOLER WITH ICE*
SHIPMENT TO LABORATORY
SAMPLE RECEIPT AT LAB *
CHECK SAMPLE INTEGRITY *
STORAGE IN SECURE AREA
CHECK OUT FOR ANALYSIS *
RETURN TO STORAGE OR DISPOSAL
CORRECTIVE ACTION IF REQUIRED
* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Chain-of-Custody Record

Laboratory:

Laboratory Job #
(Lab use only)

GEI Consultants

1301 Trumansburg Road, Suite N
Ithaca, New York
TEL: 607-216-8955

Project Information

Project Name:

Project Number:

Project Location:

Project Manager:

Send Report to:

Send Faxed Results to:

Send EDD to:

Page ____ of ____

Preservative

Analysis

Sample Handling

Sample Field Filtered
YES NO NA

Sampled Shipped With Ice
YES NO

MCP PRESUMPTIVE CERTAINTY REQUIRED -- YES NO

If Yes, Are MCP Analytical Methods Required? YES NO

If Yes, Are Drinking Water Samples Submitted? YES NO

If Yes, Have You Met Minimum Field QC Requirements? YES NO

Lab Sample Number	GEI Sample ID	Collection Date	Collection Time	Matrix	No. of Bottles	Sampler(s) Initials	Sample Specific Remarks

Turnaround Time (Business days):

Normal _____ **Other**_____

10 Day_____ **7 Day**_____

5 Day_____ **3 Day**_____

Before submitting rush turnaround samples, you **must** notify the laboratory to confirm that the TAT can be

MCP Level Needed: GEI requires the most stringent Method 1 MCP standard be met for all analytes whenever possible.

Additional Requirements/Comments/Remarks:

Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)

14 MCP Metals = Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium (total), Lead, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc.

Figure 2

FIGURE 3 Corrective Action Request

CORRECTIVE ACTION REQUEST
Number: _____ Date: _____
TO: _____ You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____
CONDITION:
REFERENCE DOCUMENTS:
RECOMMENDED CORRECTIVE ACTIONS:
_____ _____ _____ _____ _____ _____ Originator Date Approval Date Approval Date
RESPONSE
CAUSE OF CONDITION
CORRECTIVE ACTION (A) RESOLUTION (B) PREVENTION (C) AFFECTED DOCUMENTS
C.A. FOLLOWUP: CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____

GEI Consultants

Figure 4

GEI Resume – QAO

Brian T. Skelly
Environmental Scientist

resume

Brian Skelly is an environmental scientist with expertise in environmental compliance, air quality monitoring and instrumentation, three-dimensional 3D site visualization, and data management services. He has been involved in a variety of environmental projects in 16 states developing work plans, designing monitoring programs, permitting compliance review and reporting, managing projects, training staff, and supporting public meetings and regulatory negotiations.

Mr. Skelly has worked for utility, transportation, and manufacturing clients locally and in other states and has managed teams performing environment data management, data validation, computer assisted design (CAD), and geographic information systems (GIS). His portfolio of work also includes development of databases to assist in air permitting applications, environmental compliance support, air monitoring programs during construction, structural and geotechnical instrumentation monitoring, and 3-D visualization and modeling.

EDUCATION
M.S., Engineering Management, University of Connecticut
B.S., Engineering Management, University of Connecticut

EXPERIENCE IN THE INDUSTRY
13 years

EXPERIENCE WITH GEI
12 year(s)

PROGRAM EXPERIENCE

Environmental Compliance Services. Mr. Skelly has work with municipalities, manufacturers, hospitals, mining, supermarkets, and metal coatings operations to developed Spill Prevention Control and Countermeasures (SPCC) plans, Stormwater Pollution Prevention Plans (SWPPPs), air permitting and compliance certifications under GPLPE and Title V, and to assist with permit applications and renewals to support facility modifications.

Instrumentation and Monitoring Services. Mr. Skelly designs, builds, operates, and manages GEI-built air, structural, and geotechnical instrumentation systems equipped with dust meters, seismographs, noise meters, automated motorized total stations, crack monitors, and noise meters. He implements instrumentation and monitoring to protect people, property and structures during construction and remediation projects.

Air Monitoring Services. Mr. Skelly serves as the practice leader for GEI's air monitoring services. In this role, he is responsible for developing and reviewing proposals and work plans to manage the risk associated with air inhalation pathways at remediation sites, and to comply with state or federal regulations and guidance documents. He has operated and managed air monitoring and sampling programs at more than 40 sites in 16 states.

3D Visualization Services. Mr. Skelly developed three-dimensional visualization services for GEI's environmental programs to represent and refine site conceptual models. Our 3D environmental site visualizations are used to present to clients, regulators, and residents at public meetings to facilitate understanding of large and complex subsurface datasets for our projects.

Data Management Services. As manager of data management services, Mr. Skelly oversaw a team of database managers, chemists, and laboratory liasons to manage environmental data and data quality for GEI's environmental programs. He coordinated with laboratories across the United States, and developed custom data management and delivery solutions for our projects including integration of GIS mapping with our analytical databases.

GEI Consultants

PROJECT EXPERIENCE

GPLPE and EPCRA Compliance, St. Vincent's Medical Center, Bridgeport, CT. Conducted and environmental compliance assessment for environmental compliance, assisted with recording and demonstrating compliance and systems to maintain ongoing compliance records, and prepared annual reports to EPA and CT DEEP.

Air Emission Compliance Database, Hamilton Sundstrand Corporation, Windsor Locks, CT. Designed and built a coatings usage database to support air emission compliance. The database allowed our client to significantly speed up their material review process for state and federal air emission compliance and permitting.

Environmental Compliance Support, Valley Sand & Gravel Corp., North Haven, CT. Stormwater Pollution Prevention Plan (SWPPP), Spill Prevention Control and Countermeasures (SPCC) plan, wastewater.

EH&S Safety Culture Surveys, Hamilton Sundstrand Corporation, Windsor Locks, CT. Performed year-over-year analysis of the safety culture for various divisions of the organization. His analyses determined target areas for safety culture improvement and assessed the cultural differences among employee, staff, and management ranks.

Environmental Compliance Support, Metropolitan District Commission, Hartford, CT. Conducted environmental compliance assessments at various locations in the district to evaluate compliance with facility plans, registered permits, and recordkeeping and maintenance associated with each permit and plan.

Clean Water Project, Metropolitan District Commission, Multiple, CT. Assisted in developing a GIS-based web application for uploading, storing, and managing environmental and geotechnical data for the Clean Water Project to be used by all consultants and contractors collecting and reporting data for the project.

Air Quality Investigation, Confidential Client, Wallingford, CT. Conducted **a**mbient air monitoring and sampling to investigate worker concerns of Environmental Health and Safety at the facility, possibly due to offsite neighboring sources.

Bradley Memorial Hospital UST Investigation, The Hospital of Central Connecticut, Southington, CT. Geoprobe drilling and soil boring geotechnical and environmental logging to support investigation of an underground storage tank for removal

Soil Vapor Intrusion, Confidential Properties, Long Island, NY. Managed and analyzed data for more than 500 soil vapor, indoor air, and outdoor air samples to assess potential soil vapor intrusion at homes along a contaminated groundwater plume. Documented product chemical inventories and interviewed property representatives about operations and chemical usage at the sites.

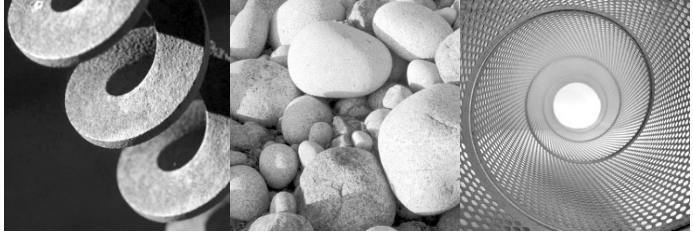
Cost Cap Cleanup Insurance, AIG, Inc., Henderson, NV. Designs business tools for managing consultants at GEI. Some examples include automated analysis of staff scheduling, project budget accounting, and data analysis and reporting tools for finance and environmental measurement.

Gastown MGP, National Fuel Gas, Tonawanda, NY. Managed both air monitoring and structural monitoring (vibration, movement, deflection, settlement, and crack) services during a 20-month remediation project in a rural area. Developed a three-dimensional subsurface visualization to demonstrate an alternate site conceptual model that challenged the state record of decision. The visualization helped make the case for alternate pathways that facilitated alternate design scenarios to remediate the site.

50 Kent Avenue, National Grid, Brooklyn, NY. Managed instrumentation of air monitoring and structural monitoring (vibration, movement, noise, and crack) services during an 18-month remediation project. Air monitoring for TVOC and dust were monitored to be protective of human health and odor was quantified to avoid public odor complaints associated with remediation. Movement, vibration, noise, and crack monitoring was conducted at three buildings and five sidewalk locations to protect neighboring structures.

Appendix F

Community Air Monitoring Plan



GEI Consultants

Consulting
Engineers and
Scientists

Appendix F

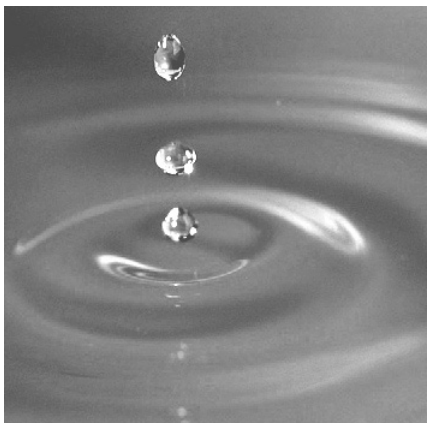
Community Air Monitoring Plan
Remedial Design

Elmira Water Street MGP Site
Elmira, New York
NYSDEC Site # 808025

Submitted To:
NYSEG
18 Link Drive, P.O. Box 5224
Binghamton, NY 13902-5224

Submitted By:
GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

Project # 1704633-1.2



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Abbreviations and Acronyms

CAMP	Community Air Monitoring Plan
COC	Constituents of Concern
GEI	GEI Consultants, Inc., P.C.
HASP	Health and Safety Plan
MGP	Manufactured Gas Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSEG	New York State Electric and Gas Corporation
PAH	Polycyclic Aromatic Hydrocarbons
PDI	Pre-Design Investigation
PID	Photo-ionization Detector
ppm	Parts per Million
RD	Remedial Design
SVOC	Semi-Volatile Organic Compounds
VOC	Volatile Organic Compounds
$\mu g/m^3$	Micrograms per cubic meter

1. Introduction

This Community Air Monitoring Plan (CAMP) will be implemented during the Pre-Design Investigation (PDI) and remedial tasks for the NYSEG Elmira Water Street Manufactured Gas Plant (MGP) site, located in the City of Elmira, New York. A CAMP is required by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) at sites where ground-intrusive activities may result in airborne release of compounds of concern (COC). Towards that end, community air monitoring will be performed for total volatile organic vapors (VOCs), and for particulates (dust).

The Elmira Water Street MGP site is located between East Water Street and the Chemung River in the City of Elmira, New York. The former MGP operations were conducted within a parcel of land that is currently owned by NYSEG. The site is mostly a vacant parking lot which is surrounded by East Water Street to the north, by additional parking lot areas to the east and west, and by the features of the NYSDEC flood control levee to the south.

This CAMP applies to the PDI and the remedial phase of work for the Elmira Water Street MGP site. The PDI field work is scheduled to be performed in the spring of 2018, as described in the document "*RD Work Plan, Elmira Water Street MGP Site, Elmira, New York*" (attached). Community air monitoring will be performed during the invasive field tasks.

The objectives of this CAMP are to:

- Ensure that the airborne concentrations of COC are minimized to protect the community.
- Provide an early warning system so that potential emissions can be controlled on site at the source.
- Measure and document the concentrations of airborne COC to confirm compliance with the specified limits.

This CAMP is a companion document to GEI's site-specific Health and Safety Plan (HASP). The HASP is a separate document and is directed primarily toward protection of on-site workers within the designated work zones. Both the CAMP and HASP are included as appendices to the Remedial Design Work Plan (RDWP).

2. Air Monitoring Equipment, Methods, and Action Levels

This section provides instructions for performing the CAMP activities. Discussed are the COC to be monitored, the equipment to be used, where sampling is to be performed, and the action limits. For the Elmira Water Street MGP site, community air monitoring will be performed for total VOCs and particulates (dust) during the invasive activities for the remedial design and remedial action.

In addition to the community air monitoring, work/exclusion zone monitoring will be performed during work activities where impacted soil may be encountered. The exclusion zone air monitoring requirements, equipment, and action levels are described in the site-specific HASP for this project. Note, however, that the work zone air monitoring and the community air monitoring are conducted as part of the overall site control program. When work zone VOC or particulate readings are found to exceed the downwind CAMP limits, the field staff will check the upwind and downwind air monitoring instruments to assess whether control measures will be required.

2.1 Monitoring Locations

For the PDI or other investigation work, two community air monitoring locations will be established at the start of each workday – one upwind of the work area, and one downwind of the work area/exclusion zone. The purpose of the upwind station will be to determine the background concentration of VOCs and particulates at the worksite. The downwind monitoring station will be used to assess compliance with the NYSDEC/NYSDOH specified action limits for VOCs and particulates. The upwind VOC and dust measurements will be subtracted from the downwind measurements in order to compare the downwind instrument readings to the CAMP action levels.

During implementation of the remedy, fixed air monitoring stations may be deployed to collect the perimeter air monitoring data. If fixed air monitoring stations are deployed, the system will measure and record air quality 24 hours a day, 7 days a week, supplied by a 110-volt AC power. Prior to the Remedial Contractor mobilization to implement the remedy, the Remedial Engineer will update the NYSDEC on the methods proposed to implement the CAMP during the remedial action.

The location of each monitoring station will be noted on the ***Community Air Monitoring Daily Data Sheet*** (Daily Data Sheet) and on a figure showing the work areas, wind direction and station locations [Attachment A]. The locations of the instruments may be changed during the day to adapt to changing wind directions. Each location will be noted on the Data Sheet and figure, along with the start and stop time at each location. Field personnel will be prepared to move the equipment to multiple locations in the event that there is little wind, if the wind direction changes frequently, or if there is a change to the location of the most sensitive downwind receptor location.

There are currently no buildings at the site, so special requirements for CAMP station positioning is not anticipated. If other activities, such as a farm or flea market or picnic area is set-up, then the Engineer will modify the CAMP, and submit the revised CAMP to the NYSDEC and NYSDOH for acceptance to be protective of potentially exposed people.

If necessary, precautions to minimize the release of VOCs and particulates will be taken at the work zone, and engineering or work controls used to protect the downwind receptor. These controls for minimizing releases from the work zone are discussed in Section 3.

2.2 Air Monitoring Equipment

A wind sock (or equivalent visible indicator) will be used to facilitate accurate downwind direction detection. The monitoring instruments will be calibrated at the start of each workday, and again during the day if the performance of an instrument is in question. The time and method of calibration will be noted on the Daily Data Sheet. Both the photo-ionization detectors (PIDs) and particulate meters will be mounted on a tripod in a vented protective case, and programmed to record 15-minute averages. A monitoring technician will check the instrumentation at each of these locations regularly during the work-day to check that they are operating properly.

2.2.1 VOC Monitoring Equipment

VOC monitoring will be performed using PIDs (RAE Systems MiniRAE™ or equivalent) equipped with a 10.2 or 10.6 eV bulb. The instruments will be set to record 15-minute running average concentrations. The PIDs will be equipped with an audible alarm to indicate an exceedance of the action level of 5 ppm total VOCs.

2.2.2 Particulate (Dust) Monitoring Equipment

Particulate monitoring will be performed using meters set to measure 10 micron and finer particulates (PM-10). Particulates will be monitored using an MIE DataRAM DR-2000l, TSI DustTrak™, or equivalent. The equipment used will be set to record 15-minute running average concentrations, for comparison to the action levels.

In addition to the instrument readings, fugitive dust migration will be visually assessed during all work activities, and the observations recorded. Per NYSDEC requirements, visible dust migration will not be allowed. If visible dust is observed to be migrating from the work zone, the work will be stopped and dust control measures implemented.

2.3 Monitoring Action Levels and Responses

The action levels and responses for VOCs and particulates are presented in Table 1.

Table 1. Air Monitoring Response Levels and Actions

VOCs	
Response Level	**Actions**
>5 ppm above background for 15-minute average	▪ Temporarily halt work activities ▪ Continue monitoring ▪ If VOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring
Persistent levels >5 ppm over background but <25 ppm	▪ Halt work activities ▪ Identify source of vapors ▪ Corrective action to abate emissions ▪ Continue monitoring ▪ Resume work activities if VOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average
>25 ppm at the perimeter of the work area	▪ Shut down work

Particulates	
Response Level	**Actions**
>100 µg/m^3 above background for 15-minute average or visual dust observed leaving the site	▪ Apply dust suppression ▪ Continue monitoring ▪ Resume work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site
>150 µg/m^3 above background for 15-minute average	▪ Stop work ▪ Re-evaluate activities ▪ Continue monitoring ▪ Resume work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site

Sources:

- NYSDOH Community Air Monitoring Plan, December 2009, as published in NYSDEC DER-10, Appendix 1A, 2010.
- Fugitive Dust and Particulate Monitoring, NYSDEC DER-10, Appendix 1B, 2010.

All data will be downloaded to a computer on a daily basis and saved for review. The data will be provided to the NYSDEC and/or the NYSDOH upon request at any stage of the project.

If VOC or particulate action levels are observed to be exceeded during the work day, the event, the source, and corrective actions taken will be recorded on the Daily Data Sheet and reported to the on-site NYSDEC representative. The Site Manager/Site Safety Officer (SSO) will be responsible for the decision to halt work at the site if there are dust, odor, or safety issues. If an on-site representative is not present, exceedances will be noted in the daily report to the NYSDEC project manager within one business day.

Table 2. Emergency Contacts and Telephone Numbers

Fire, Police, Ambulance		911
NYSDEC Contact	Parag Amin – Project Manager	(518) 402-9662 (office)
GEI Contacts	James Edwards – Project Manager Garrett Schmidt – Field Team Leader	(607) 592-6786 (cell) (607) 793-3463 (cell)
NYSEG Contact	John Ruspantini – Project Manager	(607) 762-8787 (office) (607) 725-3801 (cell)

2.4 Odor Monitoring

The staff responsible for implementing the CAMP will also monitor for nuisance odors at the work zone perimeter during the investigation, or intrusive activities or soil management tasks occurring during the Remedial Action. When nuisance odors attributable to the exposing of impacted media are generated in the work area during intrusive activities, such as soil borings or excavation of test pits, or soil excavation, observations will also be made at the downwind limit of the MGP site. The observations will be made to assess the potential for nuisance odors reaching on-site receptors or being transmitted off site. The downwind odor monitoring will be performed in conjunction with the PID and dust monitoring program described in this CAMP.

Upon detection of nuisance odors at the site perimeter by the staff performing the CAMP monitoring, site controls, starting in the work area, will be implemented by the Construction Manager and Remedial Contractor. The site controls described in Section 3 will be used to assist with odor mitigation. Note that the goal of the Odor Mitigation Plan is to minimize and to prevent, where practicable, the off-site migration of odors. Due to the short distances between any work area at the site and the on-site receptors property line, site controls will be implemented proactively when odors are detected in the breathing zone at any work area.

There are no action levels specified for odors. In the event that odors persist at the downwind receptors or property line after control measures are carried-out, the work will be stopped and the odor conditions will be discussed with the NYSEG, the NYSDEC, and NYSDOH project managers.

If a community complaint is received, the monitoring staff will notify the Construction Manager. The Construction Manager will then notify NYSEG, the Engineer, and the NYSDEC and NYSDOH. The Construction Manager will direct the Remedial Contractor to implement the odor control measures. Work will resume only if the control measures are deemed effective.

3. Control Procedures

This section outlines the procedures to be used to control VOCs, odors, and particulates that may be generated during the RD field activities. The investigation program will be conducted using two principal RD techniques that may generate odors: test pit excavations and subsurface soil borings. The remainder of this section is intended to provide site managers, representatives of the NYSDEC and NYSDOH, and the public with information summarizing typical odor control options, and to provide some guidance for their implementation. A description of potential sources of odors and methods to be used for odor control are presented in the following sections.

3.1 Potential Sources of Odors and VOCs

Generally, the residuals encountered at former MGP sites are well defined. They are related to residual coal tar-like materials and petroleum, and principally contain VOCs, polycyclic aromatic hydrocarbons (PAHs), and a number of inorganic constituents, including metal-complexed cyanide compounds, and metals. Constituents of MGP tar or petroleum products can produce odor emissions during investigation activities when they are unearthed during backhoe test pits and soil borings. When this occurs, VOCs and light-end semi-volatile organic compounds (SVOCs) can volatilize into the ambient air. Some MGP residuals can cause distinctive odors that are similar to mothballs, roofing tar, or asphalt driveway sealer. It is important to note that the CAMP will provide for continual monitoring of VOCs and particulates during the field work to monitor for any potential release of constituents which may exceed the exposure limits for downwind receptors.

3.2 General Site Controls

Several general excavation or drilling procedure site controls that will be implemented include:

- If encountered, every effort will be made to minimize the amount of time that impacted material is exposed to ambient air at the site.
- Drill cuttings from the hollow-stem auger borings will be containerized as soon as possible during completion of each soil boring.
- Loading of excavated debris or soil will be performed as quickly as possible and to keep these materials covered at all times.
- Meteorological conditions are also a factor in the generation and migration of odors. Some site activities may be limited to times when specific meteorological conditions prevail, such as when winds are blowing away from a specific receptor.

3.3 Secondary Site Controls

If substantial VOCs or odors still present an issue following implementation of the above procedures, secondary controls will be enacted. The site manager will work through the applicable list of secondary controls until the perimeter odor issues are resolved. The site manager will work closely with NYSEG and the NYSDEC during this task. Final selection of controls will be dependent on field conditions encountered. Secondary controls include the following:

- For stockpiled impacted soil, temporary polyethylene covers will be used to control odors, VOCs, and dust.
- Water may be sprayed onto dry soils to minimize the generation of dust.
- The placement of portable barriers close to small active source areas (test pits) can elevate the discharge point of emissions to facilitate dispersion and minimize the effect on downwind receptors. The barriers can be constructed using materials such as plastic "Jersey barriers", or fence poles and visual barrier fabric/plastic. The barriers are placed as temporary two or three-sided structures around active test pit or other intrusive investigation areas, oriented such that the barriers are placed on the upwind and downwind sides of the source. If only one side of the source can be accessed, then the barrier should be placed on the downwind side.
- Agents that can be sprayed over impacted soil have been determined to be effective in controlling emissions. They include odor suppressant solutions, such as Rusmar Foam®, BioSolve®, and hydromulch. These agents may be used where plastic sheeting cannot be effectively deployed over the source material, or where sheeting is ineffective in controlling odors:
  - Rusmar Foam® can provide immediate, localized control of odor emissions.
  - BioSolve® can provide immediate, localized control of odor emissions.
  - Hydromulch - Although it is unlikely that it will be necessary, modified hydromulch slurry may be used to cover inactive sources for extended periods of time (up to several days). The hydromulch, typically cellulose fibers (HydroSeal®), is modified by mixing a tackifier (glue) with the mulch and water to form a slurry. It is applied using a standard hydroseed applicator to a thickness of ¼ inch. The material forms a sticky, cohesive, and somewhat flexible cover. Reapplication may be necessary if the applied layer becomes desiccated or begins to crack.

3.4 Building Controls

Controls for minimizing the impacts to occupied buildings include temporary shut-down and/or closure of air intakes within the downwind zone, or deferral of work to times when building occupants are not present or at a minimum.

4. Documentation and Reporting

The attached Daily Data Sheet will be filled-out each day to record the details of the CAMP work. A figure will be updated daily for the CAMP submittals, and will include a daily wind rose to note the wind direction(s). The form will be used to record the following information:

- Date and weather, with significant changes noted which may affect the positioning of the meters or recording of the data.
- Calibration results for the instruments.
- Locations of the upwind and downwind monitoring stations, and any changes made to the locations during the day to adjust for changing work locations or wind directions.
- Any significant readings made during the day, such as exceedances which occur and their causes.

Additional information will be noted in the project field book(s), as necessary.

The electronic measurements from the PIDs and dust meters will be downloaded each day, reviewed, and archived. Exceedances of the action levels, if any, and the actions to be taken to mitigate the situations, will be discussed immediately with the on-site representatives, or reported within one business day to the NYSDEC project manager (if on-site NYSDEC oversight is not provided) and the NYSDOH project manager. The results of the daily CAMP monitoring will also be discussed in the daily written report to the NYSDEC project manager. Summaries of all air monitoring data will be provided to the NYSDEC and the NYSDOH.

ATTACHMENT A

Community Air Monitoring Daily Data Sheet

Community Air Monitoring Daily Data Sheet

Site:	**Date:**
	Project Number:
Weather:	
Monitoring Start Time:	**End Time:**
Start Time of Intrusive or Handling Task:	**End Time of Intrusive or Handling Task:**

Monitoring Station Location	Time (24 hour)	CAMP PID (ppm)	CAMP Particulate (mg/m3)	Wind Direction	Work Zone PID (ppm)	Work Zone Particulate (mg/m3)	Activity	Comments

Notes:

INSTRUMENT INFORMATION **Time** **Span and Agent**

PID Model: **Serial Number:** **Calibration:**

PID Model: **Serial Number:** **Calibration:**

Dust meter model: **Serial Number:** **Calibration:**

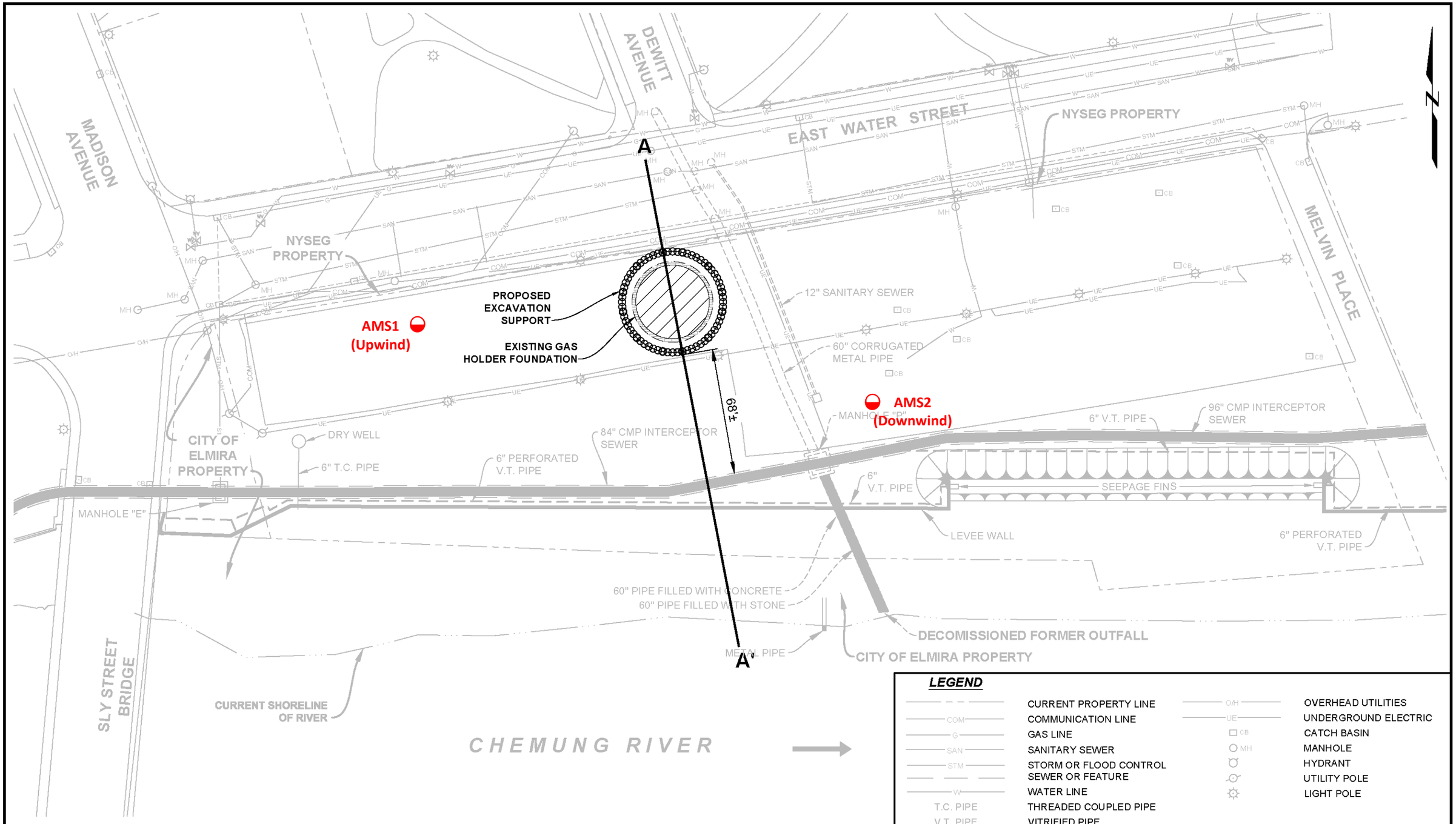
Dust meter model: **Serial Number:** **Calibration:**

Notes for Map on Reverse Side:

Circle Work Area. Show start and end times if there are multiple work areas.

↗	wind direction	**U** Upwind Station	**D** Downwind Station

Monitoring Performed By (print and sign): _____



LEGEND

CURRENT PROPERTY LINE	OVERHEAD UTILITIES
COMMUNICATION LINE	UNDERGROUND ELECTRIC
GAS LINE	CATCH BASIN
SANITARY SEWER	MANHOLE
STORM OR FLOOD CONTROL SEWER OR FEATURE	HYDRANT
WATER LINE	UTILITY POLE
THREADED COUPLED PIPE	LIGHT POLE
VITRIFIED PIPE	

SOURCES:

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50' 100'

SCALE: 1" = 50'

CAMP
Elmira Water Street MGP
Site Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

Project 1704633

CONCEPTUAL CAMP MONITORING LOCATIONS

Fig. 8

---- \\geiconsultants.com\data\Data_Storage\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\8-11 1704633_RDWP_Excv_Sect_GW.dwg - 2/15/2018

Appendix G

Health and Safety Plan

GEI Consultants

Consulting
Engineers and
Scientists

Appendix G

Health and Safety Plan

Elmira Water Street MGP Site
City of Elmira, Chemung County, New York
NYSDEC Site # 808025

Submitted By:

GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850
607-216-8955

Project #1704633-1.2

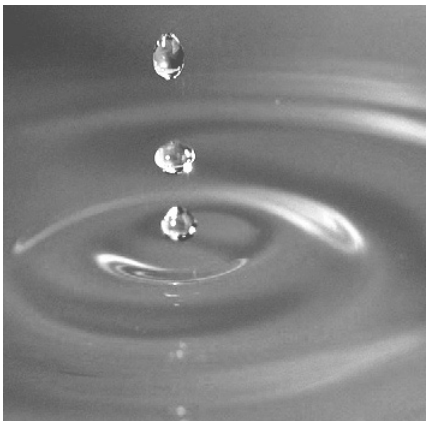


Table of Contents

Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos-Containing Material
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, Total Xylenes
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CHSO	Corporate Health and Safety Officer
CMS	Chip Measurement System
CNS	Central Nervous System
COC	Compounds of Concern
CRZ	Contamination Reduction Zone
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	United States Environmental Protection Agency
EZ	Exclusion Zone
GEI	GEI Consultants, Inc., P.C.
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
LEL	Lower Explosive Limit
MGP	Manufactured Gas Plant
NAPL	Non-aqueous Phase Liquid
NFPA	National Fire Protection Association
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSEG	New York State Electric and Gas Corporation
OSHA	Occupational Health and Safety Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated bipenyls
PEL	Permissible Exposure Level
PFD	Personal Flotation Device
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
RD	Remedial Design
SDS	Safety Data Sheets
SSO	Site Safety Officer
SVOC	Semi-Volatile Organic Compound
SZ	Support Zone
USCG	United States Coast Guard
VOC	Volatile Organic Compounds
WNV	West Nile Virus

1.0 Background Information

1.1 General

Consultant GEI Consultants, Inc., P.C.
1301 Trumansburg Road
Suite N
Ithaca, NY 14850

Project Name Remedial Design
Elmira Water Street MGP Site
City of Elmira, Chemung County, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the manufactured gas plant (MGP) site located on NYSEG property and adjacent areas in the City of Elmira, New York. Reading of the HASP is required of all on-site GEI personnel and GEI subcontractors. GEI subcontractors are required to develop their own site-specific HASP and may use this plan as a guide. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions.

In addition to GEI's HASP, all site personnel must have read and adhere to the Iberdrola Contractor Safety Requirements and Smoking Policy provided in Appendix E of this HASP.

1.2 Project Description

The scope of work for the Pre-Design Investigation (PDI) and Remedial Design (RD) is described in the RD Work Plan. The activities for the investigation are summarized as follows:

- Subsurface utilities will be located by calling Dig Safely New York and a site meeting held with any companies or municipalities with subsurface utilities present.
- Subsurface soil borings will be advanced in order to obtain additional information regarding the thickness and composition of fill beneath the site; to determine the depth to the water table; to observe and screen subsurface soil in order to identify conditions that may be indicative of impacts by MGP or other residuals; to obtain additional information to map the surface of the bedrock unit; and to install the wells proposed for the RD.
- Monitoring wells will be installed.
- Groundwater samples will be collected from each of the wells installed at the site.
- A survey will be performed for all the investigation sample points.

1.3 Site Description

The former Elmira Water Street MGP site is located in a commercial area in the central business district of Elmira, New York. The site is bordered by East Water Street to the north, NYSEG property to the east and west, and by the Chemung River to the south.

The property is mostly covered by a paved parking area. No structures exist on the site and there is no evidence of past structures. The parking lot and the surrounding grassy medians are of recent construction. Along the southern boundary of the parking lot is a concrete flood control levee wall. Along the shore of the Chemung River is a NYSDEC access road which is used to access the area to maintain the flood control features.

2.0 Statement of Safety and Health Policy

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

3.0 Hazard/Risk Analysis

Physical hazards associated with heavy equipment operations are present. The heavy equipment associated with this project will include drilling equipment, an excavator for the soil sampling in and around former MGP features, and vibra-core sediment sampling equipment mounted on a small boat, platform, or barge. Some of the hazards associated with this equipment include crushing of limbs, slipping, tripping, or falling, heavy lifting, and drowning.

Smoking is prohibited in the vicinity of hazardous operations or materials. Where smoking is permitted, safe receptacles shall be provided for smoking materials. Additional requirements regarding smoking are described in Appendix E – Iberdrola Contractor Safety Requirements and Smoking Policy.

The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

3.1 Personal Safety

Field activities have the potential to take site workers into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- www.crimereports.com
- www.cityrating.com/crimestatistics.asp
- www.crimemapping.com

Elmira, New York is listed on the City Rating website, with a 2009 crime rate of 1,177 total incidents, and a projected crime rate for 2011 of 867 total incidents. The Crime Reports website lists 0 criminal reports for third quarter 2011.

To protect yourself, take the following precautions:

- Use the buddy system (teams of a minimum of two persons present)
- Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave
- Call in regularly
- Pay attention to what is going on around you
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely

Site workers must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If site workers encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area

of concern, and contact local 911 for assistance. Notify the SSO and Corporate Health and Safety Officer (CHSO) of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on site. Confirmation of cellular phone operation and site worker safety will be confirmed at the start, mid-point, and near the end of each working day.

3.2 Activity Hazard Analysis

The potential hazards for this project have been categorized into site and activity hazards. Site hazards are those hazards associated with site conditions, and activity hazards are associated with GEI on-site activities. The potential hazards and control measures established to reduce the risk of injury or illness are identified in the following tables. Safe operating procedures established for routine hazards and common site conditions are included in the table below, or contained in the GEI Corporate Health and Safety Manual.

3.2.1 Activity Hazard Analysis Table

SITE HAZARDS	
Potential Hazard	**Control Measures**
Drilling & Test Pit Excavation Injury	▪ Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. Coordinate hand signals with operators. ▪ Stay Alert! Pay attention to equipment backup alarms and swing radii. ▪ Wear a high visibility reflective vest when working near equipment or motor vehicle traffic. ▪ Position yourself in a safe location when filling out logs and talking with the contractor. ▪ Notify the contractor immediately if any problems arise. ▪ Do not stand or sit under suspended loads or near any pressurized equipment lines. ▪ Do not operate cellular telephones in the vicinity of heavy equipment operation.
Physical Injury	▪ Wear steel toe/steel shank safety boots in good condition with non-slip soles. ▪ Maintain good visibility of the work area. ▪ Avoid walking on uneven or debris ridden ground surfaces.
Noise	▪ Wear hearing protection when near loud noises. ▪ Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection.
Cold Stress	▪ Increase water intake while working. ▪ Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in warm, dry areas. ▪ Watch for signs and symptoms of cold stress and fatigue. ▪ See Cold Stress Guidelines in Appendix C.
Vehicular Traffic	▪ Wear high visibility reflective safety vest at all times. ▪ Use cones, flags, barricades, and caution tape to define work area. ▪ Use a "spotter" to locate oncoming vehicles. ▪ Use vehicle to block work area. ▪ Engage police detail if needed.
Boating Safety	▪ Use caution when boarding the boat. ▪ Establish a safe area for boarding and de-boarding. ▪ Do not stand in the boat. Avoid sudden movements. ▪ Stay away from the edge of the boat. ▪ Wear a personal flotation device (PFD) at all times when on the water or working near water where there is a potential for falling in.

Potential Hazard	Control Measures
Utilities	▪ GEI will contact Dig Safely NY to locate and mark-out subsurface utilities see (Utility Clearance Documentation in Appendix D). ▪ All GEI subcontractors will also be required to contact Dig Safely NY to locate and mark-out subsurface utilities. ▪ GEI will contact a utility locating contractor to also assist with the utility locating task. ▪ As directed by GEI, the drilling subcontractor will pre-clear boring and well locations by hand to a depth of not less than 5 feet below ground surface. ▪ Utilities are to be considered live or active until documented otherwise. ▪ For overhead utilities within 50 feet, have contractor determine with the utility company the appropriate safe distance. Minimum distance for clearance is based on voltage of the line. ▪ An observer will be established when operating drilling rigs near overhead utilities.

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
Entering Construction Site	Heavy equipment, dust, noise.	Hard hat, high visibility reflective safety vest, steel-toed, steel-shank boots, safety glasses, and nitrile/neoprene gloves.
Drilling & Test Pit Excavation	Heavy equipment, dust, noise.	In addition to the personal protective equipment (PPE) listed above for "Entering Construction Site" hearing protection (ear plugs or ear muffs) will be utilized.
Soil Excavation and Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hat, safety glasses, and hearing protection. Maintain eye contact with equipment operator.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Cold Stress	Acclimatization, work/rest regimes, drinking warm fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and high visibility reflective safety vests in accordance with Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Excavation	Maintain proper distance from edge of excavation; be alert for unstable soil conditions/wall collapse. Do not enter excavations.
Soil Excavation and Sample	Contaminant Contact	Wear protective coveralls (e.g., Tyvek™) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
Collection (cont'd.)		samples. Dispose of gloves after sampling. PPE will be decontaminated and disposed of in general accordance with Section 11.0 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photo-ionization detector (PID) and multiple gas meter (that monitors % oxygen, and lower explosive limit), and dust monitor to monitor the work zone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, contact the CHSO, then upgrade to full face respirator with high efficiency particulate air (HEPA)/organic vapor cartridge as indicated in Section 4.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be performed in accordance with the GEI CAMP.
Subsurface Boring/ Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hat, safety glasses, and hearing protection. Maintain eye contact with equipment operator.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Cold Stress	Acclimatization, work/rest regimes, drinking warm fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and high visibility reflective safety vests in accordance with Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek™) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. PPE will be decontaminated and disposed of in general accordance with Section 11.0 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including PID and multiple gas meter (that monitors % oxygen, lower explosive limit, hydrogen sulfide and hydrogen cyanide), and dust monitor to monitor the work zone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, contact the CHSO, then upgrade to full face respirator with HEPA/organic vapor cartridge as indicated in Section 4.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be performed in accordance with the GEI CAMP.
Subsurface Boring/ Sample Collection	Exposure to vapors from contaminated soils (cont'd.)	

ACTIVITY HAZARDS		
Activity (cont'd.)	**Potential Hazards**	**Protective Equipment / Controls**
Sediment Sampling	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Cold Stress	Acclimatization, work/rest regimes, drinking warm fluids.
	Slip/Trip/Fall/ Drowning	Maintain safe and orderly work areas. Wear approved flotation device. Identify and prepare potential tripping hazards on the boat. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
Survey	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Cold Stress	Acclimatization, work/rest regimes, drinking warm fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
Personal Protective Equipment (PPE) is the *initial level of protection* based on the activity hazards and Site conditions which have been identified. *Upgrades to respiratory protection may be required based on the designated action levels.* General on-site provisions shall include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek®) with boot covers, drinking water and electrolyte fluids, reflective vest, first aid kit, sunscreen, hearing protection and washing facilities.		

If site conditions suggest the existence of a situation more hazardous than anticipated, the site personnel shall evacuate the immediate area. The hazard, the level of precautions, and the Personal Protection Equipment (PPE) shall then be re-evaluated with the assistance and approval of the GEI Corporate Health and Safety Officer (Steve Hawkins), Project Manager, and Site Safety Officer.

3.2.2 Handling Drums and Containers

Regulations for handling drums and containers are specified by Occupational Health and Safety Administration (OSHA) 29 CFR 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during the site investigation and remediation activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with all applicable regulations.

3.3 Evaluation of Potential Chemical Hazards

The characteristics of compounds of concern (COC) at the site are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below.

3.3.1 Volatile Organic Compounds (VOCs)

Volatile organic chemicals (VOCs), such as benzene, toluene, ethyl benzene, and xylene (BTEX) are present as soil and groundwater contaminants and in some cases chemical components in non-aqueous phase liquids (NAPL) such as oil or tar within soils and abandoned pipelines. At high concentrations these compounds generally have a depressant effect on the central nervous system (CNS), may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure to high concentrations may include headache, dizziness, nausea, and skin and eye irritation. The primary route of exposure to VOCs is through inhalation and therefore respiratory protection is the primary control against exposure to VOCs.

3.3.2 Coal Tar and Coal Tar Products

Coal tar products, which are semi-volatile organic compounds (SVOCs) consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphthalene, phenanthrene, phenols, pyrene.

Coal tar products and other SVOCs may be present at the site within impacted soil and groundwater and as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former MGP structures, and abandoned pipelines.

Coal tar products such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Coal tar is considered to be very toxic, if ingested. High levels of exposure to coal tar, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever anemia, liver damage, vomiting convulsions and coma. Poisoning may occur by ingestion of large doses, inhalation or skin absorption.

The major route of entry for the work activities to be conducted at this site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

3.3.3 Heavy Metals

The site soils may contain elevated levels of metals including arsenic, chromium, lead, mercury, and selenium.

Exposure to high concentrations of arsenic can cause dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, and hyperpigmentation of skin. Chronic exposure to arsenic has resulted in lung cancer in humans.

Exposure to high concentrations of lead may cause acute symptoms such as eye irritation, weakness, weight loss, abdominal pain, and anemia. Chronic exposure to lead may result in kidney disease, effects to the reproductive system, blood forming organs, and CNS.

Both lead and arsenic are regulated by specific OSHA standards. They are 29 CFR 1910.1025/1926.52 and 29 CFR 1910.1018/1926.1118, respectively. These standards include specific requirements for air monitoring, signs and labels, training and medical surveillance.

Exposure to high concentrations of chromium can cause acute symptoms such as irritation of the eyes, nose and throat as well as wheezing and coughing. Chronic effects include nosebleeds, nasal congestion, dermatitis, and loss of sight.

Exposure to high concentrations of mercury can cause dizziness, salivation nausea, vomiting, diarrhea, constipation, emotional disturbance, and kidney injury. Chronic exposure to mercury can cause CNS damage.

Exposure to high concentrations of selenium can cause mucous membrane irritation, coughing, sneezing, shortness of breath, chills, headaches, hypotension, and CNS depression. Chronic exposure to selenium could cause bronchial irritation, gastrointestinal distress, excessive fatigue, and skin discoloration.

As with SVOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

3.3.4 Asbestos-Containing Materials

The site soils potentially contain asbestos-containing materials (ACM) in the forms of demolition debris. Chronic exposure to asbestos may cause asbestosis and mesothelioma. The primary route of exposure for asbestos is inhalation during the disturbance and/or removal of asbestos from the pipe insulation and cement pipes.

Asbestos is strictly regulated under OSHA 29 CFR 1910.1001/1926.1101. Employees that may be potentially exposed to ACM must participate in a medical surveillance program, have specific training in the hazards and controls of exposure to asbestos and wear respirators with high efficiency particulate (HEPA) filters. All work must be conducted in demarcated regulated areas to minimize the amount of people within the exposure area. Employers must conduct air sampling and provide signs and labels regarding the presence of asbestos.

3.3.5 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) may be of potential concern based on previous land uses at the site. Exposure to PCBs can occur through unbroken skin without immediate pain or irritation. Acute effects of PCB exposure can include eye, skin, nose, and throat irritation. Chronic effects of PCB exposure can include skin swelling and redness, gastro-intestinal disturbances, and neurological effects such as headache, dizziness, nervousness and numbness of extremities. PCBs are suspected human carcinogens that can cause liver cancer. PCBs can accumulate in fatty tissues and result in health effects after the initial exposure has occurred. The primary route of exposure for PCBs is inhalation, dermal contact, and ingestion.

3.3.6 Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiant. It replaces the oxygen in the blood and thereby suffocates the cells. Ferrocyanides are not considered toxic because the hydrogen cyanide ion is bound too tightly to the iron and cannot therefore replace the oxygen. It takes a great amount of heat and/or acid to release cyanide gas from the ferrocyanide molecule, therefore hydrogen cyanide is not a concern at this site.

3.3.7 Hydrogen Sulfide

Hydrogen sulfide is another common by-product of manufactured gas production. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. These symptoms usually go away in a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Breathing very high levels (>800 ppm) of hydrogen sulfide can cause death within just a few breaths. The primary route of exposure is through inhalation and therefore respiratory protection is the primary control against exposure to hydrogen sulfide.

3.3.8 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action levels for VOCs and associated contingency plans for the work zone are discussed within Section 8.0 of this Health and Safety Plan.

Exposure to organic vapors shall be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a PID.
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover or covering up the impacted material with sheeting to mitigate volatile odors.

- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e., air purifying respirator with organic vapor cartridge) will be employed.

3.3.9 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 4.0 will be worn for all activities where contact with potential contaminated media or materials are expected.

Safety Data Sheets (SDS) (as available) and/or Occupational Health Guidelines for decontamination chemicals, laboratory reagents, and calibration gases that may be used on site are included in Appendix B. Specific chemical hazards information from the SDS and Occupational Health Guidelines are summarized in Table 1.

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Asbestos	1332-21-4	0.1 f/cc	0.1 f/cc over 8 hr period or 1.0f/cc over 30 min.	Inhalation Ingestion Skin Contact	Asbestosis (chronic exposure); mesothelioma, breathing difficulty, interstitial fibrosis' restricted pulmonary function, finger clubbing; irritate eyes, known human carcinogen	Respiratory system, eyes	White, greenish, blue, or gray-green fibrous solids FP: NA LEL: NA UEL NA VP: 0 mm
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L.005mg/ m^3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, known human carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12º F LEL: 1.2% UEL:7.8% VP: 75 mm
Chromium (Chromic Acid and Chromates)	1333-82-0	0.05 mg/m^3	0.1 mg/m^3	Inhalation Ingestion Skin Contact	Irritates respiratory system, nasal, septum perforation, liver and kidney damage, leucocytosis (increased blood leucocytes), leukopenia (reduced blood leucocytes), moncytosis (increased monocytes), Eosinophilia, eye injury, conjunctivitis, skin ulcer, sensitivity dermatitis, potential carcinogen	Blood, respiratory system, liver, kidney, eyes, skin, lung cancer	FP:NA VP: Very Low LEL: NA UEL: NA

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Ethylbenzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, Central Nervous System	FP: 55º F LEL: 0.8% UEL:6.7% VP: 7 mm
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, Central Nervous System	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, Central Nervous System, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA LEL: NA UEL: NA VP: 0 mm
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m^3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, Central Nervous System	Silver-white, heavy odorless liquid FP: NA LEL: NA UEL:NA VP: 0.0012 mm

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Naphthalene	91-20-3		10 ppm (50 mg/m^3) TWA	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, Central Nervous System	FP: 174 F IP: 8.12 eV, LEL: 0.8% UEL:6.7%, VP: 0.08 mm
PAH's as Coal tar pitch Volatiles (CTPV)	65996-93-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Skin contact Ingestion	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, Central Nervous System, liver, kidneys, skin, bladder,	Black or dark brown amorphous residue.
PCBs	11097-69-1	0.5 mg/m^3 (Skin)	0.5 mg/m^3 (Skin)	Inhalation Skin Absorption Ingestion Skin Contact	Irritate eyes; chloracne; liver damage	Skin, eyes, liver, reproductive system	Colorless liquid or solid with a mild, hydro-carbon odor VP = 0.00006 mm
Phenol	108-95-2	10 ppm (skin)	5 ppm (19 mg/m^3) [skin]	Inhalation Skin Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, anorexia, weight loss, weakness, muscle ache, pain, dark urine, cyanosis, liver and kidney damage, skin burns, dermatitis, tremors, convulsions, twitching	Eyes, skin, respiratory system, liver, kidneys	Colorless to light pink crystalline solid with sweet, acrid odor. FP:175 ^{o}F IP:8.5 LEL:1.8% UEL: 8.6% VP: 0.4 mm
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA LEL: NA UEL: NA VP: 0 mm

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, Central Nervous System, liver, kidneys	FP: 40° F LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, Central Nervous System, GI tract, blood, liver, kidneys	FP: 90° F LEL: 0.9% UEL: 6.7% VP: 9 mm

Abbreviations	
A.L. Action Level	ppm = parts per million
C = ceiling limit, not to be exceeded	STEL = Short-term exposure limit (15 minutes)
FP = Flash point	TWA = Time-weighted average (8 hours)
GI = Gastro-intestinal	UEL = Upper explosive limit
LEL = Lower explosive limit	VP = vapor pressure approximately 68° F in mm Hg (mercury)
mm = millimeter	

3.4 Biological Hazards

The site is located in a commercial area which is surrounded by other commercial properties, and the Chemung River. Employees working on this project should be aware of the potential biological hazards at this site. Each is discussed in detail below.

3.4.1 Mosquito-Borne Disease – West Nile Virus

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. However, most infections are mild and symptoms include fever, headache and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis and rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

If possible, stay inside between dusk and dark. This is when mosquitoes are most active. When outside between dusk and dark, wear long pants and long-sleeved shirts. Spray exposed skin with an insect repellent, preferably containing DEET.

3.4.2 Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e., anaphylactic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once.

3.4.3 Sun Exposure

Employees are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 15, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should wear safety glasses that offer protection from UVA/UVB rays.

3.5 Physical Hazards and Control

3.5.1 Utility Clearance in the Chemung River

New York requires that a utility notification be performed at least two (2) full work days prior to initiation of any subsurface work. Both GEI and GEI's sediment contractor will be required to contact Dig Safely New York (1-800-962-7962) to request a mark-out of natural gas, electric, telephone, cable television, water and sewer lines that may be present in the Project Area of the river prior to probing sediments. Work will not begin until the required utility clearances have been performed.

Public utility clearance organizations typically do not mark-out underground utility lines that are located on private property. As such, GEI and GEI's subcontractors must exercise due diligence and try to identify the location of any private utilities that may be buried within the Project Sub-Areas of the river. GEI and GEI's subcontractors will fulfill this requirement in several ways, including:

- Obtaining as-built drawings for the areas being investigated from the property owners
- Visually reviewing each proposed sediment sampling location with the property owner or knowledgeable site representative

Due to the limitations associated with utility mark-outs and the fact that work is being conducted in the river, GEI and/or the marine subcontractors' staff may meet with individual utility owners at each Project Sub-Areas to determine if they have any underground lines located in the river. This information will be reviewed by the Project Team. If it is determined that underground utilities are located in the sediment sampling areas, the sampling locations will be changed to reduce the possibility of encountering underground utilities during the proposed investigation.

3.6 Slip, Trip, and Fall Hazards

3.6.1 Access to Water

Access to the sediment sampling area will be determined prior to mobilization. When accessing these locations, employees should be aware of the potential for slipping, falling, or tripping and the presence of various types of debris, including rocks, glass, construction debris, and general refuse. Site workers will walk around, not over or on top of, debris or trash piles. When carrying equipment, identify a path that is clear of any obstructions. It may be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

Boat Deck

The boat or drilling platform itself presents slip, trip, and fall hazards to the field team due to the accumulation of water on the deck. To the extent possible, accumulated water should be removed from the boat or barge deck to avoid this hazard. If possible, anti-slip matting should be placed on the decks as an additional precaution.

Good Housekeeping

Maintaining a work environment that is free from accumulated debris is the key to preventing slip, trip, and fall hazards at construction sites. Essential elements of good housekeeping on each boat or drilling barge include:

- Orderly placement of materials, tools, and equipment
- Placing trash receptacles at appropriate locations for the disposal of miscellaneous rubbish
- Prompt removal and secure storage of items that are not needed to perform the immediate task at hand
- Awareness on the part of all employees to walk around, not over or on, equipment that may be stored in the work area

3.7 Working on Water

This project presents unique hazards to the sampling team when compared to land-based investigation programs. Therefore, special attention has been given to the topic of marine safety in this HASP, including the scheduling of a pre-mobilization strategy meeting between GEI and the marine subcontractors to develop the specific safety and emergency communications protocols (based on actual site conditions) to address the hazards of working in the river.

Boat and Inspection

Effort has not been made to incorporate all applicable USCG regulations; however, some selected excerpts from USCG regulations have been included to provide general guidance. The boat captains are ultimately responsible for having knowledge of, and complying with, all USCG and any other applicable marine regulations.

Before being placed in service, boats and barges will be inspected by the boat captains in consultation with the SSO and determined to be in safe operating condition. The boat captains also must verify that all required safety gear is aboard before use. A pre-use inspection of the watercraft also must be performed by the boat captains before each daily use. All safety deficiencies will be corrected prior to permitting the boat or barge to leave the dock and resume normal service.

The boat captains must provide written documentation of the initial boat inspection and the daily inspections to the SSO. These inspections will be documented on standard inspection forms used by the boating contractor.

Watercraft determined to be in unsafe condition shall be taken out of service and its use prohibited until unsafe conditions have been corrected.

Boat Registration

All watercraft must meet USCG or state watercraft registration and numbering requirements. The USCG requires that all motorized watercraft be numbered in the state of principal use. A valid certificate showing the numbers issued to the watercraft is required to be on board the watercraft whenever the watercraft is in use. Watercraft registration numbers are required to be painted or permanently attached to each side of the forward half of the watercraft. Watercraft registration must be updated as the governing laws require.

Boat and Barge Capacity

The sediment sampling boat or drilling barge will not be loaded beyond the maximum capacity (number of passengers or the total weight of passengers and gear) as specified on the manufactures capacity plate affixed to the vessel. In addition, consideration will be applied to down rate this capacity (at the discretion of the GEI SSO) so that there is sufficient room, freeboard, and stability to safely perform the intended task given the prevailing weather and river conditions. All equipment shall be properly loaded and secured to prevent shifting and to limit tripping hazards. All personnel will be evenly distributed on-board and will be instructed to remain seated at all times while the vessel or barge is underway or being moved to the drilling areas.

Personal Flotation Devices

All employees working on the water, near the water's edge, or at any other time where there exists the possibility of falling into the water are required to wear a USCG-approved personal flotation device (PFD). When selecting the appropriate type and style of PFD, the type of activity being conducted and the required mobility of the user must be considered, because some activities may require a PFD which is less restrictive.

GEI employees will be required to wear a USCG-approved Type III PFD or a Type V work vest. Although not as effective as a Type I in turning an unconscious wearer face-up in the water, these vests are generally less bulky and restrictive, and are typically the PFDs of choice in a marine work environment. The use of inflatable PFDs is discouraged due to questionable reliability and maintenance requirements.

Prior to and after each use, each PFD shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

In situations where the water temperature has fallen below 50˚F, a USCG-approved Mustang flotation suit shall be worn in place of the Type III or Type V PFD work vest.

Float Plan

Prior to leaving shore, a plan of the day's activities, including time and place of departure, anticipated return time, and list of employees working on the project, will be filed with the PM. In the event the boat crew does not check-in at the designated time stated on the float plan, the PM will be responsible for implementing the emergency procedures outlined in the float plan. A Float Plan Form is presented in this HASP as Appendix F.

Emergency Equipment

All GEI personnel working on boat(s) that are owned/operated by others are to be informed of the locations of all on-board safety equipment including first-aid kit, fire extinguishers, throw-ring, marine radio or other suitable communications equipment as applicable to the specific boat being used. Additionally, all personnel will be instructed as to their individual roles and responsibilities in the event of an on-board emergency (loss of operator, medical emergency, man overboard) prior to the start of any on-water work.

Handling of Fuels

Gasoline must be stored in an approved container or tank. Storage in anything other than an approved container is strictly prohibited. Gasoline is a flammable liquid and should be stored at room temperature, away from potential heat sources such as the sun and away from ignition sources.

Walking in the River

In areas of shallow water, such as along the sides of the river, it may be necessary to walk into the water to perform the probing. If it is necessary to wade into the river, site workers will be required to wear a PFD, hip waders, or knee high boots, depending on the specific conditions at hand. Because of the increased chance of a slip or fall while wading, it is necessary that all site workers exercise additional care and caution while performing such sampling activities. Site workers are cautioned not to wade into water that are more than knee high in depth, or where the employee cannot visibly see the stream bottom. All water work must be conducted via the buddy system. No site worker will be permitted to work on or near the water alone. An appropriate PFD must be worn at all times when working in or near the water's edge.

4.0 Personal Protective Equipment

The PPE specified in Table 2 represents PPE selection required by 29 CFR 1910.132, and is based on the AHA of Section 3. Specific information on the selection rationale activity can be found in the GEI Health and Safety Manual.

The PPE program addresses elements, such as PPE selection based on site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations.

A summary of PPE for each level of protection is as follows:

Table 2
PPE Selection

Safety Equipment	Level A	Level B	Level C	Level D
Tyvek™ suit or work overalls				●
Hard hats with splash shields or safety glasses			●	●
Long pants	●	●	●	●
Steel-toe/shank boots				●
Steel-toe/shank boots with overboots			●	●
Chemical-resistant gloves as appropriate for work being performed and materials handled			●	●
Half- or full-face respirators with appropriate cartridges as approved by the CHSO			●	
Tyvek™ splash-resistant suit			●	
Chemical-resistant clothing		●		
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA	●	●		
Inner and outer chemical-resistant gloves	●	●		
Chemical-resistant safety boots or shoes	●	●		
Two-way radio	●	●		
Hard hat	●	●		
Fully encapsulating chemical-resistant suit	●			
High Visibility Reflective vest	●	●	●	●

PPE requirements for field activities are as follows.

Activity	Level of Protection	Backup Protection
Mobilization and Demobilization	D	C
Drilling and Sampling	D	C
Excavation and Sampling	D	C
Sediment Sampling	D	C
Survey	D	C
Air Monitoring	D	C

PPE will include hard hats, safety glasses or face shields, long pants, steel toe/steel shank boots, hearing protection, nitrile gloves, and leather or Kevlar gloves. If heavily contaminated soil or groundwater is encountered during intrusive work, Tyvek™ suits and overboots may be utilized. Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the exclusion zone and this HASP will be revised with oversight of the CHSO. GEI personnel will not re-enter the exclusion zone until conditions allow.

OSHA Requirements for Personal Protective Equipment

All PPE used during the course of this field investigation must meet the following OSHA standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1 1968
Respiratory	29 CFR 1910.134	ANSI Z88.1 1980
Head	29 CFR 1910.135	ANSI Z89.1 1969
Foot	29 CFR 1910.136	ANSI Z41.1 1967
Foot (EH)	ASTM F2413-05	

CFR = Code of Federal Regulations
ANSI = American National Standards Institute
ASTM = American Society For Testing and Materials

5.0 Key Project Personnel/Responsibilities and Lines of Authority

5.1 GEI Personnel

- James H. Edwards GEI Project Manager
- Garrett Schmidt GEI Site Safety Officer and Field Representative
- Steven Hawkins GEI Corporate Health and Safety Officer
- Jeena Shepherd GEI Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the GEI Project Manager (PM), the GEI Corporate Health and Safety Officer (CHSO), the GEI Project Site Safety Officer (SSO), other GEI personnel implementing the proposed scope of work.

5.1.1 GEI Project Manager

The GEI Project Manager is responsible for ensuring that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Verifying that the GEI staff selected to work on this program are sufficiently trained for the sampling activities
- Assuring that all personnel to whom this HASP applies, including subcontractor personnel, have received a copy of it
- Providing the CHSO with updated information regarding conditions at the site and the scope of site work
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of all necessary safety procedures
- Supporting the decisions made by the SSO and CHSO
- Maintaining regular communications with the SSO and, if necessary, the CHSO
- Verifying that the subcontractors selected by GEI to work on this program have completed GEI environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work
- Coordinating the activities of all GEI subcontractors and ensuring that they are aware of the pertinent health and safety requirements for this project

5.1.2 GEI Corporate Health and Safety Officer

The GEI CHSO, Steven Hawkins, is the individual responsible for the review, interpretation and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the CHSO. Specific duties of the CHSO include:

1. Writing, approving and amending the HASP for this project
2. Advising the PM and SSO on matters relating to health and safety on this site
3. Recommending appropriate personal protective equipment (PPE) and safety equipment to protect personnel from potential site hazards
4. Conducting accident investigations
5. Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP

5.1.3 GEI Site Safety Officer

All GEI field staff are responsible for implementing the safety requirements specified in this HASP. However, one person will serve as the SSO. For this program, the Field Team Leader will serve as the SSO. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies, including subcontractors, have submitted a completed copy of the HASP receipt and acceptance form
- Conducting the pre-entry briefing prior to beginning work, and subsequent safety meetings as necessary
- Conduct daily Safety Tailboard meeting in accordance with NYSEG (can be combined with “pre-entry”) briefing for river-related work
- Assuring that all personnel to whom this HASP applies have attended and actively participated in a pre-entry briefing and any subsequent safety meetings that are conducted during the implementation of the program
- Maintaining a high level of health and safety consciousness among employees implementing the proposed activities
- Procuring the air monitoring instrumentation required and performing air monitoring for investigative activities
- Procuring and distributing the PPE and safety equipment needed for this project for GEI employees
- Verifying that all PPE and health and safety equipment used by GEI is in good working order

- Verifying that the selected contractors are prepared with the correct PPE and safety equipment and supplies
- Notifying the PM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived
- Monitoring and controlling the safety performance of all personnel within the established restricted areas to ensure that required safety and health procedures are being followed
- Stopping work in the event that an immediate danger situation is perceived

5.1.4 GEI Field Personnel

All GEI field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work
- Submitting a completed HASP Acceptance Form to the GEI SSO prior to the start of work
- Attending and actively participating in the required pre-entry briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program
- Stopping work in the event that an immediate danger situation is perceived
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO prior to the start of work
- Reporting all accidents, injuries and illnesses, regardless of their severity, to the GEI SSO
- Complying with the requirements of this HASP and the requests of the SSO and boat captain

Lines of Authority will be as follows:

On site – GEI will have responsibility for safety of its employees during the work performed at the Elmira Water Street MGP site. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI Project Manager and with the NYSEG representative.

Boat Captain

GEI will hire marine subcontractors to provide boats, drilling platforms or barges, drilling and coring equipment, survey equipment, boat captains and crews for the sediment sampling task. All boat captains assigned to the project will be responsible for managing all on-water operations conducted in support of these proposed efforts. These responsibilities include:

- Complying with all applicable USCG regulations and requirements
- Serving as primary point of contact for coordinating marine operations with GEI's SSO

- Verifying that the vessels are properly licensed/registered and that the vessels are properly sized and equipped for existing conditions
- Conducting a mandatory all-hands marine safety briefing prior to the start of on-water activities, which will include a review of procedures for abandoning ship and man overboard emergencies
- Support GEI SSO with daily safety tailboard meetings
- Performing a thorough daily inspection of the boats and support equipment prior to departure and submitting inspection documentation to the SSO
- Postponing or suspending marine operations due to weather and water conditions
- Coordinating all on-water emergency response efforts, if necessary

5.2 Subcontractors

GEI may subcontract the following firms or additional firms that will be identified prior to the start of the project to assist in performing work on this project:

Drilling Services – Boart Longyear	34 Talbot Road Northborough, MA 01532 (508) 936-1050
Utility Clearance – Thew Associates Subsurface Utility Associates LLC	6431 U.S. Highway 11 Canton, NY 13617 (315) 386-2346
Survey – Thew Associates Land Surveyors	6431 U.S. Highway 11 Canton, NY 13617 (315) 386-2346
Sediment Sampling – TG&B Marine Services	PO Box 773 Monument Beach, MA 02553-0773 (508) 566-7790

The list of GEI subcontractors will be finalized with an amendment to this HASP prior to site mobilization. GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for protection of their employees but at a minimum must adhere to applicable requirements set forth in this HASP.

5.3 Emergency Contact List

<table>
<tr><th colspan="3">EMERGENCY INFORMATION</th></tr>
<tr><th colspan="2">Important Phone Numbers</th><th>Directions to Hospital</th></tr>
<tr><td>Local Police</td><td>911</td><td rowspan="11">St. Joseph's Hospital
555 Market Street
Elmira, New York 14513

Start out going west on East Water St toward Madison Ave. Take the 1st right onto Madison Ave. Then take the 1st right onto East Market St.

Total Travel Estimate: 1 minute / 0.29 miles

See Map in Appendix A

<u>Nearest Occupational Health Clinic</u>

Center for Occupational & Environmental Medicine at Arnot Ogden Medical Center, Elmira, New York</td></tr>
<tr><td>Fire Department</td><td>911</td></tr>
<tr><td>Ambulance</td><td>911</td></tr>
<tr><td>State Police or
County Sheriff</td><td>911</td></tr>
<tr><td>Hospital:
St. Joseph's Hospital
Occupational Clinic:
Center for Occupational and Environmental Medicine</td><td>(607) 733-6541

(607) 737-4539</td></tr>
<tr><td>Project Manager
James H. Edwards</td><td>(607) 216-8958</td></tr>
<tr><td>Corporate Health and Safety Officer
Steve Hawkins</td><td>(860) 368-5348 office
(860) 916-4167 cell</td></tr>
<tr><td>Regional Health and Safety Officer
Jeena Shepherd</td><td>(856) 291-5663 office
(856) 298-7138 cell</td></tr>
<tr><td>John Ruspantini, NYSEG
Client Contact</td><td>(607) 762-8787</td></tr>
<tr><td>Utility Clearance Ticket #</td><td>Obtain from utility clearance one-call</td></tr>
<tr><td colspan="3">Nearest Telephone Location: On-site cellular</td></tr>
</table>

6.0 Training Program

6.1 HAZWOPER Training

In accordance with 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.3 Site-Specific Training

Prior to commencement of field activities, the GEI CHSO or her representative will ensure all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel that have not received site-specific training will not be allowed on site.

6.4 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by GEI's field representative to assist GEI personnel in safely conducting work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. Documentation of these briefings will be recorded in the GEI field book or on the GEI Daily Safety Briefing form. The meetings will also be an opportunity to periodically update the workers on monitoring results. In addition, all GEI personnel shall sign the HASP to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the plan.

6.5 First Aid and CPR

The PM will identify individuals certified in first aid and CPR, or identify individuals for such training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association.

7.0 Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. Steven Hawkins is GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at all branch office locations. Comprehensive examinations are given to all GEI field personnel participating in hazardous waste operations on an annual or biennial basis (as determined to be appropriate by the CHSO). The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Steven Hawkins' telephone number is:
Telephone: (860) 368-5348 (office) or (860) 916-4167 (cell)

Under the CHSO's supervision, all field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use all levels of respiratory protection, in particular.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

All GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

8.0 Monitoring

Monitoring shall be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on site.

GEI will conduct perimeter air monitoring, and work zone monitoring for on-site workers. GEI will monitor and document daily site conditions and operations and inform field representative of results. If action levels are exceeded GEI's field representative will immediately implement dust suppression activities and notify GEI's Project Manager.

GEI will provide the following equipment for health and safety monitoring of on-site personnel:

- Particulate Meter (PM-10 capable)
- Four-gas meter (O_2, H_2S, CGI, CO)
- Photo-ionization Detector (PID)
- Sound Level Meter if deemed necessary by the CHSO or PM (type to be appropriate to the activities performed)

The perimeter and work zone air monitoring will be conducted during drilling and excavation activities. Table 3 provides a summary of real time air monitoring action levels and contingency plans for work zone activities.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
PID	Breathing Zone	1 ppm	Use Dräger Chip Measurement System (CMS) tube for benzene or Z-nose® to verify if concentration is benzene. No respiratory protection is required if benzene is not present.
	Breathing Zone	10 ppm	Use Dräger Chip Measurement System (CMS) or tube for naphthalene or Z-nose® to verify if concentration is naphthalene. No respiratory protection is required if naphthalene is not present
	Breathing Zone	10 - 50 ppm	No respiratory protection is required if benzene or naphthalene is not present.
	Breathing Zone	50 - 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist Upgrade to Level C.
	Breathing Zone	> 100 ppm	Stop work, withdraw from work area; notify PM & CHSO.
Oxygen meter (O_2)	Breathing Zone	< 20.7%	Stop work; withdraw from work area; ventilate area, notify PM & CHSO.
	Breathing Zone	> 21.1%	Stop work; withdraw from work area; notify PM & CHSO.
Hydrogen Sulfide	Breathing Zone	<5 ppm	No respiratory protection is required.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
(H_2S) meter		>5 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, and notify PM & CHSO.
Combustible Gas Indicator (CGI)	Excavation/ Work Zone	< 10 % Lower Explosive Limit (LEL)	Investigate possible causes, allow excavation to ventilate; use caution during procedures.
		> 10% LEL	Stop work; allow excavation, borehole to ventilate to < 10% LEL; if ventilation does not result in a decrease to < 10% LEL, withdraw from work area; notify PM & CHSO.
Particulate Meter	Excavation/ Work Zone	150 $\mu g/m^3$	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

9.0 Site Control Measures

9.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site by the Contractor when operations begin for each task requiring such delineation.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to site contaminants exists, will only be allowed access after proper training and medical documentation.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone. This zone will be clearly delineated by cones, tapes or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the Contractor allowing adequate space for the activity to be completed, field members and emergency equipment.

The earthwork, drilling, and marine subcontractors are responsible for constructing, maintaining, and enforcing the zones.

9.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site personnel should be aware of their role as a "buddy" and be able to provide

assistance in the event of an emergency. A copy of this plan shall be given to any person acting as a GEI "buddy" for informational purposes.

9.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on site.

9.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. All activities planned for the site are anticipated to occur outside during daylight hours. However, if yard areas are used after dark they will be equipped with illumination that meets or exceeds requirements specified in 29 CFR 1926.56, Illumination.

9.5 Utilities

The site has buried utilities and also overhead utilities in certain areas. It will be necessary for all parties disturbing the existing ground surface and conducting operations with heavy equipment having high clearances to exercise a high degree of caution in performing project-related work with respect to the presence of utilities. Site workers will use these data to choose apparently safe work locations.

The location of any utility that could pose a risk to workers must be communicated to all workers during site safety indoctrination. Utilities should be marked or access otherwise restricted to avoid change of accidental contact.

Even when a utility search has been completed, drilling, boring and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. All utilities shall be considered “live” or active until reliable sources demonstrate otherwise.

9.5.1 Overhead Utilities

Overhead transmission and distribution lines are present at the site. Clearances will be adequate for the safe movement of vehicles and for the operation of construction equipment.

Overhead or above-ground electric lines should be considered active until a reliable source has documented them to be otherwise. Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures shall be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded or shielded and a competent electrician has certified that arcing cannot occur between the work location or superstructure.

10.0 Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report shall be made to the GEI Project Manager verbally within 2 hours of the incident. The Project Manager will immediately inform the CHSO, the Director of Human Resources, and the NYSEG representative of the incident. An Accident Report Form (see Appendix D) will be completed and submitted to the CHSO and the Director of Human Resources within 24 hours of the incident.

11.0 Decontamination Procedures

11.1 Personnel Decontamination Station

A personnel decontamination station where workers can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor. It will be equipped with basins for water and detergent, and trash bag(s) or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.)

The following specific decontamination procedure will be used as necessary by GEI personnel or subcontractor personnel wearing PPE from Level D through Level C.

Step 1 Equipment drop (respirator, tools, monitoring equipment, etc.)
Decontaminate as appropriate (per GEI's field representative's instructions).

Step 2 Boot wash/rinse (wash with non-foaming detergent, rinse with fresh water spray). Remove boots. If inner and outer gloves are worn, wash outer gloves, remove and save for later use, or remove and discard outer gloves and place in trash bag/can provided in the decontamination area.

Step 3 Hard hat removal, wash if visibly contaminated (use same wash as in Step 2).

Step 4 If Tyvek™ (or equivalent) suit was worn and is visibly contaminated, remove and place in trash bag/can provided in the decontamination area or decontaminate (wash) and store for reuse.
Contaminated washable coveralls should be removed and bagged for washing.

Step 5 Respirator and/or eye protection removal (as applicable). Wash (per Step 2) to remove visible contamination.

Step 6 Remove outer gloves.

Step 7 Wash potentially exposed skin (use water and soap at indoor sink).

Step 8 Disinfect respirator per manufacturer's recommendations.

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate container) and disposed of in an approved facility. Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with all applicable state and federal regulations.

11.2 Decontamination Equipment Requirements

The following equipment, if required, should be in sufficient supply to implement decontamination procedures for GEI's equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handle soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for ensuring that the above materials, as required for their operation, are in sufficient supply.

12.0 Supplemental Contingency Plan Procedures

12.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their 40-hour HAZWOPER training. All hazardous materials used on the site will be properly labeled, stored, and handled. Safety Data sheets (SDS) will be available to all potentially exposed employees.

12.2 Fire

In the event of a fire, all personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the GEI PM and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI PM.

12.3 Medical Support

In case of minor injuries, on-site care will be administered with the site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger.

Section 5 of this HASP contains detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. GEI field personnel will carry a cellular telephone.

12.4 Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 mph, heavy rains or snow squalls, thunderstorms, hurricanes, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the GEI PM, the CHSO, and the NYSEG representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI PM.

12.5 Spills or Material Release

If a hazardous waste spill or material release occurs, the SSO or his representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following.

- MSDS, if available, for the material spilled or released
- Source of the release or spillage of hazardous material

- An estimate of the quantity released and the rate at which it is being released
- The direction in which the spill or air release is moving
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result
- Potential for fire and/or explosion resulting from the situation
- Estimates of area under influence of release

If the spill or release is determined to be within the on-site emergency response capabilities, the SSO will ensure implementation of the necessary remedial action. If the release is beyond the capabilities of the site personnel, all personnel will be evacuated from the immediate area and the local fire department will be contacted. The SSO will notify the PM, the CHSO, and the NYSEG representative.

12.6 Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the site.

Health and Safety Plan Sign-Off

All GEI personnel conducting site activities must read the Health and Safety Plan, be familiar with its requirements, and agree to its implementation.

Once the Health and Safety Plan has been read, complete this sign-off sheet, and return it to the Project Manager.

Site Name:
Elmira Water Street MGP Site
City of Elmira, Chemung County, New York
NYSDEC Site #8-08-025

Investigation:
NYSEG Property
Adjacent Properties
Chemung River

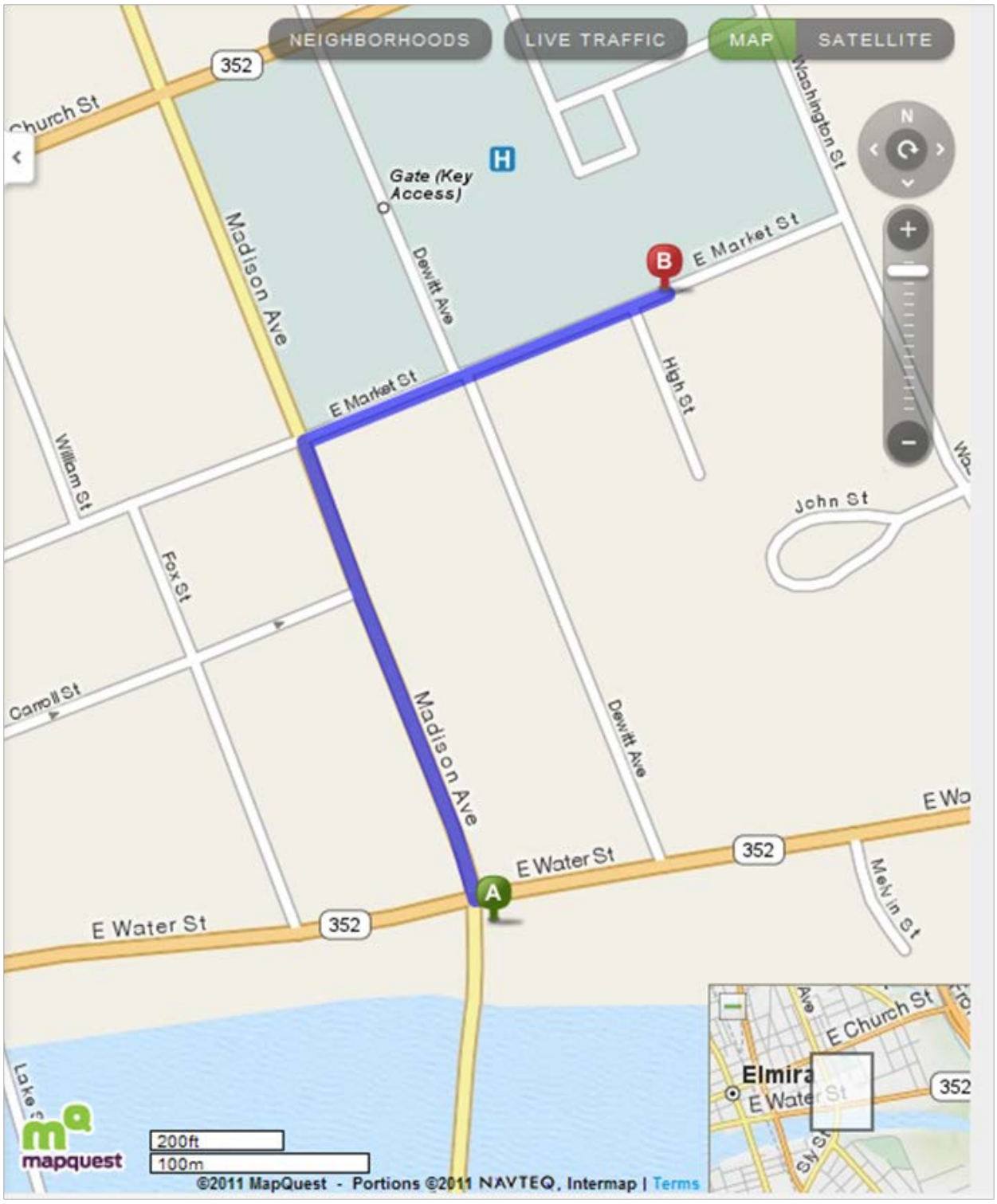
GEI Project No: 1704633

I have received and read the Health and Safety Plan, been briefed on it, and agree to its implementation.

Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:

APPENDIX A – HOSPITAL MAP

510 East Water Street, Elmira, NY to St. Joseph's Hospital, 555 Market Street, Elmira, NY



APPENDIX B – SAFETY DATA SHEETS

SAFETY DATA SHEET

Benzene

Section 1. Identification

GHS product identifier : Benzene

Chemical name : benzene

Other means of identification : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

Product use : Synthetic/Analytical chemistry.

Synonym : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

SDS # : 001062

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
GERM CELL MUTAGENICITY - Category 1B
CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (bone marrow) - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes serious eye irritation.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
Causes damage to organs through prolonged or repeated exposure. (bone marrow)

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Section 2. Hazards identification

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF SWALLOWED: Call a POISON CENTER or physician if you feel unwell. Rinse mouth. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : benzene

Other means of identification : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

CAS number/other identifiers

CAS number : 71-43-2

Product code : 001062

Ingredient name	%	CAS number
benzene	100	71-43-2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Section 4. First aid measures

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
benzene	**ACGIH TLV (United States, 3/2012).** **Absorbed through skin.** STEL: 8 mg/m³ 15 minutes. STEL: 2.5 ppm 15 minutes. TWA: 1.6 mg/m³ 8 hours. TWA: 0.5 ppm 8 hours. **NIOSH REL (United States, 1/2013).** STEL: 1 ppm 15 minutes. TWA: 0.1 ppm 10 hours. **OSHA PEL (United States, 6/2010).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL Z2 (United States, 11/2006).** AMP: 50 ppm 10 minutes. CEIL: 25 ppm TWA: 10 ppm 8 hours.

Section 8. Exposure controls/personal protection

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Watery liquid.]

Color : Colorless. Yellowish.

Molecular weight : 78.12 g/mole

Molecular formula : C6-H6

Boiling/condensation point : 80.09°C (176.2°F)

Melting/freezing point : 5.49°C (41.9°F)

Critical temperature : 288.95°C (552.1°F)

Odor : Characteristic.

Odor threshold : Not available.

Section 9. Physical and chemical properties

pH	:	Not available.
Flash point	:	Closed cup: -11°C (12.2°F)
Burning time	:	Not applicable.
Burning rate	:	Not applicable.
Evaporation rate	:	3.5 (butyl acetate = 1)
Flammability (solid, gas)	:	Not available.
Lower and upper explosive (flammable) limits	:	Lower: 1.2% Upper: 7.8%
Vapor pressure	:	10 kPa (75.006094245 mm Hg) [room temperature]
Vapor density	:	2.7 (Air = 1)
Specific Volume (ft^3/lb)	:	1.1403
Gas Density (lb/ft^3)	:	0.877 (20°C / 68 to °F)
Relative density	:	0.88
Solubility	:	Not available.
Solubility in water	:	1.88 g/l
Partition coefficient: n-octanol/water	:	2.13
Auto-ignition temperature	:	498°C (928.4°F)
Decomposition temperature	:	Not available.
SADT	:	Not available.
Viscosity	:	Dynamic (room temperature): 0.604 mPa·s (0.604 cP)

Section 10. Stability and reactivity

Reactivity	:	No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	:	Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.
Incompatibility with various substances	:	Highly reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
benzene	LC50 Inhalation Gas. LD50 Oral	Rat Rat	10000 ppm 930 mg/kg	7 hours -

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
benzene	Eyes - Moderate irritant Eyes - Severe irritant Skin - Mild irritant Skin - Mild irritant Skin - Moderate irritant	Rabbit Rabbit Rat Rabbit Rabbit	- - - - -	88 milligrams 24 hours 2 milligrams 8 hours 60 microliters 24 hours 15 milligrams 24 hours 20 milligrams	- - - - -

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
benzene	+	1	Known to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
benzene	Category 1	Not determined	bone marrow

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Section 11. Toxicological information

Skin contact : Causes skin irritation.

Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : Causes damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : May cause genetic defects.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Section 12. Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
benzene	2.13	11	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Benzene (I,T)	71-43-2	Listed	U019

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1114	UN1114	UN114	UN1114	UN1114
UN proper shipping name	BENZENE	BENZENE	BENZENE	BENZENE	BENZENE
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	II	II	II	II	II
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 10 lbs / 4.54 kg [1.3675 gal / 5.1767 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

Section 14. Transport information

	Limited quantity Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1				

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Water Act (CWA) 307: benzene

Clean Water Act (CWA) 311: benzene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Section 15. Regulatory information

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
benzene	100	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	benzene	71-43-2	100
Supplier notification	benzene	71-43-2	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
benzene	Yes.	Yes.	6.4 µg/day (ingestion) 13 µg/day (inhalation)	24 µg/day (ingestion) 49 µg/day (inhalation)

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

Section 15. Regulatory information

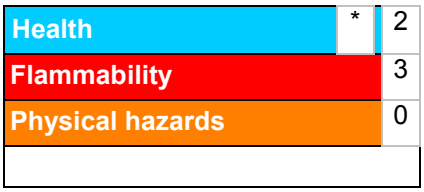
WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 4/26/2015.

Date of issue/Date of revision : 4/26/2015.

Date of previous issue : 10/16/2014.

Version : 0.03

Section 16. Other information

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Safety Data Sheet

Material Name: NAPHTHALENE **SDS ID: 00228306**

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name
NAPHTHALENE

Synonyms
NAPHTHALENE CRUDE 78 DEGREE; NAPHTHALENE INTERMEDIATE 79 DEGREE; NAPHTHALENE REFINED 80 DEGREE

Chemical Family
polynuclear aromatic hydrocarbons

Product Use
process chemical.

Restrictions on Use
None known.

Details of the supplier of the safety data sheet

KOPPERS INC.
436 Seventh Avenue
Pittsburgh, PA 15219-1800
Mfg Contact: 412-227-2001 (SDS Requests: 866-852-5239)

CHEMTREC: 800-424-9300 (Outside USA: +1 703-527-3887)
Emergencies: (Medical in USA): 877-737-9047
Emergencies: (Medical Outside of USA): 651-632-9269
E-mail: naorgmsds@koppers.com

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.
Flammable Liquids - Category 4
Acute Toxicity - Oral - Category 4
Carcinogenicity - Category 2
Specific target organ toxicity - Repeated exposure - Category 1 (blood)
Hazardous to the Aquatic Environment - Acute - Category 1
Hazardous to the Aquatic Environment - Chronic - Category 1

GHS Label Elements

Symbol(s)

Signal Word
Danger

Hazard Statement(s)
Combustible liquid.
Harmful if swallowed.
Suspected of causing cancer.

Causes damage to organs through prolonged or repeated exposure.
Very toxic to aquatic life with long lasting effects.

Precautionary Statement(s)

Prevention

Keep away from heat/sparks/open flame/hot surfaces - No smoking.
Do not breathe vapor or mist.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid release to the environment.

Response

In case of fire, use media appropriate for extinction.
IF exposed or concerned: Get medical advice/attention.
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
Rinse mouth.
Collect spillage.

Storage

Store in a well-ventilated place.
Keep cool.
Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

Statement(s) of Unknown Acute Toxicity

2% of the mixture consists of ingredient(s) of unknown acute toxicity.

Other Hazards

Heated material may cause thermal burns.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS	Component Name	Percent
91-20-3	Naphthalene	95-100
95-15-8	Benzo[b]thiophene	1-2
91-57-6	2-Methylnaphthalene	<1
1319-77-3	Cresol	<1
92-52-4	Biphenyl	<1
90-12-0	1-Methylnaphthalene	<1

Section 4 - FIRST AID MEASURES

Inhalation

If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin
Wash skin with soap and water or use a waterless handcleaner while removing contaminated clothing and shoes. For thermal burns, cool affected areas as quickly as possible by drenching or immersing in water until material solidifies. Get immediate medical attention.

Eyes
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.

Ingestion
Not a likely route of exposure. If burns occur, treat as thermal burns. Do NOT induce vomiting. If a large amount is swallowed, get medical attention. Do not give anything by mouth to unconscious or convulsive person. If vomiting occurs, keep head lower than hips to help prevent aspiration. Rinse mouth.

Most Important Symptoms/Effects

Acute
Harmful if swallowed

Delayed
blood damage, nasal cancer, lung tumors

Indication of any immediate medical attention and special treatment needed
Treat symptomatically and supportively.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media
regular dry chemical, carbon dioxide, dry sand, earth, water spray, regular foam, Large fires: Use water spray, fog or regular foam.

Unsuitable Extinguishing Media
Do not use water jets.

Special Hazards Arising from the Chemical
Moderate fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

Hazardous Combustion Products
oxides of carbon

Fire Fighting Measures
Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Directly spraying water or foam onto hot burning product may cause frothing. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. Keep unnecessary people away, isolate hazard area and deny entry. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire.

Special Protective Equipment and Precautions for Firefighters
Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Avoid inhalation or contact. Provide adequate ventilation. Wear personal protective clothing and equipment, see Section 8. Avoid release to the environment. Collect spillage.

Methods and Materials for Containment and Cleaning Up

Eliminate all ignition sources if safe to do so. Do not touch or walk through spilled material. Stop leak if possible without personal risk. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Prevent entry into waterways, sewers, basements, or confined areas. In Canada, report releases to provincial authorities, municipal authorities, or both, as required. If this product is spilled or leaked into the environment, the CERCLA (40 CFR 302.4) reportable quantity is 100 pounds, and requires National Response Center notification.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling

Keep away from flames and hot surfaces. No smoking. Do not breathe vapor or mist. Avoid breathing vapors of heated materials. Avoid contact with eyes, skin and clothing. Use only in well ventilated area. Wash exposed areas thoroughly with soap and water, or a waterless handcleaner, after skin contact and before eating, drinking, using tobacco products, or restrooms. Contaminated clothing should be removed and laundered before reuse. Wear protective gloves/clothing and eye/face protection. Do not eat, drink, or smoke when using this product. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.

Conditions for Safe Storage, Including any Incompatibilities

Store in a well-ventilated place.
Keep cool.
Store locked up.
Store and handle in accordance with all current regulations and standards. Label all containers. Keep away from heat, sparks and naked flames. Store in a cool, dry place. Protect from physical damage. Keep separated from incompatible substances.

Incompatible Materials

oxidizing materials

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Component Exposure Limits

Naphthalene	**91-20-3**
ACGIH:	10 ppm TWA
	Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA (US):	10 ppm TWA ; 50 mg/m3 TWA

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)

Naphthalene (91-20-3)

Time: end of shift Parameter: 1-Naphthol with hydrolysis plus 2-Naphthol with hydrolysis (nonquantitative, nonspecific)

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)

Naphthalene (91-20-3)
Time: end of shift Parameter: 1-Naphthol with hydrolysis plus 2-Naphthol with hydrolysis (nonquantitative, nonspecific)

Engineering Controls
Ensure adequate ventilation. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

Individual Protection Measures, such as Personal Protective Equipment

Eye/face protection
ANSI Z87.1-1989 approved safety glasses with side shields. Provide an emergency eye wash fountain and quick drench shower in the immediate work area. For the molten form: A face shield is recommended.

Skin Protection
Wear protective clothing to prevent contact. Contaminated clothing should be removed and laundered before reuse. In the molten form: Wear appropriate heat resistant clothing.

Respiratory Protection
If the applicable TLVs and/or PELs are exceeded, use canister or cartridge respirators, which are MSHA/NIOSH-approved, with organic vapor cartridges and high-efficiency particulate filters.

Glove Recommendations
Wear appropriate gloves. In the molten form: Wear appropriate heat resistant gloves.

Protective Materials
chemical resistant material, heat resistant material

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance	forms crystals during cooling	**Physical State**	liquid
Odor	mothball odor	**Color**	Not available
Odor Threshold	0.003 ppm	**pH**	Not available
Melting Point	77 - 80 °C	**Boiling Point**	218 °C
Boiling Point Range	Not available	**Freezing point**	Not available
Evaporation Rate	<1 (Ether = 1)	**Flammability (solid, gas)**	Not applicable
Autoignition Temperature	526 °C	**Flash Point**	>80 °C
Lower Explosive Limit	0.9 % (by volume)	**Decomposition temperature**	Not available
Upper Explosive Limit	5.9 % (by volume)	**Vapor Pressure**	0.187 mmHg @ 20 °C
Vapor Density (air=1)	4.42	**Specific Gravity (water=1)**	1.028 at 4 °C
Water Solubility	0.003 wt%	**Partition coefficient: n-octanol/water**	Not available

Viscosity	Not available	**Solubility (Other)**	Not available
Density	1.162 g/cc at 4 °C	**Log KOW**	3.7 at 25 °C
Physical Form	liquid when loaded , solid at room temperature , changes from solid to liquid as temperature increases	**Volatility by Volume**	>99 %
Molecular Weight	Not available		

Other Information
No additional information is available.

Section 10 - STABILITY AND REACTIVITY

Reactivity
No reactivity hazard is expected.

Chemical Stability
Stable at normal temperatures and pressure.

Possibility of Hazardous Reactions
Will not polymerize.

Conditions to Avoid
Avoid heat, flames, sparks and other sources of ignition.

Incompatible Materials
oxidizing materials

Hazardous decomposition products
oxides of carbon

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Inhalation
blood damage, nasal cancer, lung tumors

Skin Contact
thermal burns from heated material

Eye Contact
temporary irritation, thermal burns from heated material

Ingestion
Harmful if swallowed, blood damage

Acute and Chronic Toxicity

Component Analysis - LD50/LC50
The components of this material have been reviewed in various sources and the following selected endpoints are published:
Naphthalene (91-20-3)
Oral LD50 Rat 1110 mg/kg
Dermal LD50 Rabbit 1120 mg/kg
Inhalation LC50 Rat >340 mg/m3 1 h

Biphenyl (92-52-4)
Dermal LD50 Rabbit >5010 mg/kg (40% solution-suspension in corn oil)

Product Toxicity Data

Acute Toxicity Estimate

Oral	498.4 mg/kg

Immediate Effects
Harmful if swallowed.

Delayed Effects
blood damage, nasal cancer, lung tumors

Irritation/Corrosivity Data
The material was found to be non-irritating.

Respiratory Sensitization
No data available.

Dermal Sensitization
Not sensitive.

Component Carcinogenicity

Naphthalene	**91-20-3**
ACGIH:	A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
IARC:	Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))
NTP:	Reasonably Anticipated To Be A Human Carcinogen

Germ Cell Mutagenicity
Negative.

Tumorigenic Data
No data available

Reproductive Toxicity
No data available for the mixture.

Specific Target Organ Toxicity - Single Exposure
No data available.

Specific Target Organ Toxicity - Repeated Exposure
blood

Aspiration hazard
No data available.

Medical Conditions Aggravated by Exposure
respiratory disorders, skin disorders, eye disorders, blood system disorders

Section 12 - ECOLOGICAL INFORMATION

Ecotoxicity

Very toxic to aquatic life with long lasting effects.

Component Analysis - Aquatic Toxicity

Naphthalene	**91-20-3**
Fish:	LC50 96 h Pimephales promelas 5.74 - 6.44 mg/L [flow-through]; LC50 96 h Oncorhynchus mykiss 1.6 mg/L [flow-through]; LC50 96 h Oncorhynchus mykiss 0.91 - 2.82 mg/L [static]; LC50 96 h Pimephales promelas 1.99 mg/L [static]; LC50 96 h Lepomis macrochirus 31.0265 mg/L [static]
Invertebrate:	LC50 48 h Daphnia magna 2.16 mg/L IUCLID ; EC50 48 h Daphnia magna 1.96 mg/L [Flow through] EPA ; EC50 48 h Daphnia magna 1.09 - 3.4 mg/L [Static] EPA

Algal Toxicity
Naphthalene: 0.4 mg/L 72 hours EC50 Skeletonema costatum.

Persistence and Degradability
Biodegradable.

Bioaccumulative Potential
This material is believed not to bioaccumulate due to low water solubility. BCF for fish is 168.

Mobility
The product has poor water-solubility.

Other Toxicity
No data available.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose in accordance with all applicable regulations.

Component Waste Numbers
The U.S. EPA has not published waste numbers for this product's components

Section 14 - TRANSPORT INFORMATION

Component Marine Pollutants
This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants

Component	CAS #	Minimum Concentration
Naphthalene	**91-20-3**	DOT regulated marine pollutant

US DOT Information:
Shipping Name: NAPHTHALENE, MOLTEN
Hazard Class: 4.1
UN/NA #: UN2304
Packing Group: III
Required Label(s): 4.1
Additional information: This material contains reportable quantity (RQ) Hazardous Substances. Applicable shipping classification

IATA Information:

Additional information: Air shipment is porhibited

TDG Information:
Shipping Name: NAPHTHALENE, MOLTEN
Hazard Class: 4.1
UN#: UN2304
Packing Group: III
Required Label(s): 4.1

International Bulk Chemical Code

Additional information
US DOT Reportable Quantites NAPHTHALENE (91-20-3) 100 lbs RQ; 45.4 kg RQ

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations
This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

Naphthalene	**91-20-3**
SARA 313:	0.1 % de minimis concentration
CERCLA:	100 lb final RQ ; 45.4 kg final RQ

SARA Section 311/312 (40 CFR 370 Subparts B and C) 2016 reporting categories
Acute Health: Yes **Chronic Health:** Yes **Fire:** Yes **Pressure:** No **Reactivity:** No

SARA Section 311/312 (40 CFR 370 Subparts B and C) 2017 reporting categories
Flammable; Carcinogenicity; Acute toxicity; Specific Target Organ Toxicity

U.S. State Regulations
The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
Naphthalene	**91-20-3**	Yes	Yes	Yes	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):
WARNING! This product contains a chemical known to the state of California to cause cancer

Canada Regulations

Canadian WHMIS Ingredient Disclosure List (IDL)
Components of this material have been checked against the Canadian WHMIS Ingredients Disclosure List. The List is composed of chemicals which must be identified on MSDSs if they are included in products which meet WHMIS criteria specified in the Controlled Products Regulations and are present above the threshold limits listed on the IDL

Naphthalene	**91-20-3**
	1 %

WHMIS Classification

B3 , D2A

Component Analysis - Inventory

Naphthalene (91-20-3)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW
Yes	DSL	EIN	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes

Benzo[b]thiophene (95-15-8)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW
Yes	NSL	EIN	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes

2-Methylnaphthalene (91-57-6)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW
Yes	DSL	EIN	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes

Cresol (1319-77-3)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW
Yes	DSL	EIN	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes

Biphenyl (92-52-4)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW
Yes	DSL	EIN	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes

1-Methylnaphthalene (90-12-0)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW
Yes	DSL	EIN	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes

U.S. Inventory (TSCA)
Listed on inventory.

Section 16 - OTHER INFORMATION

NFPA Ratings
Health: 1 Fire: 2 Reactivity: 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Summary of Changes
Updated: 12/21/2016; MSDS SUMMARY OF CHANGES: SECTION 15 - Regulatory Information

Key / Legend
ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CFR - Code of Federal Regulations (US); CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC – European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL) , KR - Korea; LD50/LC50 - Lethal Dose/ Lethal Concentration; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of LIsts™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; MX – Mexico; NDSL – Non-Domestic Substance List (Canada); NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL- Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TCCA – Korea Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TLV - Threshold Limit Value; TSCA - Toxic Substances Control Act; TW – Taiwan; TWA - Time Weighted Average; UEL - Upper Explosive Limit; UN/NA - United Nations /North American; US - United States; VLE - Exposure Limit Value (Mexico); WHMIS - Workplace Hazardous Materials Information System (Canada).

Other Information

Disclaimer:
The information set forth in this Safety Data Sheet does not purport to be all-inclusive and should be used only as a guide. While the information and recommendations set forth herein are believed to be accurate, the company makes no warranty regarding such information and recommendations and disclaims all liability from reliance thereon.

SAFETY DATA SHEET

Toluene

Section 1. Identification

GHS product identifier : Toluene

Chemical name : toluene

Other means of identification : Benzene, methyl-; Methylbenzene; Toluol; toluene, pure

Product use : Synthetic/Analytical chemistry.

Synonym : Benzene, methyl-; Methylbenzene; Toluol; toluene, pure

SDS # : 001063

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
TOXIC TO REPRODUCTION (Fertility) - Category 2
TOXIC TO REPRODUCTION (Unborn child) - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes skin irritation.
Suspected of damaging fertility or the unborn child.
May cause drowsiness and dizziness.
May cause damage to organs through prolonged or repeated exposure.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Section 2. Hazards identification

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Do not breathe vapor. Wash hands thoroughly after handling.

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : toluene

Other means of identification : Benzene, methyl-; Methylbenzene; Toluol; toluene, pure

CAS number/other identifiers

CAS number : 108-88-3

Product code : 001063

Ingredient name	%	CAS number
toluene	100	108-88-3

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
toluene	**ACGIH TLV (United States, 3/2012).** TWA: 20 ppm 8 hours. **NIOSH REL (United States, 1/2013).** STEL: 560 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 375 mg/m³ 10 hours. TWA: 100 ppm 10 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 560 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 375 mg/m³ 8 hours. TWA: 100 ppm 8 hours. **OSHA PEL Z2 (United States, 11/2006).** AMP: 500 ppm 10 minutes. CEIL: 300 ppm TWA: 200 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Section 8. Exposure controls/personal protection

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Watery liquid.]

Color : Colorless.

Molecular weight : 92.14 g/mole

Molecular formula : C7-H8

Boiling/condensation point : 110.6°C (231.1°F)

Melting/freezing point : -95°C (-139°F)

Critical temperature : 318.65°C (605.6°F)

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: 4.4°C (39.9°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Section 9. Physical and chemical properties

Evaporation rate : 2 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 1.1%
Upper: 7.1%

Vapor pressure : 3.1 kPa (23.168353815 mm Hg) [room temperature]

Vapor density : 3.1 (Air = 1)

Specific Volume (ft ^{3}/lb) : 1.1494

Gas Density (lb/ft ^{3}) : 0.87 (20°C / 68 to °F)

Relative density : 0.87

Solubility : Not available.

Solubility in water : 0.573 g/l

Partition coefficient: n-octanol/water : 2.73

Auto-ignition temperature : 480°C (896°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Dynamic (room temperature): 0.56 mPa·s (0.56 cP)

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
toluene	LC50 Inhalation Vapor LC50 Inhalation Vapor	Rat Rat	28830 ppm 49 g/m³	1 hours 4 hours

Irritation/Corrosion

Section 11. Toxicological information

Product/ingredient name	Result	Species	Score	Exposure	Observation
toluene	Eyes - Mild irritant	Rabbit	-	0.5 minutes 100 milligrams	-
	Eyes - Mild irritant	Rabbit	-	870 Micrograms	-
	Eyes - Severe irritant	Rabbit	-	24 hours 2 milligrams	-
	Skin - Mild irritant	Pig	-	24 hours 250 microliters	-
	Skin - Mild irritant	Rabbit	-	435 milligrams	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 milligrams	-
	Skin - Moderate irritant	Rabbit	-	500 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
toluene	-	3	-

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
toluene	Category 2	Not determined	Not determined

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Ingestion : Irritating to mouth, throat and stomach.

Section 11. Toxicological information

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : Suspected of damaging the unborn child.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
toluene	2.73	90	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Toluene; Benzene, methyl-	108-88-3	Listed	U220

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1294	UN1294	UN1294	UN1294	UN1294
UN proper shipping name	TOLUENE	TOLUENE	TOLUENE	TOLUENE	TOLUENE
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	II	II	II	II	II

Section 14. Transport information

Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 1000 lbs / 454 kg [137.86 gal / 521.84 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Water Act (CWA) 307: toluene

Clean Water Act (CWA) 311: toluene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Listed

SARA 302/304

Composition/information on ingredients

Section 15. Regulatory information

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
toluene	100	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	toluene	108-88-3	100
Supplier notification	toluene	108-88-3	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
toluene	No.	Yes.	No.	7000 µg/day (ingestion)

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Section 15. Regulatory information

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

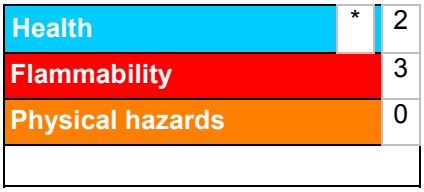
WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 5/20/2015.

Section 16. Other information

Date of issue/Date of revision : 5/20/2015.

Date of previous issue : 10/16/2014.

Version : 0.04

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Occupational Health Guideline for Coal Tar Pitch Volatiles

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

Anthracene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Pale green solid with a faint aromatic odor.

Phenanthrene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Pyrene

- Formula: $C_{16}H_{10}$
- Synonyms: None
- Appearance: Bright yellow solid

Carbazole

- Formula: $C_{12}H_9N$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Benzo(a)pyrene

- Formula: $C_{20}H_{12}$
- Synonyms: BaP, 3,4-benzopyrene
- Appearance and odor: Colorless solid with a faint aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for coal tar pitch volatiles is 0.2 milligram of coal tar pitch volatiles per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit for coal tar products be reduced to 0.1 mg/m^3 (cyclohexane-extractable fraction) averaged over a work shift of up to 10 hours per day, 40 hours per week, and that coal tar products be regulated as occupational carcinogens. The NIOSH Criteria Document for Coal Tar Products and NIOSH Criteria Document for Coke Oven Emissions should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- Routes of exposure

Coal tar pitch volatiles can affect the body if they are inhaled or if they come in contact with the eyes or skin.

- Effects of overexposure

Repeated exposure to coal tar pitch volatiles has been associated with an increased risk of developing bronchitis and cancer of the lungs, skin, bladder, and kidneys. Pregnant women may be especially susceptible to exposure effects associated with coal tar pitch volatiles. Repeated exposure to these materials may also cause sunlight to have a more severe effect on a person's skin. In addition, this type of exposure may cause an allergic skin rash.

- Reporting signs and symptoms

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to coal tar pitch volatiles.

- Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to coal tar pitch volatiles at potentially hazardous levels:

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

1. *Initial Medical Examination:*

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the oral cavity, respiratory tract, bladder, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity.

—Urinalysis: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. A urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment, as well as a test for red blood cells.

—Urinary cytology: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology examination.

—Sputum cytology: Coal tar pitch volatiles are associated with an excess of lung cancer. Employees having 10 or more years of exposure or who are 45 years of age or older should have a sputum cytology examination.

—14" x 17" chest roentgenogram: Coal tar pitch volatiles are associated with an excess of lung cancer. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Coal tar pitch volatiles are reported to cause an excess of bronchitis. Periodic surveillance is indicated.

—A complete blood count: Due to the possibility of benzene exposure associated with coal tar pitch volatiles, a complete blood count is considered necessary to search for leukemia and aplastic anemia.

—Skin disease: Coal tar pitch volatiles are defatting agents and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of these agents.

2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated on an annual basis, and semi-annually for employees 45 years of age or older or with 10 or more years' exposure to coal tar pitch volatiles.

- Summary of toxicology

Coal tar pitch volatiles (CTPV) are products of the destructive distillation of bituminous coal and contain polynuclear aromatic hydrocarbons (PNA's). These hydrocarbons sublime readily, thereby increasing the amounts of carcinogenic compounds in working areas. Epidemiologic evidence suggests that workers intimately exposed to the products of combustion or distillation of bituminous coal are at increased risk of cancer at many sites. These include cancer of the respiratory tract, kidney, bladder, and skin. In a study of coke oven workers, the level of exposure to CTPV and the length of time exposed were related to the development of cancer. Coke oven workers with the highest risk of cancer were those employed exclusively at topside jobs for 5 or more years, for whom the increased risk of dying from lung cancer was 10-fold; all coke oven workers had a 7-½-fold increase in risk of dying from kidney cancer. Although the causative agent or agents of the cancer in coke oven workers is unidentified, it is suspected that several PNA's in the CTPV generated during the coking process are involved. Certain industrial populations exposed to coal tar products have a demonstrated risk of skin cancer. Substances containing PNA's which may produce skin cancer also produce contact dermatitis; examples are coal tar, pitch, and cutting oils. Although allergic dermatitis is readily induced by PNA's in guinea pigs, it is only rarely reported in humans from occupational contact with PNA's; these have resulted largely from the therapeutic use of coal tar preparations. Components of pitch and coal tar produce cutaneous photosensitization; skin eruptions are usually limited to areas exposed to the sun or ultraviolet light. Most of the phototoxic agents will induce hypermelanosis of the skin; if chronic photodermatitis is severe and prolonged, leukoderma may occur. Some oils containing PNA's have been associated with changes of follicular and sebaceous glands which commonly take the form of acne. There is evidence that exposures to emissions at coke ovens and gas retorts may be associated with an increased occurrence of chronic bronchitis. Coal tar pitch volatiles may be associated with benzene, an agent suspected of causing leukemia and known to cause aplastic anemia.

CHEMICAL AND PHYSICAL PROPERTIES

- Physical data—Anthracene
  1. Molecular weight: 178.2
  2. Boiling point (760 mm Hg): 340 C (644 F)
  3. Specific gravity (water = 1): 1.24
  4. Vapor density (air = 1 at boiling point of anthracene): 6.15
  5. Melting point: 217 C (423 F)
  6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
  8. Evaporation rate (butyl acetate = 1): Not applicable
- Physical data—Phenanthrene
  1. Molecular weight: 178.2
  2. Boiling point (760 mm Hg): 340 C (644 F)
  3. Specific gravity (water = 1): 1.18
  4. Vapor density (air = 1 at boiling point of phenanthrene): 6.15
  5. Melting point: 100.5 C (213 F)
  6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
  8. Evaporation rate (butyl acetate = 1): Not applicable
- Physical data—Pyrene
  1. Molecular weight: 202.3
  2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)

3. Specific gravity (water = 1): 1.28
4. Vapor density (air = 1 at boiling point of pyrene): 6.9
5. Melting point: 150.4 C (303 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

- Physical data—Carbazole

1. Molecular weight: 167.2
2. Boiling point (760 mm Hg): 355 C (671 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of carbazole): 5.8
5. Melting point: 246 C (475 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

- Physical data—Benzo(a)pyrene

1. Molecular weight: 252.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of benzo(a)pyrene): 8.7
5. Melting point: 179 C (354 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

- Reactivity

1. Conditions contributing to instability: None hazardous
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: None
4. Special precautions: None

- Flammability

1. Flash point: Anthracene: 121 C (250 F) (closed cup); Others: Data not available
2. Autoignition temperature: Anthracene: 540 C (1004 F); Others: Data not available
3. Flammable limits in air, % by volume: Anthracene: Lower: 0.6; Others: Data not available
4. Extinguishant: Foam, dry chemical, and carbon dioxide

- Warning properties

Grant states that "coal tar and its various crude fractions appear principally to cause reddening and squamous eczema of the lid margins, with only small erosions of the corneal epithelium and superficial changes in the stroma, which disappear in a month following exposure. Chronic exposure of workmen to tar fumes and dust has been reported to cause conjunctivitis and discoloration of the cornea in the palpebral fissure, either near the limbus or, in extreme cases, across the whole cornea. Occasionally, epithelioma of the lid margin has been attributed to contact with coal tar."

MONITORING AND MEASUREMENT PROCEDURES

- General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

- Method

Coal tar products may be sampled by collection on a glass fiber filter with subsequent ultrasonic extraction and weighing. An analytical method for coal tar pitch volatiles is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 1, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00267-3).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent skin contact with condensed coal tar pitch volatiles, where skin contact may occur.
- If employees' clothing may have become contaminated with coal tar pitch volatiles, employees should change into uncontaminated clothing before leaving the work premises.
- Clothing contaminated with coal tar pitch volatiles

should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of coal tar pitch volatiles from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the coal tar pitch volatiles, the person performing the operation should be informed of coal tar pitch volatiles's hazardous properties.

- Employees should be provided with and required to use splash-proof safety goggles where condensed coal tar pitch volatiles may contact the eyes.

SANITATION

- Workers subject to skin contact with coal tar pitch volatiles should wash with soap or mild detergent and water any areas of the body which may have contacted coal tar pitch volatiles at the end of each work day.
- Employees who handle coal tar pitch volatiles should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- Areas in which exposure to coal tar pitch volatiles may occur should be identified by signs or other ropriate means, and access to these areas should be ..nited to authorized persons.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to coal tar pitch volatiles may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from extraction and packaging from coal tar fraction of coking	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a binding agent in manufacture of coal briquettes used for fuel; use as a dielectric in the manufacture of battery electrodes, electric-arc furnace electrodes, and electrodes for alumina reduction	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
In manufacture of roofing felts and papers and roofing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use for protective coatings for pipes for underground conduits and drainage; use as a coating on concrete as waterproofing and corrosion-resistant material; use in road paving and sealing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture and repair of refractory brick; use in production of foundry cores; use in manufacture of carbon ceramic items	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- Eye Exposure

If condensed coal tar pitch volatiles get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with these chemicals.

- Skin Exposure

If condensed coal tar pitch volatiles get on the skin, wash the contaminated skin using soap or mild detergent and water. Be sure to wash the hands before eating or smoking and to wash thoroughly at the close of work.

- Breathing

If a person breathes in large amounts of coal tar pitch volatiles, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of releases until cleanup has been completed.
- If coal tar pitch volatiles are released in hazardous concentrations, the following steps should be taken:

1. Ventilate area of spill.

2. Collect released material in the most convenient and safe manner for reclamation or for disposal in sealed containers in a secured sanitary landfill.

- Waste disposal method:

Coal tar pitch volatiles may be disposed of in sealed containers in a secured sanitary landfill.

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RESPIRATORY PROTECTION FOR COAL TAR PITCH VOLATILES

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m³
Particulate and Vapor Concentration	
2 mg/m³ or less	A chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high-efficiency filter. Any supplied-air respirator. Any self-contained breathing apparatus.
10 mg/m³ or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high-efficiency filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
mg/m³ or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode. A powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter.
400 mg/m³ or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 400 mg/m³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors and particulates, including pesticide respirators which meet the requirements of this class. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

APPENDIX C – COLD STRESS GUIDELINES

Cold Stress Guidelines

	Symptoms	What to do
Mild Hypothermia	• Body Temp 98-90°F • Shivering • Lack of coordination, stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes of blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90-86°F • Shivering stops • Unable to walk or stand • Confused irrational	• All of the above, plus: • Call 911 • Cover all extremities completely • Place very warm objects, such as hot packs on the victim's head, neck, chest and groin
Severe Hypothermia	• Body temp 86-78°F • Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin • Death	• Call 911 • Treat victim very gently • Do not attempt to re-warm
Frostbite	• Cold, tingling, stinging or aching feeling in the frostbitten area, followed by numbness • Skin color turns red, then purple, then white or very pale skin • Cold to the touch • Blisters in severe cases	• Call 911 • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm, not hot, water
Trench Foot	• Tingling, itching or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm sugary drink

Isobutylene

Safety Data Sheet P-4614

This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

Date of issue: 01/01/1979 Revision date: 10/17/2016 Supersedes: 02/27/2015

SECTION: 1. Product and company identification

1.1. Product identifier

Product form	:	Substance
Name	:	Isobutylene
CAS No	:	115-11-7
Formula	:	C4H8 / CH2=C(CH3)2
Other means of identification	:	Isobutene, 2-methylpropene

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Industrial use. Use as directed.

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
10 Riverview Drive
Danbury, CT 06810-6268 - USA
T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number : Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week
— Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887
(collect calls accepted, Contract 17729)

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Gas 1 H220
Liquefied gas H280

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS02 GHS04

Signal word (GHS-US) : DANGER

Hazard statements (GHS-US) :
H220 - **EXTREMELY FLAMMABLE GAS**
H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFOCATION
CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR
CGA-HG01 - MAY CAUSE FROSTBITE

Precautionary statements (GHS-US) :
P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces. - No smoking
P271+P403 - Use and store only outdoors or in a well-ventilated place
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381 - Eliminate all ignition sources if safe to do so
CGA-PG05 - Use a back flow preventive device in the piping
CGA-PG12 - Do not open valve until connected to equipment prepared for use
CGA-PG06 - Close valve after each use and when empty
CGA-PG11 - Never put cylinders into unventilated areas of passenger vehicles
CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F)

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on ingredients

3.1. Substance

Name	Product identifier	%
Isobutylene (Main constituent)	(CAS No) 115-11-7	100

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

First-aid measures after skin contact : The liquid may cause frostbite. For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). Water temperature should be tolerable to normal skin. Maintain skin warming for at least 15 minutes or until normal coloring and sensation have returned to the affected area. In case of massive exposure, remove clothing while showering with warm water. Seek medical evaluation and treatment as soon as possible.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Carbon dioxide, Dry chemical, Water spray or fog.

5.2. Special hazards arising from the substance or mixture

Fire hazard : **EXTREMELY FLAMMABLE GAS**. If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.

Explosion hazard : **EXTREMELY FLAMMABLE GAS**. Forms explosive mixtures with air and oxidizing agents.

Reactivity : No reactivity hazard other than the effects described in sub-sections below.

5.3. Advice for firefighters

Firefighting instructions : **DANGER: FLAMMABLE LIQUID AND VAPOR.** Evacuate all personnel from danger area. Use self-contained breathing apparatus. Immediately cool surrounding containers with water spray from maximum distance, taking care not to extinguish flames. Avoid spreading burning liquid with water. Remove ignition sources if safe to do so. If flames are accidentally extinguished, explosive reignition may occur. Reduce vapors with water spray or fog. Stop flow of liquid if safe to do so, while continuing cooling water spray. Remove all containers from area of fire if safe to do so. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1919 Subpart L - Fire Protection.

Special protective equipment for fire fighters	:	Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Other information	:	Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : **DANGER: Flammable, liquefied gas.** FORMS EXPLOSIVE MIXTURES WITH AIR. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Try to stop release. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment

Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g, wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post “No Smoking/No Open Flames” signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Isobutylene (115-11-7)		
ACGIH	ACGIH TLV-TWA (ppm)	250 ppm

8.2. Exposure controls

Appropriate engineering controls : Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): **Inadequate - Use only in a closed system.** Use explosion proof equipment and lighting.

Eye protection : Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or whenever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133.

Skin and body protection : Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

Respiratory protection : When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

Thermal hazard protection : Wear cold insulating gloves when transfilling or breaking transfer connections.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Gas

Molecular mass : 56 g/mol

Color : Colorless.

Odor : Poor warning properties at low concentrations. Sweetish.

Odor threshold : Odor threshold is subjective and inadequate to warn for overexposure.

pH : Not applicable.

Relative evaporation rate (butyl acetate=1) : No data available

Relative evaporation rate (ether=1) : Not applicable.

Melting point : -140.3 °C

Freezing point : No data available

Boiling point	:	-6.9 °C
Flash point	:	-80 °C (closed cup)
Critical temperature	:	144.7 °C
Auto-ignition temperature	:	465 °C
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	1.8 - 8.8 vol %
Vapor pressure	:	260 kPa
Critical pressure	:	4000 kPa
Relative vapor density at 20 °C	:	No data available
Relative density	:	0.63
Density	:	0.599 g/cm³ (at 20 °C)
Relative gas density	:	2
Solubility	:	Water: 388 mg/l
Log Pow	:	2.35
Log Kow	:	Not applicable.
Viscosity, kinematic	:	Not applicable.
Viscosity, dynamic	:	Not applicable.
Explosive properties	:	Not applicable.
Oxidizing properties	:	None.
Explosion limits	:	No data available

9.2. Other information

Gas group	:	Liquefied gas
Additional information	:	Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level

SECTION 10: Stability and reactivity

10.1. Reactivity

No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

May occur.

10.4. Conditions to avoid

High temperature. Catalyst.

10.5. Incompatible materials

Halogens. Oxidizing agents. Acids.

10.6. Hazardous decomposition products

Thermal decomposition may produce : Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Isobutylene (\f)115-11-7	
LC50 inhalation rat (mg/l)	620 mg/l/4h
LC50 inhalation rat (ppm)	541657 ppm/1h
ATE US (gases)	270828.500 ppmV/4h
ATE US (vapors)	620.000 mg/l/4h
ATE US (dust, mist)	620.000 mg/l/4h

Skin corrosion/irritation : Not classified

pH: Not applicable.

Serious eye damage/irritation : Not classified

pH: Not applicable.

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Isobutylene (115-11-7)	
National Toxicology Program (NTP) Status	1 - Evidence of Carcinogenicity

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No known ecological damage caused by this product.

12.2. Persistence and degradability

Isobutylene (115-11-7)	
Persistence and degradability	The substance is biodegradable. Unlikely to persist.

12.3. Bioaccumulative potential

Isobutylene (115-11-7)	
Log Pow	2.35
Log Kow	Not applicable.
Bioaccumulative potential	Not expected to bioaccumulate due to the low log Kow (log Kow < 4). Refer to section 9.

12.4. Mobility in soil

Isobutylene (115-11-7)	
Mobility in soil	No data available.
Ecology - soil	Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5. Other adverse effects

Effect on ozone layer : None

Effect on the global warming : No known effects from this product

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1055 Isobutylene, 2.1

UN-No.(DOT) : UN1055

Proper Shipping Name (DOT) : Isobutylene

Class (DOT) : 2.1 - Class 2.1 - Flammable gas 49 CFR 173.115

Hazard labels (DOT) : 2.1 - Flammable gas

DOT Special Provisions (49 CFR 172.102) : 19 - For domestic transportation only, the identification number UN1075 may be used in place of the identification number specified in column (4) of the 172.101 table. The identification number used must be consistent on package markings, shipping papers and emergency response information
T50 - When portable tank instruction T50 is referenced in Column (7) of the 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 173.313 of this subchapter

Additional information

Emergency Response Guide (ERG) Number : 115 (UN1055)

Other information : No supplementary information available.

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG) : 1055

Proper Shipping Name (IMDG) : ISOBUTYLENE

Class (IMDG) : 2 - Gases

MFAG-No : 115

Air transport

UN-No. (IATA) : 1055

Proper Shipping Name (IATA) : Isobutylene

Class (IATA) : 2

Civil Aeronautics Law : Gases under pressure/Gases flammable under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

Isobutylene (115-11-7)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Delayed (chronic) health hazard Sudden release of pressure hazard Fire hazard

15.2. International regulations

CANADA

Isobutylene (115-11-7)
Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

Isobutylene (115-11-7)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.2.2. National regulations

Isobutylene (115-11-7)
Listed on the AICS (Australian Inventory of Chemical Substances) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Listed on the Korean ECL (Existing Chemicals List) Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances) Listed on INSQ (Mexican National Inventory of Chemical Substances)

15.3. US State regulations

Isobutylene(115-11-7)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

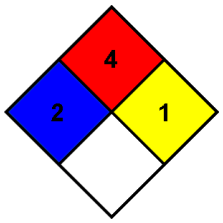
Other information : When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc, it is the user's obligation to determine the conditions of safe use of the product

Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc, P.O. Box 44, Tonawanda, NY 14151-0044)

NFPA health hazard	: 2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.
NFPA fire hazard	: 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
NFPA reactivity	: 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.



HMIS III Rating

Health	: 1 Slight Hazard - Irritation or minor reversible injury possible
Flammability	: 4 Severe Hazard
Physical	: 2 Moderate Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Section 1: IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Additional Names:

Manufacturer's Part Number: **Please refer to Section 16*

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.
Restrictions on Use: Do not use on non-rinsable surfaces.

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Beach, CA 92649 USA
Telephone: 800-228-0709 ● 562-795-6000 *Mon – Fri, 8am – 5pm PST*
Fax: 562-592-3830
Email: info@simplegreen.com
Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product is not classified as hazardous under 2012 OSHA Hazard Communication Standards (29 CFR 1910.1200).

OSHA HCS 2012
Label Elements
Signal Word: None **Hazard Symbol(s)/Pictogram(s):** None required

Hazard Statements: None
Precautionary Statements: None
Hazards Not Otherwise Classified (HNOC): None
Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS Number	Percent Range
Water	7732-18-5	> 84.8%*
Ethoxylated Alcohol	68439-46-3	< 5%*
Sodium Citrate	68-04-2	< 5%*
Tetrasodium *N,N*-bis(carboxymethyl)-L-glutamate	51981-21-6	< 1%*
Sodium Carbonate	497-19-8	< 1%*
Citric Acid	77-92-9	< 1%*
Isothiazolinone mixture	55965-84-9	< 0.2%*
Fragrance	Proprietary Mixture	< 1%*
Colorant	Proprietary Mixture	< 1%*

**specific percentages of composition are being withheld as a trade secret*

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.
Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.
Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.
Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.

Most Important Symptoms/Effects, Acute and Delayed: None known.

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO2, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

This product is non-flammable. See Section 9 for Physical Properties.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: *For non-emergency and emergency personnel:* See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems

Individual Protection Measures / Personal Protective Equipment (PPE)
Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Green Liquid
Odor: Added sassafras odor
Odor Threshold: Not determined
pH ASTM D-1293**:** 8.5 – 9.5
Freezing Point ASTM D-1177**:** 0-3.33°C (32-38°F)
Boiling Point & Range ASTM D-1120**:** 101°C (213.8°F)
Flash Point ASTM D-93**:** > 212°F
Evaporation Rate ASTM D-1901**:** ½ Butyl Acetate @ 25°C
Flammability (solid, gas): Not applicable
Upper/Lower Flammability or Explosive Limits: Not applicable
Vapor Pressure ASTM D-323**:** 0.60 PSI @77°F, 2.05 PSI @100°F
Vapor Density: Not determined

Partition Coefficient: n-octanol/water: Not determined
Autoignition Temperature: Non-flammable
Decomposition Temperature: 109°F
Viscosity: Like water
Specific Gravity ASTM D-891**:** 1.01 – 1.03
VOCs: ***Water & fragrance exemption in calculation*

SCAQMD 304-91 / EPA 24:	0 g/L	0 lb/gal	0%
CARB Method 310**:	2.5 g/L	0.021 lb/gal	0.25%
SCAQMD Method 313:	Not tested		

VOC Composite Partial Pressure: Not determined
Relative Density ASTM D-4017**:** 8.34 – 8.42 lb/gal
Solubility: 100% in water

Section 10: STABILITY AND REACTIVITY

Reactivity: Non-reactive.
Chemical Stability: Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions: None known.
Conditions to Avoid: Excessive heat or cold.
Incompatible Materials: Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products: Normal products of combustion - CO, CO2.

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:
Inhalation - Overexposure may cause headache.
Skin Contact - Not expected to cause irritation, repeated contact may cause dry skin.
Eye Contact - Not expected to cause irritation.
Ingestion - May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity

Acute Toxicity:
Oral LD_{50} (rat) > 5 g/kg body weight
Dermal LD_{50} (rabbit) > 5 g/kg body weight
Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation: Non-irritant per Dermal Irritection® assay modeling. No animal testing performed.
Eye Damage/Irritation: Minimal irritant per Ocular Irritection® assay modeling. No animal testing performed.
Germ Cell Mutagenicity: Mixture does not classify under this category.
Carcinogenicity: Mixture does not classify under this category.
Reproductive Toxicity: Mixture does not classify under this category.
STOT-Single Exposure: Mixture does not classify under this category.
STOT-Repeated Exposure: Mixture does not classify under this category.
Aspiration Hazard: Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Aquatic: Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC_{50} & IC_{50} ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Terrestrial: Not tested on finished formulation.

Persistence and Degradability: Readily Biodegradable per OCED 301D, Closed Bottle Test
Bioaccumulative Potential: No data available.
Mobility in Soil: No data available.
Other Adverse Effects: No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

U.N. Number: Not applicable
U.N. Proper Shipping Name: Cleaning Compound, Liquid NOI
Transport Hazard Class(es): Not applicable
NMFC Number: 48580-3
Packing Group: Not applicable
Class: 55
Environmental Hazards: Marine Pollutant - NO
Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.
Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG: Not Regulated for shipping.
ICAO/ IATA: Not classified as Hazardous
IMO / IDMG: Not classified as Hazardous
ADR/RID: Not classified as Hazardous

Section 15: REGULATORY INFORMATION

All components are listed on: TSCA and DSL Inventory.

SARA Title III: Sections 311/312 Hazard Categories – Not applicable.
Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
Sections 302 – Not applicable.

Clean Air Act (CAA): Not applicable
Clean Water Act (CWA): Not applicable

State Right To Know Lists: No ingredients listed
California Proposition 65: No ingredients listed
Texas ESL:

Ethoxylated Alcohol	68439-46-3	60 µg/m³ long term	600 µg/m³ short term
Sodium Citrate	68-04-2	5 µg/m³ long term	50 µg/m³ short term
Sodium Carbonate	497-19-8	5 µg/m³ long term	50 µg/m³ short term
Citric Acid	77-92-9	10 µg/m³ long term	100 µg/m³ short term

Section 16: OTHER INFORMATION

Size	UPC	Size	UPC
2 oz. Pump	043318130366	1 Gallon w/ Dilution Bottle	043318000669
2 oz. Pump	043318131035	1 Gallon	043318000799
4 oz. Pump	043318130014	1 Gallon w/ Dilution Bottle	043318001383
16 oz. Trigger	043318130021	1 Gallon w/ Dilution Bottle	043318002021
22 oz. Trigger	043318130229	1 Gallon	043318130052
24 oz. Trigger, 12 per case	043318000034	1 Gallon w/ Dilution Bottle, 112 per case	043318480140
24 oz. Trigger	043318000300	1 Gallon w/ Dilution Bottle, 4 per case	043318480416
24 oz. Trigger	043318130137	1 Gallon w/ Dilution Bottle, 24 per case	043318480492
32 oz. Trigger	043318000652	1 Gallon w/ laundry	043318002052
32 oz. Trigger	043318130335	1 Gallon w/ towel	043318001222
67.6 oz	043318000393	140 oz.	043318001390
67.6 oz.	043318130144	140 oz., 168 per case	043318561405
1 Gallon w/ Dilution Bottle	043318000539	140 oz. w/ Dilution Bottle	043318001468
1 Gallon w/ Dilution Bottle	043318000645		

USA items listed only. Not all items listed. USA items may not be valid for international sale.

Section 16: OTHER INFORMATION - continued

NFPA:

Health – None
Flammability – Non-flammable
Stability – Stable
Special - None

Acronyms

NTP	National Toxicology Program	IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration	CPSC	Consumer Product Safety Commission
TSCA	Toxic Substances Control Act	DSL	Domestic Substances List

Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.
This SDS has been revised in the following sections: Revised SDS layout

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

APPENDIX D – GEI UTILITY CLEARANCE AND GEI ACCIDENT REPORTING FORM

ACCIDENT REPORT FORM

Report No. _____

Site: _____ Project No. _____

Location: _____

Date of Report: _____ Preparer's Name: _____

Name and Address of Injured: _____

Date of Birth _____ Date of Hire: _____ Title/Classification: _____

Division/Department _____ Date of Accident _____ Time: _____

Accident Category: ___ Motor Vehicle ___ Property Damage ___ Fire

___ Chemical Exposure ___ Near Miss ___ Other

Severity of Injury or Illness: ____ Non-disabling ___ Disabling

____ Medical Treatment ___ Fatality

Amount of Damage: $_____ Property Damaged: _____

Estimated Number of Days Away from Job: _____

Nature of Injury or Illness: _____

CLASSIFICATION OF INJURY:

____ Fractures	____ Heat Burns	____ Cold Exposure
____ Dislocations	____ Chemical Burns	____ Frostbite
____ Sprains	____ Radiation Burns	____ Heat Stroke
____ Abrasions	____ Bruises	____ Heat Exhaustion
____ Lacerations	____ Blisters	____ Concussion
____ Punctures	____ Toxic Respiratory Exposure	____ Faint/Dizziness
____ Bites	____ Toxic Ingestions	____ Toxic Respiratory
____ Toxic Ingestions	____ Dermal Allergy	

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care Was Received: _____

Where Medical Care Was Received: _____

Address (if off site): _____

ACCIDENT LOCATION:

Causative agent most directly related to accident (object substance, material, machinery, equipment conditions):

_____

_____

Was weather a factor? _____

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

_____

_____

Unsafe act by injured and/or others contributing to the accident (be specific, must be answered):

_____

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue):

_____

_____

Level of personal protection equipment required in Site Safety Plan: _____

_____

Modifications: _____

Was injured using required equipment? _____

If not, how did actual equipment use differ from plan? _____

_____

What can be done to prevent a recurrence of this type of accident (modification of machine; mechanical guards; correct environment training):

_____

_____

Detailed narrative description (how did accident occur, why; objects, equipment, tools used, circumstance assigned duties) (be specific):

_____

_____

(Use separate sheet as required)

Witnesses to accident _____

Signature of Preparer _____

Signature of Site Leader _

Utility Clearance Documentation

Client: _____

Project: _____

Site: _____

Drilling Location ID: _____

Driller: _____

GEI PM: _____

GEI Field Team Leader: _____

Utility Drawings Reviewed: _____

Provided By: _____

Reviewed By: _____

One Call Utility Clearance Call Date: _____

Utility Clearance Received back from (list utilities): _____

Completed By (Company): _____ Date: _____

GEI Staff Responsible for Oversight: _____

Metal Detector Survey (yes/no): _____

Drilling Location Cleared by: _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Physical Test Pit Clearance Required (yes/no): _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Hand clearing Performed: _____ Date: _____

Contractor: _____

GEI Staff Responsible for Oversight: _____

Notes: _____

_____

Based upon the best available information, appropriate utility clearance procedures were performed for the invasive

work specified. If client ordered/site specific deviations from existing GEI utility clearance procedures exist, they are approved by the client signature below.

Client Signature (Optional): _____ Date: _____

GEI, Inc. Representative: _____ Date: _____

APPENDIX E – IBERDROLA CONTRACTOR SAFETY REQUIREMENTS

IBERDROLA
USA

CONTRACTOR SAFETY REQUIREMENTS

September 22, 2008

Table of Contents

CONTRACTOR SAFETY REQUIREMENTS FOR SERVICES PROVIDED TO IBERDROLA USA MANAGEMENT CORPORATION AFFILIATE COMPANIES

August 13, 2008

1. PURPOSE

The purpose of this document is to advise Contractors providing services to Iberdrola USA Management Corporation affiliate companies ("Affiliates") of their responsibility to plan and perform their work in conformance with all applicable federal, state, and local laws, rules, regulations and ordinances of any agency having jurisdiction on the premises. These requirements apply to construction type projects where Affiliate employees are not working at the same site, and to Contractors who perform independent work related to electric transmission and distribution operations, and gas operations. Commitment to safe work practices is important at all Affiliate job sites; thus, evidence concerning Contractor safety performance and past safety history are factors that influence contract award decisions.

2. SCOPE AND RESPONSIBILITIES

This document shall be provided to Contractors to aid in the communication of hazards and minimum safety requirements, and to establish Affiliate expectations regarding safe work behavior while on company property. All Contractors must follow the requirements in this document, as well as their own company safety rules, policies and procedures. In the case of conflicting requirements, the most stringent shall prevail.

Each Contractor shall have a current written safety program and employee safety rules that comply with all regulatory requirements. In addition, each Contractor employee shall be familiar with the safety requirements in this document, and is expected to abide by them. All Contractors and Subcontractor employees must be properly equipped and trained.

Contractors shall communicate the required safety rules and regulations to their employees in a documented tailboard meeting prior to the start of the job. The form given in Attachment A may be used for this purpose. Contractors are responsible for interpreting these rules for non-English speaking and reading-impaired employees. Contractors are responsible for informing all Subcontractors of the safety rules and regulations set forth here and in the contract terms and conditions.

Affiliate Project Monitors shall facilitate Contractor compliance with safety requirements by including this document into contract specifications. All questions pertaining to this document shall be directed to the Affiliate Project Monitor or an Affiliate Health and Safety Representative. Neither the Affiliate Project Monitor nor Health and Safety Representatives shall exercise general supervisory authority over contractor worksites. In particular, the Company shall not conduct worksite safety inspections, identify safety and health hazards, or correct

deficiencies and violations. Moreover, the Company shall not provide personal protective equipment to contractor employees, perform employee exposure monitoring, or provide advice concerning safe work practices. Rather, the Contractor is accountable for all aspects of worker protection, as well as for preventing, detecting and promptly correcting all safety and health deficiencies associated with activities covered by the contract scope of work.

SAFETY ADMINISTRATION

Pre-Bid Meeting

For certain projects where specific safety issues exist or known site conditions require special precautions, a pre-bid meeting may be held. The purpose of the meeting is to emphasize the key safety requirements that apply to the project, and offer the opportunity for bidders to ask questions regarding job site conditions and worker protection issues. When necessary, an Affiliate Health and Safety Representative will participate to address safety-related issues such as known site hazards and anticipated personal protective equipment (PPE) requirements. Where applicable, announcement of a pre-bid meeting will be issued with the contract Request for Proposal.

Prospective Contractors will be informed that past safety performance is an evaluation factor that may determine contract award and/or disqualification of bidders.

Project Health & Safety Plan

Contractors performing high-hazard work may be required to prepare and submit a Project Health & Safety Plan (e.g., as required under 29 CFR 1910.120 and 29 CFR 1926.65). Projects requiring a Plan will be identified at the pre-bid stage of the contracting process. The Plan must address topics such as:

1. Scope of work and planned activities
2. Potential health and safety hazards
3. Individual job functions and responsibilities
4. Personal protective equipment and hazard mitigation strategies
5. Emergency equipment and incident response procedures
6. Exposure monitoring and control
7. Training and medical surveillance requirements
8. Standard operating procedures

Depending on the nature of the project, the Contractor may be required to have their Plan endorsed by a Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP), and/or a licensed Professional Engineer (P.E.).

Post-Award Contractor Safety Orientation

For certain projects, a pre-construction conference may be required to discuss and agree upon safety procedures and controls at the job site. Contractor management representatives, key Contractor employees (i.e., designated on-site "Competent Person"), Affiliate Project Monitors, and Affiliate Health and Safety Representatives shall typically participate. The topics for discussion include:

1. Job site housekeeping practices
2. Storage of materials and tools
3. Restricted areas and evacuation plans
4. Safety inspection and exposure monitoring plans
5. Procedures for documented employee safety meetings and job briefs
6. Subcontractor responsibilities
7. Hazardous chemicals and spill response procedures
8. Certification of Contractor employee qualifications
9. Site security and public protection
10. Emergency notification call lists and procedures

The orientation session is not intended to provide Contractor employees with training to meet regulatory compliance requirements.

4. PROCEDURES

A. Prohibited Conduct

Violation of the following conduct rules shall result in immediate dismissal of an employee from the site by the Contractor.

1. The possession or drinking of alcohol on any company property, including parking lots.
2. The suspected use of any substances which alter mental or physical capacity, including but not limited to non-prescription drugs, prescription drugs not prescribed to the user, narcotics, marijuana or other "controlled substance" or "controlled dangerous substance."
3. Possession of firearms, ammunition, explosives or other weapons on company property/private vehicles
4. Engaging in fighting or horseplay
5. Operating switches, valves, or push buttons unless authorized

B. General Rules

The Contractor shall ensure that all personnel comply with the following rules, regardless of the nature of their job.

1. Contractor employees shall not enter any building or area where their work does not

require their presence.

2. The Contractor shall maintain current safety warning signs/devices, barricades, handrails, and guardrails, and erect new ones if the hazard changes. The contractor shall also remove signs from the work site when there is no longer a hazard present.
3. Contractor employees shall not use emergency exits other than for emergencies, or block emergency exits.
4. The Contractor shall have a program to provide for frequent and regular inspections of the job site, materials, and equipment by designated competent persons.
5. The Contractor shall instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his/her work environment to control or eliminate any hazards or other exposure to illness or injury.
6. The Contractor shall permit only those employees qualified by training or experience to operate equipment and machinery.
7. Contractor employees shall not work on equipment or facilities that are not included in the contract scope of work, or where specific permits/clearances may be required prior to performing a task.

C. Incident Reporting

1. After notifying emergency agencies or calling 911, as appropriate, the Affiliate Project Monitor shall be notified immediately, and in writing, of any accidents involving personal injury requiring medical treatment, or property damage. The Contractor is responsible for notifying OSHA, when applicable. Appropriate written reports shall be completed within one working day.

2. All work must be done in a manner which minimizes the possibility of a spill of hazardous or non-hazardous substance to the environment. Placement of fuel, oils, chemicals and sanitary facilities, or fueling, greasing, or oiling of equipment shall be in a location which avoids, to the degree possible, water sources, wells, or other ecologically sensitive sites. Any spill must be immediately reported in writing to the Affiliate Project Monitor and the appropriate authorities. Contractor is responsible for all associated clean-up costs, penalties, etc.

D. Asbestos Containing Materials (ref: 29 CFR 1926.1101 and 1910.1001)

Contractors shall not disturb known or suspected asbestos-containing materials. When these materials are encountered and could potentially be disturbed by the work being performed, work should immediately be stopped and confirmatory analyses performed as necessary. The Contractor shall immediately notify the Affiliate Project Monitor in writing. Examples of presumed asbestos-containing materials include, but are not limited to, the following:

- Cement wallboard and exterior sheeting
- Thermal insulation and high temperature gaskets
- Ceiling tiles and lay-in panels
- Acoustical and decorative plaster

- Vinyl or asphalt floor tile and sheeting, and mastic
- Electrical cloth, electrical panel partitions, underground conduit, and fabric-type wire insulation
- Roofing shingles, felt, base flashing, and caulking
- Boiler, breeching, duct, and pipe insulation
- Wallboard and spackling/taping/joint compounds

E. Compressed Air/Air tools (ref: 29 CFR 1926.302 and 1910.243)

1. The contractor will comply with the standards for compressed air equipment used in providing compressed air for performing operations such as cleaning, drilling, hoisting and chipping.
2. Pneumatic power tools shall be secured to the hose in a positive manner to prevent accidental disconnection.
3. Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent attachments from accidentally being expelled.
4. The manufacture's safe operating pressure for all fittings shall not be exceeded.
5. All hoses exceeding ½ -inch inside diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of failure.

F. Confined and Enclosed Spaces (ref: 29 CFR 1926.21; 1910.269(e) and 1910.146)

The Contractor is responsible for developing their own program and complying with all applicable confined-space and enclosed space work practices and standards. Contractor employees working in confined/enclosed space conditions must have demonstrated competency in proper work practices and rescue techniques (achieved by training and experience). The Contractor shall have a means of emergency rescue arranged prior to start of work and must check with the local fire department or agency expected to provide rescue assistance as to their availability prior to entering space.

G. Cranes (ref: 29 CFR 1926.550; 1910.179 and1910.180)

The Contractor shall not use Affiliate cranes. Specific exceptions to this rule shall be written and made part of the contract. Qualified employees, with licenses when required, will operate cranes. If a license is required, the operator will have the license with them when operating subject cranes. Lift plans may be necessary before work begins. Documentation will be submitted to the Affiliate Project Monitor upon request. The Contractor must maintain a physical barrier around all equipment and machinery in the hoisting area. In areas exposed to vehicular traffic, the Contractor must conform with OSHA paragraph 1926.651(d) and also make appropriate arrangements with local authorities for traffic control/detour. All crane sites and equipment must be secured during off work hours to prevent unauthorized access.

H. Drugs and Alcohol (ref: 49 CFR 382; DOT Part 199)

1. Possession or use of controlled substances or alcohol is strictly prohibited on Affiliate premises or while working for the Company. Reporting to work on Affiliate property under the influence of unauthorized drugs or alcohol is strictly prohibited; any person under the influence of unauthorized drugs or alcohol shall not be permitted on the premises of an Affiliate project.
2. When applicable, Contractors must comply with U.S. Department of Transportation Part 199 regulations. The Contractor's written program and documented random sampling program for Drugs and/or Alcohol shall be made available upon request.

I. Electrical Safety (ref: 29 CFR 1926.402-408, 416, 417; 29 CFR 1926, subpart V, and 1910.269)

1. Only authorized and qualified personnel shall work on installation and maintenance of electrical equipment.
2. All equipment used, including extension cords, shall have required approvals and be free from known defects.
3. Electrical equipment or tools (unless specially designed) shall not be operated in wet areas, or where potentially flammable dusts, vapors, or liquids are present.
4. When working on Affiliate-owned equipment and facilities, the Contractor will utilize a lockout/tagout procedure or recognized isolation/tagging procedure, as specified by the Affiliate. GFCI's (ground fault circuit interrupters) shall be used for all electrical tools and equipment when used outdoors or in wet locations.
5. If a circuit breaker or other protective device operates ("trips") to open a circuit, a qualified electrician must determine the cause of the problem before the device is reset.
6. Equipment, boxes, switchgear, cabinets, or electrical rooms with exposed energized parts shall be attended or secured at all times.
7. All non-qualified Contractor employees and equipment shall stay a minimum of 10 feet away from overhead, energized lines. Non-qualified Contractor employees are not permitted to enter an energized substation unless qualified personnel accompany them.
8. Mobile radio antennas shall be lowered prior to taking any vehicles inside a substation.
9. No metal measuring tapes or tapes containing a metal wrap shall be used near energized circuits, equipment, poles or substation structures.
10. Metal tools utilizing cable slings, winch cable, chains, loose sections and ends of conductors, or other similar objects, shall be kept under control by the worker to prevent contact with energized conductors or equipment and the worker's body.

J. Excavations (ref: 29 CFR 1926.650-652, 1926.800, and 1926.956)

The general requirements of the OSHA Excavation Standard, 29 CFR 1926 Subpart P, including the provision for a competent person, shall be understood and followed by all Contractor employees. All excavations that workers may enter that are 5 feet or more in depth, or a depth where there is danger of cave-in shall be protected by a shoring or shielding system, or by an appropriate benching or sloping system. Materials shall not be stored closer than two (2) feet from the edge of a trench or excavation, and mobile equipment shall not be operated in close proximity to the edge unless extra precautions are taken to shore or slope the walls back to a stable slope. Additional requirements include but are not limited to the following items:

- Contractor must submit excavation plans to the Affiliate Project Monitor prior to any excavation work.
- Provide adequate barriers/barricades around excavations and machinery, including special considerations for securing excavations left overnight.
- In areas exposed to vehicular traffic, the Contractor must conform with OSHA paragraph 1926.651(d) and also make appropriate arrangements with local authorities for traffic control/detour.
- Perform air monitoring where there is a potential for a hazardous atmosphere.
- Make advance notification to Underground Facilities Protective Organization (e.g. Dig Safe).
- Provide adequate access and egress, and signage necessary to direct vehicular and pedestrian traffic safely around the work area.
- Perform routine inspections of all excavation equipment, including lights and safety features such as back-up warning devices.
- Hand dig when within two feet of any underground facility until the facility is exposed; then hand dig within four inches of the underground facility
- Notify Affiliate Project Monitor to obtain environmental assistance if it becomes necessary to perform dewatering.
- The Contractor shall promptly notify appropriate utilities of any damage done, prior to backfilling the trench.

K. Fire Regulations (ref: 29 CFR 1926.150, 152, 1910.38, 1910.39, 1910.157)

1. Contractors shall provide fire extinguishers, sealed, fire service ready, inspected and in good working order and properly maintained at all times when live gas work is being done. At least one 20-pound dry chemical fire extinguisher shall be on the ground near the edge of the excavation.
2. Contractors shall provide a trained fire watch as dictated by the job hazard assessment.
3. When required, hot work permits shall be obtained from the Affiliate Project Monitor for such activities as welding, cutting, burning, anything that causes a spark, uses an open flame, or involves temperatures high enough to ignite combustible materials.

4. All acetylene and oxygen cylinders shall be stored and used in accordance with OSHA regulations (ref: 29 CFR 1926.350), and transported per DOT specifications. Flashback arresters shall be installed at the welding tip and at the regulator.
5. Open flames, sparks or smoking shall be prohibited in areas so marked or designated, and where a recognized combustible/flammable hazard exists.
6. Fire detection and/or suppression systems shall not be disabled or blocked without notifying the Affiliate Project Monitor and obtaining his/her consent.
7. Flammable/combustible material shall be stored in approved containers and locations. Quantities in excess of one day's use shall be reported to the Affiliate Project Monitor.

L. Hazard Communication (ref: 29 CFR 1926.59 and 1910.1200)

1. The Contractor must have a written program that complies with OSHA's Hazard Communication standard.
2. Before commencing work, all affected Contractor employees must be trained in accordance with the requirements of the standard.
3. Contractors shall provide to the Affiliate Project Monitor a list of chemicals and Material Safety Data Sheets (MSDS) for each chemical that they will bring on Affiliate property or use on an Affiliate project.
4. Contractor chemical containers shall be properly labeled and stored.
5. All unused chemicals, which Contractors bring onto Affiliate property or use for a project, shall be the responsibility of the Contractor to properly dispose of and/or remove.
6. The Affiliate Project Monitor shall make Contractors aware of the Affiliate's Hazard Communication Program, notify them of any chemicals that they may be exposed to while working on Affiliate property, and provide access to the applicable MSDS.
7. The use of any hazardous material by a Contractor in occupied buildings must be approved by the Affiliate Project Monitor.

M. PCB fluids (Polychlorinated Biphenyl Fluids) (40 CFR 761)

PCB fluids were formerly used as an electrical insulating fluid (transformers, regulators, capacitors, PTs, CTs), and also can occasionally be found in the gas distribution system in gas pipe, distribution equipment, (filters, separators, drips, meters, and regulators) and gas condensate/pipeline liquids. All liquids recovered from gas pipelines must be assumed to contain PCBs until proven otherwise by approved testing methods. When these materials are encountered and could potentially be disturbed by the work being performed, work shall immediately be stopped. The Contractor shall immediately notify the Affiliate Project Monitor in writing.

N. Hazardous Waste (ref: 40 CFR 260)

Requirements of the U.S. DOT and U.S. EPA must be observed for all aspects of hazardous waste handling, storage and transportation. Contractor is responsible for the removal and proper disposal of all hazardous waste they generate, including completion of documentation such as waste profiles, waste analytical samples, and hazardous waste manifests. As a minimum, the Contractor shall perform proper labeling, adequate secondary containment, segregation of incompatible materials, and routine inspection of storage areas as required by all U.S. EPA, state and local regulations. In addition, all hazardous waste containers must be properly constructed and in sound condition, and shall be kept securely closed. Contractor employees must be properly trained in hazardous waste procedures in accordance with regulatory requirements. The Contractor shall notify the Affiliate Project Monitor in writing before making any arrangements for shipping and disposal of hazardous waste.

O. Housekeeping (ref: 29 CFR 1926.25)

1. Good housekeeping practices shall be strictly adhered to daily. The work site shall be kept clean and orderly.
2. Trash shall be promptly removed from the work site and from the customer's property.
3. Boards with protruding nails shall not be left lying around. All nails shall be withdrawn or hammered down.
4. Contractors shall not block means of access or egress, or safety equipment.

P. Ladders and Scaffolding (ref: 29 CFR 1926.451, 1050-1053, 1060, 1910.27)

1. Contractors shall not use Affiliate ladders without permission from the Affiliate Project Monitor, or where an exception is included in contract documents.
2. Contractors are required to furnish their own ladders and equipment free of defects.
3. All straight and extension ladders shall be properly maintained and equipped with approved safety feet.
4. No work shall be performed until the ladder is properly secured.
5. Barricades should be placed to direct pedestrian traffic away from ladders.
6. Ladders must be inspected for defects on a regular basis, and immediately removed from service when deemed unsafe
7. The areas at the top and bottom of a ladder shall be kept clear of debris and equipment.
8. Ladders made of conductive materials shall not be used while working in proximity to energized electrical facilities.
9. All ladders shall be removed at the end of the work shift to prevent unauthorized use, or access to elevated surfaces.

10. All scaffolding erection and use shall be in compliance with OSHA standards. A licensed Professional Engineer's approval of scaffolding plan(s) shall be submitted as required.

Q. Lead (ref: 29 CFR 1926.62 and 1910.1025)

Contractors shall not disturb known or suspected lead-based paint and other lead-containing materials. When these materials are encountered and could potentially be disturbed by the work being performed, work shall be stopped immediately. The Contractor shall immediately notify the Affiliate Project Monitor in writing.

R. Medical Services (ref: 29 CFR 1926.50)

1. When a medical facility is not reasonably accessible (i.e., within 15 minutes) for the treatment of injured employees, personnel trained to render first aid and CPR shall be available at the worksite. The personnel designated to provide CPR and first aid must have current certifications and must carry evidence of their training while on site.
2. First aid supplies approved by a consulting physician shall be readily available at the worksite.

S. Motor Vehicles (ref: 29 CFR 1926.600-02)

1. Contractors shall not use Affiliate vehicles without permission. Contractors shall transport employees in a safe manner (e.g., riding in the back of a pick-up and in places other than the operator's seat, (i.e., a backhoe bucket or fender) is prohibited).
2. Contractor employees shall possess the necessary license classification for vehicle(s) being driven.

T. Overhead Work (ref: 29 CFR 1926.500-503)

1. Personnel shall be protected from falling tools, equipment and material.
2. All girders, beams and overhead surfaces shall be kept free of loose material.

U. Personal Safety Equipment (ref: 29 CFR1926.28, 52, 95,100-103, 353, 500-503; 1910 Subpart I)

1. Eye and Face Protection - Approved and appropriate eye and/or face protection shall be worn at the worksite. Personnel involved in welding operations shall wear eye protection with filter lenses or plates of the proper shade number. The eye and face protection must meet the requirements of ANSI Z87.1-2003.
2. Head Protection – OSHA approved hard hats meeting the requirements of ANSI Z89.1-2003 shall be worn at work sites where there is potential for head injury. Bump caps, metal hard hats, and metal hard caps are prohibited.

3. Clothing – Contractors employees shall be properly clothed at all times. Appropriate flame retardant clothing is required while working on energized gas pipelines, energized electrical equipment and whenever a flame hazard exists.
4. Gloves – Suitable gloves will be worn when there is a potential for hand injury.
5. Foot Protection – Safety shoes and boots that meet the guidelines of ANSI Z41-1991 must be worn whenever exposed to crushing hazards.
6. Hearing Protection – All personnel subjected to sound exceeding the OSHA permissible 90 decibel level shall have available and wear appropriate hearing protection. Hearing protection training and medical monitoring are required by OSHA for contractor employees working in areas exceeding the OSHA 85 decibel action level.
7. Respirators - The contractor shall provide respirators based on the hazard encountered. Contractor respirator use will be in compliance with OSHA requirements.
8. Fall protection - Whenever work site conditions involve a potential for a fall hazard of 4 feet or more, the contractor shall use appropriate fall protection meeting the requirements of OSHA 29 CFR Subpart M – Fall Protection.

V. Radiation (ref: 29 CFR 1926.53, 1910.96, 1910.97, 1910.1096, 10 CFR 19,20,32-36,39)

1. The Contractor may utilize equipment containing an ionizing radiation source only when appropriately licensed to do so. A copy of their license must be available on-site.
2. The Affiliate Project Monitor will inform the Contractor when work is necessary near an Affiliate ionizing radiation source.
3. If work is required in the proximity of an ionizing radiation source, the Contractor shall comply with all applicable regulations.

W. Tools (ref: 29 CFR 1926.300-305, 1910.242)

1. Contractors shall not use Affiliate tools without permission.
2. Tools shall be kept defect free and if defects are found, immediately taken out of service.
3. Tools shall be maintained as per manufacturer's specifications and governing regulations.
4. Tools shall not be retrofitted or modified.

X. Water Safety (ref: 29 CFR 1926.106)

When Contractors work over or near water and where the danger of drowning exists, the contractor must comply with all provisions of OSHA (i.e., training, Coast Guard approved life jackets, ring buoys, skiffs, fall protection etc.).

Y. Work Zone Protection (1926.201)

1. Contractors shall use adequate work area protection. All work area protection shall be in accordance with the Federal/State Manual of Uniform Traffic Control Devices.
2. All contractors working in the road right-of-way:
    a. Shall wear ANSI 107 Class 2 or 3 compliant clothing.
    b. Shall wear ANSI 107 Class 2 or 3 compliant traffic vests for flagging and night work.
    c. Must comply with the provisions of any state permits issued to the Affiliate.

5. SPECIFIC REQUIREMENTS FOR ELECTRIC AND GAS WORK

Electric Power Generation, Transmission and Distribution Work (ref: 29 CFR 1910.269)

Contractor shall comply with all OSHA requirements for operation and maintenance of electric power generation, transmission and distribution lines and equipment including:

- Job briefing requirements
- Line clearance tree- trimming operations including brush chippers and chain saw use.
- Specific training including skills and techniques necessary to perform this work
- Hazardous energy control (lockout/ tag out) procedures
- Enclosed spaces
- Fall protection
- Tools and equipment including live-line tools
- Working on or near exposed energized parts
- Minimum approach distance
- Grounding for the protection of employees
- Work involving overhead lines including installing and removing lines
- Substation work activities including entry and job briefings

Tree contractors working for Affiliates will be required to work in accordance with the latest American National Standard Institute (ANSI) safety requirements for tree care operations involving pruning, trimming, repairing, maintaining and removing trees and cutting brush.

Helicopter Regulations (ref: 29 CFR 1926.551, 1910.183)

Contracted helicopters shall comply with any applicable regulations of the Federal Aviation Administration.

- Briefing: Prior to each day's operation a briefing shall be conducted. This briefing shall set forth the plan of operation for the pilot and ground personnel.
- Personal protective equipment for employees shall consist of complete eye protection and

hard hats secured by chinstraps.

- Loose fitting clothing likely to flap in the downwash, shall not be worn.
- Every practical precaution shall be taken to provide for the protection of the employees from flying objects in the rotor downwash. All loose material within 100 feet shall be secured or removed.
- No unauthorized person shall be allowed to approach within 50 feet of the helicopter when the rotor blades are turning.
- Whenever approaching or leaving a helicopter with blades rotating, all personnel shall remain in full view of the pilot and keep in a crouched position. Personnel shall avoid the area from the cockpit or cabin rearward unless authorized by the helicopter operator to work there.
- There shall be constant reliable communication between the pilot, and a designated person of the ground crew who acts as a signalman. This signalman shall be distinctly recognizable from other ground personnel.

Gas Distribution Operations and Personal Protective Equipment in Potentially Hazardous Atmospheres

All gas Contractors must comply with applicable OSHA requirements, as well as the requirements of the U.S. Department of Transportation (DOT), including drug and alcohol misuse testing. Worker protection is a key requirement on all gas projects. A copy of the Affiliate's procedures will be provided if the work involves encountering a potentially hazardous atmosphere requiring the use of personal protective equipment. This will include a copy of the Affiliate's task-specific Personal Protective Equipment Matrix (see Attachment B). This procedure describes specific requirements for working in an atmosphere which may be hazardous due to the presence of natural gas or oxygen deficiency (asphyxiation hazard). This procedure is applicable to all phases of operation, maintenance and construction of the gas system.

Attachment B

(AFFILIATE COMPANY NAME)

CONTRACTOR'S SIGN-OFF SHEET

NOTE: The Contractor Safety Requirements shall be read and understood and the sign-off sheet completed before arrival on the job site or commencement of work.

NAME OF CONTRACTED CO.:		
DATE THE WORK STARTED:		
DESCRIPTION OF THE WORK:		
NAME OF THE AFFILIATE SUPERVISOR WHO IS RESPONSIBLE FOR THIS JOB:		
NAME OF THE CONTRACTOR SUPERVISOR RESPONSIBLE FOR THIS JOB:		
DATE	NAME (please print)	SIGNATURE

Attachment C

(AFFILIATE COMPANY NAME)

PERSONAL PROTECTIVE EQUIPMENT MATRIX

(INCLUDE WHERE APPLICABLE)

APPENDIX F – FLOAT PLAN

GEI Consultants

Daily Float Plan

Name of vessel's operator:	
Telephone Number:	
Name of Vessel:	
Registration No.:	
Description of Vessel: Type: Make: Color of Hull/Trim Most distinguishing identifiable feature:	

Rafts/Dinghies: Number:_____ Size:_____ Color:_____

Radio: Type: _____ Frequencies Monitored: _____

Number of persons onboard:

Name:	Age:	Address & Telephone:

Engine Type:_____ H.P.:_____ Normal Fuel Supply (days):_____

Survival equipment on board: (check as appropriate)

☐ Life Jackets	☐ Flares	☐ Smoke Signals
☐ Medical Kit	☐ EPIRB	☐ Paddles
☐ Anchor	☐ Loran/Gps	☐ _____

Trip:

Date & Time of Departure:	
Departure From:	
Departure To:	

Expected to arrive by:_____ In no case later than:_____

GEI Consultants

Appendix H

Citizens Participation Plan

New York State Department of Environmental Conservation

NYSDEC MGP Remedial Program

DRAFT

Citizen Participation Plan

for

NYSEG Elmira Water Street Manufactured Gas Plant Site
NYSDEC Site # 808025
Index # D0-0002-9309

City of Elmira
Chemung County, New York

February 2018

Contents

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Note: The information presented in this Citizen Participation Plan (CPP) was current as of the date of its approval by the New York State Department of Environmental Conservation (NYSDEC). Portions of this CPP may be revised during the site's investigation and cleanup process. The CPP may need to be revised to include a remedy construction phase if and when the project reaches that stage.

Responsible Party: New York State Electric and Gas Corporation (NYSEG)
Site Name: Elmira Water Street MGP Site
Site Address: 510 East Water Street, Elmira, NY
Site County: Chemung County
NYSDEC Site Number: Site # 808025

NYSEG is investigating the site under an Order on Consent with the NYSDEC (Index #: D0-0002-9309).

1. New York's MGP Site Investigation and Remedial Program

The NYSDEC Manufactured Gas Plant (MGP) Program is the State's program for identifying, investigating and cleaning up sites where consequential amounts of MGP-related residuals exist. From the late 1800's to the mid 1900's, hundreds of manufactured gas plants across New York State supplied homes and industry with fuel for heating, cooking, and lighting. Today, the NYSDEC is overseeing the investigation and cleanup of contamination left behind from these plants.

MGP sites go through a process of investigation, evaluation, cleanup and monitoring that has several distinct stages. An environmental investigation called a Site Characterization (SC) is performed when the NYSDEC Division of Environmental Remediation (DER) is made aware that an MGP operated at a site. The goal of the SC is to assess the presence of MGP-related residuals and to determine the potential threat posed by the site to public health or the environment.

Once the presence of a consequential amount of MGP-related residuals is confirmed at a site, the site is added to the State's official list of sites, and is given a classification code. Sites that are deemed to be a significant threat to public health and/or the environment and therefore requiring action, undergo a detailed environmental investigation, called a remedial investigation (RI). Each site is assigned a NYSDEC DER project manager. When a responsible party performs an investigation, the project manager reviews and approves investigation work plans and reports and ensures the responsible party performs a thorough and proper investigation. The project manager also works closely with New York State Department of Health (NYSDOH) staff who ensure that public health concerns are addressed.

Following approval of the RI, the NYSDEC DER project manager writes the Proposed Remedial Action Plan (PRAP) that outlines the State's preferred method to address the site. The project manager presents the proposed plan at a public meeting and responds to public comments. After a final plan is selected, and a Record of Decision (ROD) is approved, DER staff may remain involved with the design and implementation of the cleanup.

The Elmira Water Street MGP is under a multi-site order on consent between NYSEG and the NYSDEC which covers several MGP sites across New York State. NYSEG is responsible for cleanup at this site which is performed in compliance with NYSDEC regulations and oversight. Once cleanup is achieved, the NYSDEC will issue a Certificate of Completion to NYSEG for the site.

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

The NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well being. The NYSDEC provides opportunities for citizen involvement, and encourages early two-way communication with citizens before decision makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include the following:

- To promote the development of timely, effective site investigation and cleanup programs that protect public health and the environment.
- To improve public access to, and understanding of, issues and information related to a particular site, and that site's investigation and cleanup process.
- To provide citizens with early and continuing opportunities to participate in the NYSDEC's site investigation and cleanup process.
- Ensuring that the NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community.
- To encourage dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This CPP provides information about how the NYSDEC will inform and involve the public during the investigation and cleanup of the NYSEG Elmira Water Street site. The public information and involvement program will be carried out with assistance, as appropriate, from NYSEG.

Project Contacts

Appendix A identifies the project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CPP and the CPP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the project work plans and reports, and information related to the site's investigation and cleanup program are identified in Appendix B. These locations provide convenient access to important project documents for public review and comment. Some documents, including this one, may be placed on the NYSDEC web site at the following link: http://www.dec.ny.gov/chemical/37556.html. The NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

The NYSDEC, with input from NYSEG, has developed a site-specific contact list included in Appendix B. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as field work), as well as availability of project documents, and announcements about public comment periods.

The site contact list typically includes:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located near the site for purposes of posting and/or dissemination of information at the facility; and
- Location(s) of work plans, reports, and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

The NYSDEC invites the public to sign up with county email listservs for one or more contaminated sites which are available at the following web page: www.dec.ny.gov/chemical/61092.html. Listserv members will periodically receive site-related information/announcements for all contaminated sites in the county(ies) selected.

CPP Activities

The table at the end of this section identifies the CPP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The public is informed about these CPP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CPP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.
- **Public forums, comment periods, and contact with project managers** provide opportunities for the public to contribute information, opinions, and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CPP may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned CPP activities.

Note: The table identifying the CPP activities related to the site's investigation and cleanup program follows:

NYSDEC MGP Program Citizen Participation Requirements

Citizen Participation Requirements	Timing of CPP Requirement(s)
Before Start of Remedial Investigation (RI):	
• Prepare site contact list • Establish document repository • Prepare Citizen Participation Plan (CPP) • Place approved RI Work Plan in document repository • Mail fact sheet to site contact list that announces availability of RI Work Plan and describes upcoming RI field work	Before the start of RI: Note: Plan must be approved by DER before distribution
When NYSDEC Approves Remedial Investigation Report:	
• Mail fact sheet to site contact list that describes RI results • Place approved RI Report in document repository	When DER approves RI Report
When DER Releases Proposed Remedial Action Plan (PRAP):	
• Place PRAP in document repository • Mail fact sheet to site contact list that describes PRAP and announces 30-day comment period and public meeting • Conduct 30-day public comment period • Hold public meeting about PRAP	When DER releases the PRAP. Comment period begins/ends as per dates identified in fact sheet. Public meeting is held during the comment period.
When DER Issues Record of Decision (ROD):	
• Place ROD in document repository • Mail notice to site contact list that announces availability of ROD. ROD includes responsiveness summary of significant comments about PRAP.	When DER issues ROD
Before Start of Remedial Action (RA):	
• Mail fact sheet to site contact list that describes upcoming RA	Before the start of RA at the site
When DER Issues Certificate of Completion (COC) or Other Similar Site Closure Document:	
• Place COC in document repository • Mail fact sheet to site contact list that announces issuance of COC	Within 10 days after DER issues COC or other similar site closure document

3. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

The site is located between East Water Street and the Chemung River in the City of Elmira. The site consists of the parcel of land where the former MGP operations were conducted. This parcel is now part of a larger parcel owned by NYSEG, which surrounds the site to the east and west. The site and surrounding area is zoned for commercial use. The site is currently vacant, and public access to the site is unrestricted. Most of the ground surface of the site in the area along East Water Street is covered by an asphalt parking lot. To the south of the lot is a grass-covered area, which is bounded to the south by a flood control concrete retaining wall. South from the wall, the ground surface slopes steeply down to an access road along the shoreline of the Chemung River. The access road is used to maintain the flood control levee.

To the north of the site is East Water Street. To the north of the street are buildings and grounds of the Chemung County Nursing Facility and the First United Church of Christ.

Directly to the south of the site is the Chemung River. The Chemung River has a NYSDEC Class D classification in the area of the site. Class C surface waters are suitable for fishing and primary and secondary contact recreation.

To the west of the property owned by NYSEG is a strip of land adjacent to the Sly Street Bridge which is owned by the City of Elmira.

History of Site Use, Investigation, and Cleanup

PRIOR AND CURRENT USE(S):

The Elmira Water Street MGP was constructed in 1852. Based on the date of construction and the configuration of the plant, the MGP was a coal carbonization plant using coal as a feedstock. The MGP was operated for about 15 years and was shut down in 1867. The gas holder continued to be used to store gas that was manufactured at an off-site location until 1898. All of the aboveground portions of the MGP features were removed by 1899.

PREVIOUS ENVIRONMENTAL ASSESSMENTS:

Site Characterization (SC) work has previously been performed at the site. A Preliminary Site Screening investigation was performed in March 1992. The investigation included the collection of three surface water samples, three sediment samples, and the description of site characteristics for input into a site screening and prioritization program. A Phase II Environmental Site Assessment was performed in 1998 to assess whether there were impacts related to an auto repair and body shop that was present at the site. Several underground storage tanks and in-ground hydraulic lifts were being removed from the site. The field activities for the investigation included the collection of soil samples from tank or hydraulic lift excavations, and from surface soil borings. Groundwater samples were also collected from temporary monitoring wells.

CONTAMINANTS RELATED TO THE SITE THAT ARE KNOWN OR SUSPECTED:

A trace amount of sludge-like material that may be coal tar was identified within a subsurface historic gas plant process structure during a previous investigation. Because the sludge-like material was found in the area of the former gas holder for the MGP, it appears possible that coal tar-impacts may be present at the site. Coal tar was a by-product of the manufacture of gas from coal which was conducted at the site in the mid-1800's. The primary compounds of concern associated with coal tar are benzene, toluene, ethylbenzene, and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs). If coal tar is present below the ground surface of the site, site users cannot come into contact with it unless excavations are performed. From the information obtained during the previous investigations, the coal tar is believed to be limited to the area beneath the paved parking lot. Groundwater which comes into contact with the coal tar-impacted soil may contain dissolved compounds associated with the coal tar. Monitoring wells will be installed during the RI to assess the extent of any groundwater impacts at the site and the surrounding areas.

4. Investigation and Cleanup Process

Investigation

NYSEG will has performed the investigation phase of the project. The Remedial Investigation was performed according to the methods included in the document entitled "*Remedial Investigation Work Plan, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309*", dated February 18, 2013.

The investigation was performed with NYSDEC oversight. The investigation results were presented in the document entitled "*Remedial Investigation Report, Elmira Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309*", dated August 27, 2014.

The site investigation provided sufficient information to address the following goals:

1) Defining the nature and extent of contamination in soil, surface water, groundwater, sediments, and any other parts of the environment that may be affected;
2) Identifying the source(s) of the contamination;
3) Assessing the possible impact of the contamination on public health and the environment; and
4) Providing information to support the development of a proposed remedy to address the contamination, or a determination that cleanup is not necessary.

GEI, 2015.

Remedy Selection

The NYSDEC approved the RI Report and a feasibility study evaluation (FS) was prepared. The results of the feasibility study evaluation were provided in the document entitled "*Feasibility Study Report, Elmira Water Street Manufactured Gas Plant Site, City of Elmira, New York, NYSDEC Site #808025, Index #: D0-0002-9309*", dated November 2, 2015.

The NYSDEC, with input and concurrence from the NYSDOH, prepared and issued a Proposed Remedial Action Plan (PRAP) and the public had the opportunity to ask questions and comment on the proposed site remedy. The NYSDEC has issued a Record of Decision (ROD) for the selected remedy for site cleanup. The document is entitled "*Record of Decision - NYSEG – Elmira Water Street MGP State Superfund Project – Elmira, Chemung County, Site No. 808025*", dated March 2017. The next step for the project is the preparation of a remedial design which will be proposed to, and approved by the NYSDEC DER. The schedule for the remedial action will then be developed in consultation with the NYSDEC.

Appendix A
Project Contacts and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Mr. Parag Amin
Project Manager
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 11th Floor
Albany, NY 12233-7014
(518) 402-9662
Fax: (518) 402-9679

Ms. Linda Vera
Citizen Participation Specialist
NYSDEC Region 8
6274 E. Avon-Lima Road
Avon, NY 14414
(585) 226-5324

New York State Department of Health (NYSDOH):
Scarlett McLaughlin
Public Health Specialist
New York State Department of Health
Bureau of Environmental Exposure Investigation
Empire State Plaza - Corning Tower Room 1787
Albany, NY 12237
518-402-7860
scarlett.mclaughlin@health.ny.gov

NYSEG:

Bob Pass
Regional Manager
Community Outreach & Development
P.O. Box 3607
Binghamton, NY 13902-3607
Tel: 607.762.6298 (Binghamton)
607.347.2148 (Ithaca)

Location of Project Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Chemung County
Steele Memorial Library
Central Branch
101 E. Church St. Elmira, NY 14901
(607) 733-9175
Fall/Winter/Spring Hours (9/6/11-5/12/12):
Sunday – Closed
Monday through Thursday,
9 a.m. to 9 p.m.
Friday and Saturday, 9 a.m. to 5 p.m.

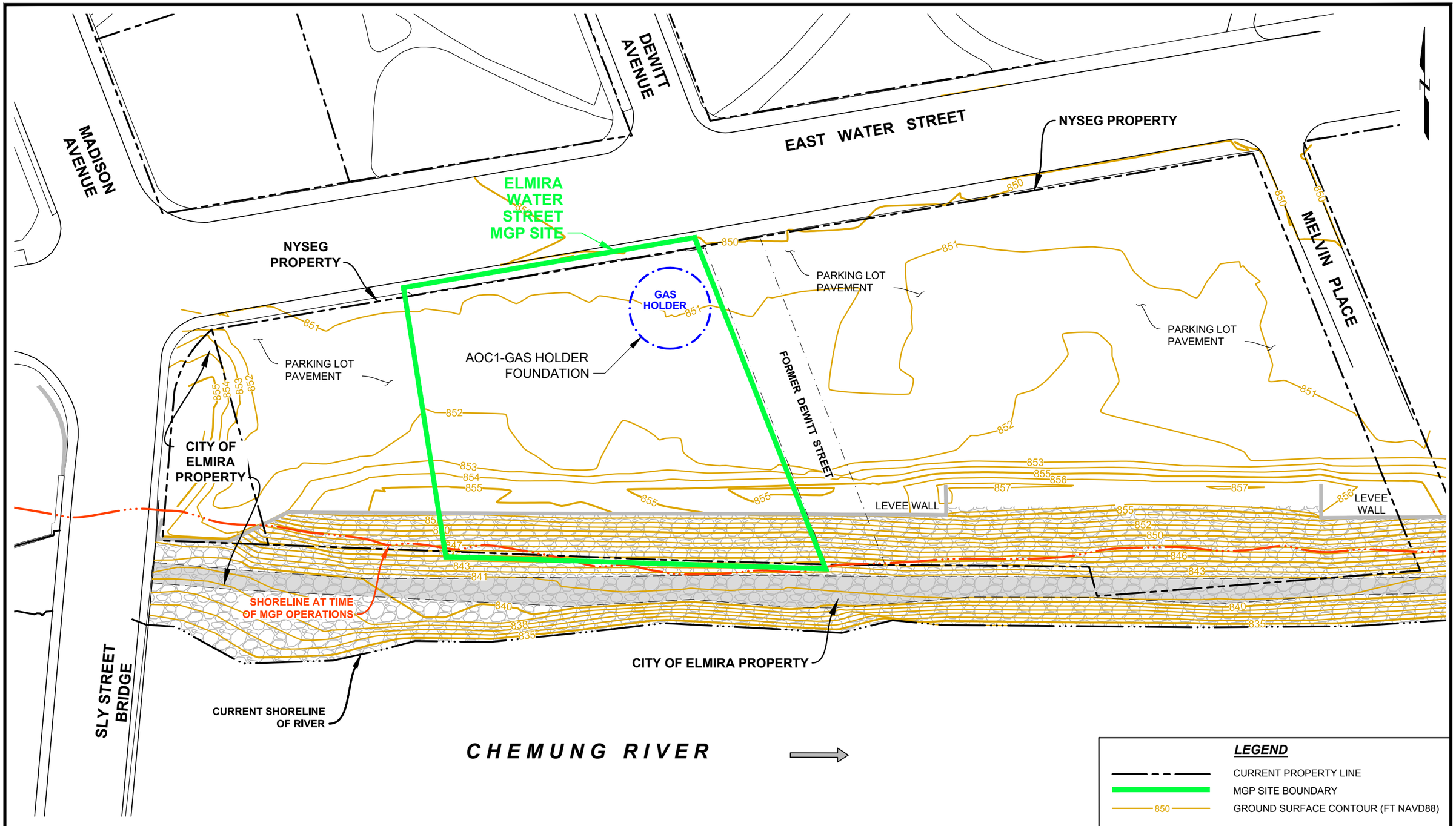
NYSDEC Region 8
6274 E. Avon-Lima Road
Avon, NY 14414
(585) 226-5324

APPENDIX B
Site Contact List

As of this writing, the Site Contact List is comprised of the following:

- 83 Nearby Residences
- 123 Nearby Businesses
- 11 Media Outlets
- 10 Public Officials

Appendix C
Site Location Map



LEGEND

- CURRENT PROPERTY LINE
- MGP SITE BOUNDARY
- 850 GROUND SURFACE CONTOUR (FT NAVD88)

SOURCES

1. 5/30/13 KEYSTONE ASSOCIATES PLS, SURVEY.
2. *ELMIRA, NY SECTION NO. 2, CHEMUNG RIVER, LEFT BANK, PLAN AND PROFILE,* PREPARED BY: ARMY CORPS OF ENGINEERS, 1" = 50', DATE: 1/10/1944.

0 50 100

SCALE: 1" = 50'

Remedial Design Work Plan
Elmira Water Street MGP Site
Elmira, New York

NYSEG
Binghamton, New York

GEI Consultants

SITE LAYOUT, GROUND SURFACE CONTOURS

Project 1704633 | February 2018 | Fig. 5

B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\5-7 1704633-RDWP.dwg

---- B:\Working\NYSEG\1704633 Elmira Water RD\00_CAD\Figures\RDWP\5-7 1704633-RDWP.dwg - 2/15/2018