Mill Seat Landfill Expansion

Facility ID No. 8-2648-00014
Town of Riga, New York

Draft Supplemental Environmental Impact Statement

Volume 2

Attachment C – Hydrogeologic Report

COUNTY OF MONROE
STATE OF NEW YORK

April 2015

DSEIS Volume 2

For the Proposed Mill Seat Landfill Expansion
303 Brew Road
Town of Riga, Monroe County, New York
Facility ID No. 8-2648-00014

Attachment C – Hydrogeologic Report

April 2015

DSEIS Prepared for:

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Hydrogeologic Report

COUNTY OF MONROE
STATE OF NEW YORK

For the Proposed Mill Seat Landfill Expansion

303 Brew Road
Town of Riga, Monroe County, New York
Facility ID No. 8-2648-0014

Hydrogeologic Report

Prepared For:

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February 2015

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Glossary of Terms

6 NYCRR Part 360 Permit Application **–** In order to modify, the County must demonstrate compliance with the design, construction, operation, and closure requirements of 6 NYCRR Part 360 to demonstrate the expansion's compliance with current regulations.

AMSL **–** Above Mean Sea Level

B&L **–** Barton & Loguidice, D.P.C.

cfm **–** cubic feet per minute

cm/s **–** centimeters per second

County **–** Monroe County, New York.

CSS **–** Critical Stratigraphic Section

CY **–** cubic yard(s)

DSEIS **–** Draft Supplemental Environmental Impact Statement

EMP **–** Environmental Monitoring Plan

fasl **--** feet above sea level

fbgs **--** feet below ground surface

FEIS -- Final Environmental Impact Statement

FIDs **--** fracture intensification domains

ft/day **–** feet per day

GEI **-** GEI Consultants, Inc. (P.C.)

GWSS **–** Groundwater suppression system

Hydrogeologic Investigation Area **–** The area studied for bedrock and groundwater characteristics for siting the Proposed Landfill Expansion. This area stretches across the Proposed Site over the existing monitoring well network and various borings, test pits, and piezometers installed as part of previous and current hydrogeologic investigations. This area stretches north to the existing landfill infrastructure, south across Bovee Road to the Proposed Wetland Mitigation Area, and is bounded to the east and west by Wetlands RG-7 and RG-5, respectively and the Proposed Wetland Mitigation Area property boundaries.

Landfill Lease Agreement **–** The Agreement by and between Monroe County, New York (Lessor) and WMNY (Lessee) dated January 14, 2002 and any Amendments thereafter.

LFG – Landfill gas

mg/L – milligram per liter

Mill Seat Landfill **–** Currently permitted landfill and associated operations.

MSW – Municipal solid waste

NYCRR **–** New York Official Compilation of Codes, Rules and Regulations

NYGWQS **–** New York Groundwater Quality Standards as provided in Technical and Operational Guidance Series (TOGS) 1.1.1 and in 6 NYCRR Part 703

NYSDEC **–** New York State Department of Environmental Conservation

NYSDOH **–** New York State Department of Health

Owner **–** Monroe County is the owner of the Mill Seat Landfill

6 NYCRR Part 360 **–** NYSDEC's solid waste management regulations, codified at 6 NYCRR Part 360 (Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York), effective May 12, 2006.

Permitted Footprint **–** The existing 98.6 acres of the Permitted Site allocated for solid waste disposal within a double composite liner system.

Permitted Site **–** The land on which the Permitted Footprint and associated support features (including buildings and structures, stormwater ponds, access roads, and borrow areas) is located, and the land included as part of the Landfill Lease Agreement. The Permitted Site totals 485 acres.

Primary Water Supply Aquifer or Primary Aquifer **–** Highly productive aquifers presently utilized as sources of water supply by major municipal water supply systems.

Principal Aquifer **–** Aquifers known to be highly productive or whose geology suggests abundant potential water supply, but which are not intensively used as sources of water supply by major municipal systems at the present time.

Proposed Footprint **–** The 118.3 acres allocated for solid waste disposal within the proposed double composite liner system in addition to and directly adjacent to the Permitted Footprint.

Proposed Landfill Expansion **–** The addition of a contiguous footprint to the south of the Permitted Footprint. This defined term is specific to the Proposed Footprint of an additional 118.3 acres, 39.2 acres of overlay onto the Permitted Footprint, and any support features (stormwater management structures, access roads, LFG collection and control infrastructure, and leachate conveyance infrastructure).

Proposed Wetland Mitigation Property **–** The parcels are located south of the Permitted Site across Bovee Road. The property is proposed as remediation to mitigate impacts to wetlands from the Proposed Landfill Expansion.

QA/QC **–** Quality Assurance/Quality Control

RQD – Rock Quality Designation

SIP **--** Site Investigation Plan

SRP **–** Stormwater Retention Pond

SPT **--** Standard Penetration Testing

tsf – Tons per square foot

ug/L **–** microgram per liter

USCS **–** Unified Soil Classification System

USDA **–** United States Department of Agriculture

USEPA **–** United States Environmental Protection Agency

Wetlands **–** A land area that is inundated or saturated (or meets other primary or secondary indicators of hydrology) by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Under normal conditions, an area needs to satisfy three (3) criteria to be deemed a wetland: presence of wetland hydrology indicators, presence of hydric soil indicators, and a dominance of hydrophytic (water-loving) vegetation.

WMNY **–** Waste Management of New York, LLC operates the Mill Seat Landfill under a lease agreement with Monroe County.

1. Introduction

This Hydrogeologic Report has been prepared by GEI Consultants, Inc. P.C. (GEI) in accordance with the requirements in 6 NYCRR Part 360-2.11. The report is submitted to the NYSDEC in support of a 6 NYCRR Part 360 Permit Application for lateral expansion of the Mill Seat Landfill. It documents hydrogeologic conditions at the Mill Seat Landfill through implementation of a Draft Site Investigation Plan (SIP) (June 2013) which was provided to the NYSDEC for comment with regard to the adequacy of methods proposed to satisfy 6 NYCRR Part 360-2.11 requirements for the Proposed Landfill Expansion. The scope of work included Draft SIP clarifications and work scope modifications summarized in a GEI memorandum dated July 31, 2013 following a meeting with the NYSDEC on July 26, 2013 and NYSDEC email correspondence dated August 6, 2013.

1.1 Background

The Mill Seat Landfill is located in the Town of Riga, Monroe County, New York (Figure 1). The Mill Seat Landfill is owned by Monroe County (County) and is operated by Waste Management of New York, LLC (WMNY) under the landfill's Solid Waste Management Facility (SWMF) Permit I.D. 8-2648-0014. The Mill Seat Landfill is currently leased to WMNY and occupies approximately 385 acres. The land surrounding the Permitted Footprint is used for site roadways, buffer areas, leachate collection and retention basins and support facilities including buildings used for administration, maintenance, and landfill gas power generation. More than 250 acres of land is undeveloped grass and woodlands owned by the County. Additional land, adjacent to the County-owned property, is currently owned by WMNY. The County and WMNY-owned land and the Mill Seat Landfill are shown in Figure 2. The final cells of the Permitted Footprint have been constructed and landfill operations are expected to reach permitted capacity in 2020 based on current disposal rates.

The Proposed Footprint occupies approximately 118 acres of land encompassing the permitted soil borrow mining areas, Wetland RG-6, farmland, and undeveloped land covered by grasses and brush. The Proposed Footprint is shown in Figure 3. The hydrogeologic investigation characterized the property in and around the Proposed Footprint.

1.2 Report Objectives and Format

This hydrogeologic report addresses the primary objectives stated in the SIP and includes:

- Integration of hydrogeologic data collected from the Mill Seat Landfill completed during the late 1980s and early 1990s with hydrogeologic data from SIP implementation and other studies conducted in the area south of the Mill Seat Landfill for soil borrow area permitting.

- Provision of data necessary for landfill design and construction to meet engineering requirements of 6 NYCRR Part 360.
- Defines the critical stratigraphic section for the Proposed Landfill Expansion to develop an appropriate environmental monitoring and groundwater protection program for the Proposed Landfill Expansion.

In addition, the investigation findings are compared to 6 NYCRR Part 360-2.12 siting requirements applicable to landfill expansion.

As stated in the Draft SIP (June 2013), a substantial database of geologic, hydrogeologic and groundwater quality data exist for the Mill Seat Landfill. These data were collected during site investigations conducted to support permitting of the Permitted Footprint and soil borrow areas south of the Permitted Footprint. The investigation work described in this report supplements that information and has been used to comprehensively document the hydrogeologic conditions, not only for the Proposed Footprint, but for the Proposed Site. This report is divided into the following:

- Section 2 describes site history and prior site investigations
- Section 3 describes the Site Investigation Plan for hydrogeologic investigation
- Section 4 describes regional geologic and hydrogeologic conditions including groundwater usage
- Section 5 describes comprehensive site investigation findings for the Proposed Site including definition of the Critical Stratigraphic Section
- Section 6 provides a conceptual plan to adequately monitor environmental conditions at the Mill Seat Landfill and Proposed Landfill Expansion
- Section 7 summarizes design considerations and investigation conclusions

In addition to figures referenced in Section 5, Plate size sheets are provided for most figures presenting hydrogeologic information in this report.

2. Site History and Summary of Previous Investigations

2.1 Site History

Investigations for landfill siting and site characterization were completed by several consulting firms from 1980 through 1991 for permitting of the Mill Seat Landfill. Hydrogeologic data gathered during these site investigations were peer reviewed by a group of qualified professionals commissioned by the County known as the Monroe County Landfill Coordinating Committee. The committee engaged consultants working under contract with the County to fully characterize site conditions, recommended field programs to address data gaps, and assisted in the interpretation of geologic and hydrogeologic data. Following these investigations, a 6 NYCRR Part 360 Permit Application for the Mill Seat Landfill was submitted to the NYSDEC in December 1989.

An FEIS was prepared and submitted to the NYSDEC in October 1990 by Clark Engineers. In April 1993, the County received a permit from the NYSDEC to operate the Mill Seat Landfill. The County and WMNY entered into a Landfill Lease Agreement in 2002, whereby WMNY assumed operation and maintenance of the Mill Seat Landfill and ownership of the Permitted Site is retained by the County.

Additional investigations were conducted by AMEC Geomatrix between 2006 and 2010 in support of the permitting for two (2) soil borrow areas located south of the Permitted Footprint.

2.2 Previous Hydrogeologic Investigations

Site investigations have been completed in and around the area of the Permitted Footprint. This section summarizes investigations completed to support construction of the Permitted Footprint and to support two (2) soil borrow areas situated south of the Permitted Footprint.

2.2.1 Existing Landfill Area Hydrogeologic Investigations

Seven (7) subsurface exploration programs were conducted at the Permitted Site during the time-period from 1980 to 1991 in support of the permit application to construct and operate the Mill Seat Landfill. These programs were reported in the following reports:

1. Todd Giddings Associates, Inc. (TGA) – June 1980
2. TGA – September through October 1982
3. TGA and Erdman, Anthony Associates (EAA) – April through November 1984
4. Dunn Geoscience Corporation (Dunn)– October through December 1986

5. H&A of New York – September 1988
6. H&A of New York – February through March 1989
7. H&A of New York – May through July 1989
8. H&A of New York – May 1990 through October 1991

A summary of the investigation findings is presented below.

1. TGA – June 1980

The initial subsurface exploration program was conducted by TGA from June 2 – 5, 1980 and consisted of seven (7) test pits and four (4) test borings (B-1, B-2, B-3 and B-2A). Test borings B-1 and B-2 were completed as observation wells. This study indicated the surficial soil material consisted of dense glacial till of sufficient thickness to provide adequate cover material for development of a sanitary landfill.

2. TGA – September through October 1982

Field investigations were conducted from September 29 through October 14, 1982 by TGA to further assess the suitability of the site and to provide data for consideration of a permit application. This investigation included 14 test pits and nine (9) test borings (DH-1, -2, -3, -4, -5, -6, -7, -8, and -9), five (5) of which were completed as observation wells. Falling head permeability tests were conducted in glacial till. As part of the investigation, an inventory of domestic water wells was conducted in the area surrounding the site and water levels were measured in accessible wells. TGA concluded the site was hydrogeologically very suitable for development as a landfill.

3. TGA – April through November 1984

Differing interpretations of the available groundwater information by the NYSDEC and the Monroe County Landfill Coordinating Committee resulted in the development and implementation of a subsequent expanded investigation by TGA and Erdman, Anthony Associates (EAA) in 1984. Twelve additional test pits were excavated and nine (9) monitoring well pairs (M1-A, M2-A, M3-A, M4-A, M5-A, M6-A, M7-A, M8-A and M9-A) and four (4) multi-piezometer clusters (PC-1A, PC-2A, PC-3A and PC-4A) were installed. Soil and bedrock data were collected from borings that were drilled for the installation of wells and piezometers, and hydraulic conductivity testing was conducted at completed piezometer and monitoring wells. Twenty soil samples were analyzed according to ASTM D-2487-69 “Standard Test Method for Classification of Soils for Engineering Purposes”. The report concluded the site is geologically suitable for landfill development.

4. Dunn Geoscience Corporation (Dunn) – October through December 1986

Dunn participated in field investigations in conjunction with EAA from October through December 1986. The objective of these field investigations was to define the site hydrogeology in the detail required by the NYSDEC for consideration of the site as a municipal waste landfill and to address comments on the site hydrogeology from both the NYSDEC and the Monroe County Landfill Coordinating Committee. The field investigations included the installation of three (3) additional piezometer clusters (PC-5A, PC-6A and PC-7A) and the performance of numerous hydraulic conductivity tests. Soil and bedrock data were collected from the borings drilled for the piezometers.

5. H&A of New York (H&A) – September 1988

H&A was retained by Clark Engineers in the fall of 1988 for further investigation of the site. The initial field investigation program conducted by H&A took place September 7-8, 1988 and was designed to obtain additional data on subsurface conditions and to obtain soil samples for laboratory testing (consisting of grain size analysis, compaction tests, and permeability testing). Ten (10) test pits were excavated and logs were developed from these test pits.

6. H&A of New York (H&A) – February through March 1989

H&A conducted a second phase of subsurface explorations in February and March 1989. This program consisted of five (5) test borings (B101, B102, B103, B104 and B105) completed at the site during the period of February 22 through March 1, 1989 by Empire Soils Investigations, Inc., and six (6) test pit excavations.

H&A provided the NYSDEC with a draft Hydrogeologic Site Investigation Work Plan on May 8, 1989 in preparation of the hydrogeologic report that would be submitted for landfill permitting. The draft Work Plan was subsequently revised to incorporate comments from the NYSDEC.

7. H&A of New York (H&A) – May through July 1989

H&A conducted further field investigations in accordance with the approved Work Plan. The additional subsurface exploration program was conducted from May 15 through July 27, 1989 to provide data to specifically address 6 NYCRR Part 360 (December 31, 1988).

Fourteen piezometers, four (4) monitoring wells, and one (1) test boring were installed (B201, B202, B203, B204, B205, B206, B210, B211, M1Z, M2Z, M9Z, M10-A, M10-B, P8S, P8Z, P9Z, PC-3Z, PC-7P and PC-7Z). Packer testing was performed on various intervals of the bedrock and falling/rising head tests were conducted on numerous piezometers screened in the overburden below the proposed landfill liner base. Hydraulic conductivities were calculated from these tests. The upper 15 feet of the bedrock was cored and packer tests were run in several borings. Bedrock wells were sampled to evaluate groundwater quality and to determine vertical horizontal gradients deeper within bedrock.

Test boring P-8S was drilled 100 feet into competent bedrock as a site stratigraphic test and borehole geophysical logs were obtained.

A pumping well was installed in the northwest portion of the site where relatively high hydraulic conductivities in nearby wells had been noted from previous investigations and where linear features were observed in aerial photographs. A pumping test was conducted for 48 hours from July 25 to 27, 1989. The discharge from the pumping well was monitored continuously and water levels were taken at designated time intervals during drawdown and recovery. Testing results indicated that groundwater flowing at the bedrock/overburden interface was not in strong hydraulic communication with deeper sections of the pumping well (Z-zone well equivalent).

8. H&A of New York (H&A) – May 1990 through October 1991

H&A completed supplemental hydrogeologic assessments of regional scale areas including an assessment of the Village of Bergen public water supply well head area and the Comstock Foods water production wells. They concluded that a zone of low permeability bedrock occurs between the Mill Seat Landfill and the water supply well head area to the north. No hydraulic effects were observed near the Mill Seat Landfill from pumping at the Comstock Foods production wells. In 1991, H&A installed 27 groundwater monitoring wells to monitor the existing Mill Seat Landfill area as described in the original EMP approved for the Mill Seat Landfill.

A synopsis of the investigation results summarized above, and a comprehensive assessment of the geologic and hydrogeologic conditions at the Permitted Site is documented in "Hydrogeologic Summary Report for the Mill Seat Landfill" prepared by Geomatrix Consultants, Inc. (Geomatrix) in September 2006. WMNY transmitted this report to the Region 8 NYSDEC Office on September 29, 2006.

2.2.2 Soil Borrow Area Hydrogeologic Investigations

AMEC Geomatrix, Inc. completed investigations south of the Permitted Footprint during separate phases between 2006 and 2010. The investigations focused on characterizing geologic and hydrogeologic conditions in the overburden across an investigation area that extended from the southern footprint of the Permitted Footprint southward to Bovee Road in the area between Wetland RG-5 and an area a few hundred feet east of Brew Road north of Hotel Creek. The property south of the Mill Seat Landfill had not been characterized previously and the data were used to support permitting of the eastern and western soil borrow areas which are situated south of the Permitted Footprint (see Figure 2). The AMEC Geomatrix investigations were conducted using methods consistent with 6 NYCRR Part 360, effective May 12, 2006 and included the following:

- electromagnetic geophysical survey
- test pit excavations
- completion of soil borings to the top of bedrock
- installation of temporary piezometers to monitor groundwater elevations in the glacial overburden
- installation of monitoring wells screened in the till and weathered bedrock
- hydraulic conductivity testing
- physical testing of site soil
- groundwater and surface water elevation monitoring

The geologic and hydrogeologic conditions in the study area were documented in "Hydrogeologic Investigation Report – Potential Soil Borrow Area for the Mill Seat Landfill" prepared by AMEC Geomatrix in January 2011. The report was transmitted to the NYSDEC Region 8 Office as an appendix to the DEIS for the proposed soil borrow area project. The soil borrow area project received NYSDEC permit approval effective on July 11, 2011.

3. Site Investigation Plan

A Draft SIP for the Proposed Landfill Expansion was prepared for WMNY by GEI and transmitted to the NYSDEC Region 8 office in June 2013. A meeting was held between NYSDEC Region 8, WMNY personnel and GEI on July 26, 2013 to discuss the proposed scope of work described in the Draft SIP. During the meeting, it was agreed that the vertical extent of the Critical Stratigraphic Section (CSS) needed to be adequately characterized in the Proposed Landfill Expansion. Previous investigations at the Mill Seat Landfill concluded that the vertical extent of the CSS is approximately 30 to 40 feet below the top of rock, which was based on higher hydraulic conductivities in this zone. WMNY agreed that packer testing of bedrock core holes would continue until lower hydraulic conductivity bedrock was encountered, indicating the bottom of the CSS. The criteria for discontinuing vertical packer testing along with a complete summary of meeting discussion items was provided in a GEI memorandum dated July 31, 2013 and submitted to NYSDEC. A copy of this memorandum is provided in Appendix A.

NYSDEC requested additional modifications to the Draft SIP in email correspondence to WMNY and GEI dated August 6, 2013. In the e-mail, NYSDEC described a need to characterize deeper Z-Zone bedrock hydrogeology and groundwater quality in the area of the Proposed Landfill Expansion. The email also outlined the requirements for background groundwater quality testing and monitoring well/piezometer abandonment. The August 6, 2013 email correspondence is also provided in Appendix A.

3.1 Literature Search

A comprehensive review of available reports and literature was performed prior to beginning the field investigation and during the compilation of regional and site-specific information. The review included appropriate documents referenced in previous hydrogeologic investigations performed by TGA and H&A during site characterization. Some of the sources used to more comprehensively understand the physical site setting included, but was not limited to:

- The United States Geological Survey
- The United States Department of Agriculture
- The New York State Geological Survey
- The Monroe County GIS Services Division (http://www.monroecounty.gov/gis-index.php)
- The U.S. Army Corps of Engineers
- The New York State Department of Health
- The Monroe County Department of Health

- The Monroe County Division of Pure Waters
- The NYSDEC
- The New York State Department of Transportation
- The United States Environmental Protection Agency

Seismic, geologic, and hydrologic information was obtained from academic research papers and other resources to complete the understanding of regional and site conditions.

3.2 Water Well Survey

A water well survey was documented in the December 1990 permit application submittal for the Mill Seat Landfill. More than 70 private home owner wells were identified within a one (1) mile radius downgradient from the planned site for the Mill Seat Landfill. Since that time, the County and WMNY acquired numerous properties near the Mill Seat Landfill and Monroe County Pure Waters installed water lines to provide municipally supplied water to nearby residential properties. In 2014, the survey was updated to include a search of the Monroe County Department of Health and the NYSDEC water well database for private water wells installed within one-quarter mile upgradient and one (1) mile downgradient of the Proposed Site in accordance with 6 NYCRR Part 360 2.11(1)(a)(5). The search area is shown in Figure 4. Additionally, WMNY mailed a water well survey questionnaire to the 83 property owners (non-County and WMNY owned properties) identified in the search radius. The results of the water well survey are summarized in Section 4.2.4.

3.3 Surface Geologic Mapping

The US Department of Agriculture Soil Conservation Service (SCS) soil series and associated hydrologic soil groups were identified for the Proposed Site soils. Soil information obtained from the SCS was compared with shallow boring data obtained during the site investigation for confirmation of soil type. Results of the surface soil mapping are discussed in Section 5.1.1.

3.4 Subsurface Investigation Activities

A substantial amount of investigation work was completed in the area of the Proposed Landfill Expansion between 2006 and 2010 in support of investigation of additional soil borrow material. This work included the completion of 41 soil borings, excavation of 14 test pits, installation of 11 piezometers and installation of two (2) groundwater monitoring wells. Activities were completed in accordance with 6 NYCRR Part 360 protocols under the direction of a senior level hydrogeologist. Borings, monitoring wells, piezometers and test pits completed in the expansion area are listed in Table 1 and their locations are shown on Figure 5. The data obtained from the investigations in the area of the Proposed Landfill Expansion are of suitable quality to adequately characterize the overburden soil type and thickness, bedrock topography, and overburden groundwater flow direction across the area of the Proposed Landfill Expansion. As such, the implementation of the SIP has addressed data gaps described in the Draft SIP and collected additional hydrogeologic and water quality data required to meet 6 NYCRR Part 360 requirements.

Field activities associated with the 2013-2014 hydrogeologic investigation described in the Draft SIP were performed between August 22, 2013 and April 3, 2014 and included:

- Completion of two (2) soil borings with geologic sampling;
- Installation of five (5) monitoring wells to monitor B-Zone groundwater (overburden/bedrock interface);
- Installation of six (6) monitoring wells to monitor A-Zone groundwater (upper 20 to 30 feet of bedrock);
- Installation of five (5) monitoring wells/piezometers to monitor the deep Z-Zone bedrock flow system (between 40 and 100 feet below top of bedrock);
- In-situ hydraulic conductivity testing of B-Zone, A-Zone and Z-Zone monitoring wells and piezometers including the performance of straddle-packer tests and rising-head (slug) tests; and
- Collection of groundwater elevation and preliminary groundwater quality data.

Potable water was used for bedrock coring and packer testing, as well as, steam cleaning between drilling locations. A sample of the potable water used during the investigation was collected on August 27, 2013 from the on-site fire hydrant which is a municipally supplied water source and analyzed for the 6 NYCRR Part 360 Baseline parameter list including special compounds listed in the EMP. The following halogenated volatile organic compounds:

- Bromodichloromethane (11 ug/L);
- Chloroform (24 ug/L); and
- Dibromochloromethane (3.7 ug/L)

were detected at low part per billion level concentrations in the potable water sample. These compounds are common artifacts from chlorination disinfection of water in municipal water supply systems.

The locations of borings and monitoring wells completed during the 2013-2014 hydrogeologic investigation are shown on Figure 5 along with previous investigation locations and the Mill Seat Landfill detection monitoring network. The subsurface investigation was implemented in a single phase to complete investigation activities needed to address 6 NYCRR Part 360 requirements. However, based on Permitted Footprint geometry, cell construction progression, and groundwater flow direction in the B-Zone and in the A-Zone, the full suite of groundwater monitoring well installations required to monitor the expanded Mill Seat Landfill during its operational and post-closure existence will be implemented as described in the Environmental Monitoring Plan (EMP).

3.4.1 Existing Piezometer/Monitoring Well Assessment

Piezometers and monitoring wells installed previously in the area of the Proposed Landfill Expansion were inspected for suitability to provide water level monitoring and groundwater quality information in support of the hydrogeologic investigation. The assessment was performed on September 4, 2013 and included:

- Determining the accessibility of each well or piezometer,
- Assessing the integrity of the surface completion of the well/piezometer, including riser condition and locking mechanism where originally present;
- Development of existing monitoring wells (2” casing diameter and larger) and monitoring recovery to determine a hydraulic conductivity value. Groundwater elevations and total well depths were measured in wells from the top of the riser using an electric water level meter to the nearest 0.01 foot, to determine if current groundwater elevations are similar to historic measurements, and;
- Comparing measured well depths to existing well completion logs.

All existing monitoring wells and piezometers in the area of the Proposed Landfill Expansion were determined to be suitable for the purposes of groundwater elevation or groundwater quality monitoring except for piezometer PZ-1-2006, which was previously cut-off at the ground surface and was not located during the assessment. PZ-1-2006 was a 1” diameter, PVC well that was installed to monitor the lower portions of the till unit. An attempt will be made to locate piezometer PZ-1-2006 using existing survey data. If the piezometer is located, the monitoring point will be repaired or decommissioned in accordance with 6 NYCRR Part 360 requirements.

3.4.2 Soil Borings

Soil borings B-SEA-1 and B-SEA-2 were completed in areas not previously investigated, at locations where information was needed to better define site geology. A soil boring was not completed in Wetland RG-6 as proposed in the SIP due to the lack of an access permit necessary for wetland area drilling. It was decided that depth to bedrock in this area of the property was deeper than 10 feet and that verification could be completed during pre-design data gathering for cell construction in that area of the property. At each soil boring location, the soil was drilled using 2 3/4-inch diameter hollow stem augers with an all-terrain drill rig. The soil profile was continuously sampled using 2-inch diameter stainless steel split spoons in accordance with 6 NYCRR Part 360 requirements. Blow counts for Standard Penetration Testing (SPT) were recorded during soil sample collection. The soil was continuously logged by a GEI hydrogeologist in accordance with the Unified Soil Classification System (USCS). Representative soil samples from each split spoon were placed in a glass jar and labeled with the boring number, date, and sample collection depth, and packaged neatly for archive at the Mill Seat Landfill. Each soil boring was advanced to sampler refusal in the Vernon Shale bedrock. Following the completion of each boring, the boring was backfilled to ground surface using a cement-bentonite grout mixture emplaced using tremie methods. Soil boring logs are provided in Appendix B. Passero Associates surveyed the location and obtained the surface elevation of each soil boring.

3.4.3 Geotechnical Soil Sample Collection and Analysis

Representative soil samples were collected during the investigation of soils for geotechnical analysis by 3rd Rock, LLC which maintains AASHTO accreditation. The geotechnical laboratory reports are included in Appendix C. Soils considered representative of laterally extensive soil types were collected at the following six (6) locations:

- B-SEA-1 (4-16’)
- B-SEA-2 (0-14’)
- B-SEA-2 (14-36’)
- MW-SEA-3 (12-15’)
- MW-SEA-5 (0-20’)
- MW-SEA-6 (0-19’)

Samples were analyzed for the following parameters as required by 6 NYCRR Part 360 2.11 (a)(9)(ii):

- Atterberg limits – ASTM D4318
- Grain Size Gradation (grain size distribution sieve and hydrometer analysis – ASTM D422

An attempt was made to advance a Shelby tube sampler into the coarser grained till at two (2) locations and two (2) locations in the dense lodgment till. At each location, the thin wall tube bent upon advancement, and Shelby tube samples could not be collected for analysis. Due to the lack of in-situ Shelby tube samples, the following tests were not performed:

- Consolidated/Undrained Tri-axial Shear Test w/ pore pressures monitored (5 tons per square foot (tsf), 7.5 tsf, 10 tsf) - ASTM D4767
- Consolidation test - ASTM D2435.

As an alternative to Shelby tube samples, soil was collected at three (3) soil boring locations for remolded soil permeability measurement by ASTM D5084 Method C to assess the permeability of unsaturated and saturated soils. Soil geotechnical data for samples collected during 2013 field investigation activities and previous investigations completed in the area of the Proposed Landfill Expansion are summarized in Table 2.

3.4.4 Monitoring Well Installations

Groundwater monitoring wells were installed to monitor the groundwater in the area of the Proposed Landfill Expansion between August 22 and September 23, 2013. Monitoring well installations included five (5) B-Zone wells (MW-SEA-B series), six (6) A-Zone wells (MW-SEA-A series) and five (5) Z-Zone (MW-SEA-Z series) monitoring wells, as shown on Figure 5. Monitoring wells completed in the Proposed Landfill Expansion were installed to monitor zones consistent with the B, A, and Z monitoring zones designated for the Mill Seat Landfill, and are as follows:

- B-Zone monitoring wells monitor the lower portions of the saturated overburden materials and uppermost portions of the weathered Vernon Shale bedrock (regolith).

- A-Zone monitoring wells were installed to monitor the unweathered portions of the Vernon Shale bedrock generally between 15 and 30 feet below the top of bedrock.

- Deeper bedrock Z-Zone monitoring wells were installed to monitor bedrock intervals generally between 30 and 80 feet below the top of bedrock.

Monitoring well construction details are summarized in Table 3.

As discussed in the introduction to Section 3.0, NYSDEC outlined a requirement of the Draft SIP to investigate and characterize the Z-zone bedrock flow system in the area of the Proposed Landfill Expansion. In fulfillment of this requirement, five (5) Z-zone monitoring wells/piezometers were installed to monitor the deep bedrock flow regime at locations shown on Figure 5. Z-zone bedrock core holes were advanced until RQD values generally improved to a value above 25% or lower permeability values were obtained from packer tests.

One (1) of the A-zone wells (MW-SEA-4A) was paired with existing monitoring well pair MW-1S (2006) and MW-1D (2006) previously constructed according to 6 NYCRR Part 360 monitoring well construction requirements. In field notes, MW-1D (2006) is sometimes referred to as MW-SEA-4B based on the positioning of the well screen (B-zone).

At the MW-SEA-3 well series, a deep exploratory core hole (PZ-SEA-3Z) was completed to characterize and monitor the hydraulic characteristics of the lower portions of the Vernon “C” Horizon at a depth of approximately 100 feet below ground surface. A piezometer was constructed in the core hole that screens an interval from 89-99 feet below ground surface. Piezometer construction (identical to monitoring well construction) is summarized in Table 3.

The boring for each well was advanced using 4 ¼-inch diameter hollow stem augers to auger refusal in weathered bedrock. At each bedrock monitoring well location, the augers were removed and a 6-inch diameter permanent steel casing was grouted in a 2-4 foot deep rock socket. At Z-zone monitoring well locations (or deepest well at nested well locations), the bedrock was cored using an HQ diameter core barrel and logged according to the 6 NYCRR Part 360 2.11 (a)(10)(ii) requirements. The rock core was placed in appropriately labeled wooden core boxes, photographed, and placed in on-site storage for archive. Bedrock core photographs are included in Appendix D. Discrete depth packer tests were performed on the deepest bedrock core hole at each well cluster to assess bedrock hydraulic conductivity in ten (10) foot increments. The continuous 10 to 20 foot zone having the highest hydraulic conductivity was selected for monitoring. The packer testing procedure is described in Section 3.5. Following testing and monitoring interval selection, the bedrock core hole was reamed using a 5-7/8 inch roller bit. The estimated volume of potable water introduced to the bedrock formations during coring, reaming and packer testing is summarized in Appendix B. Following the completion of the packer tests and prior to monitoring well construction in the core hole, each bedrock core hole was developed with the drill rig using air-lift methods to remove potable water introduced to the bedrock formations. Development water was discharged to the ground surface. At each well location, the monitoring well consisted of a 10 to 20-foot long, 2-inch diameter continuous slot wire-wrapped PVC well screen and associated schedule 40 PVC flush-joint riser. Each monitoring well was completed with a lockable protective surface casing and appropriately labeled for incorporation into the Proposed Site groundwater monitoring network. Each monitoring well construction conforms to those requirements outlined in 6 NYCRR Part 360 2.11(a)(8)(ii), “Construction of Monitoring Wells and Piezometers”. All drilling equipment including augers, drill rods and sampling spoons were decontaminated with high-pressure steam between monitoring well and boring locations.

Each newly-installed monitoring well was manually developed no sooner than one (1) week following well installation. Monitoring wells were developed using a bottom-discharging bailer to remove groundwater and any accumulated sediment on the well bottom. Approximately ten (10) casing volumes of water were removed from each newly installed well. Water removed during development was discharged to the ground surface. Passero Associates surveyed the location and obtained elevations of each newly installed monitoring well.

3.5 Hydraulic Conductivity Testing

Hydraulic conductivity estimates for monitoring wells and piezometers installed in the Proposed Landfill Expansion were obtained by performance of rising head (slug) tests in completed wells and using an inflatable double-packer system in open rock holes.

Slug tests were performed on October 1 and 2, 2013. At each monitoring well location, a depth to water was measured to establish the static water level. A known volume of water was removed from the well casing using a bailer and the recovery of the water level in the casing was measured using a down-hole pressure transducer. The water level was monitored until the level had recovered to at least 80% of the static level or sufficient data were available for reliable analysis. Slug test recovery data was analyzed using the Hvorslev calculations to yield estimates of hydraulic conductivity of B-Zone, A-Zone and Z-zone monitoring wells. Hydraulic conductivity calculations are provided in Appendix E.

Where bedrock was cored, bedrock straddle packer tests using an inflatable double packer assembly were performed to estimate hydraulic conductivity to aid in the selection of well screen placement depths in A-Zone and Z-Zone wells. Packer tests were completed with a ten (10) foot packer assembly at the following boring locations:

- PZ-SEA-1Z
- MW-SEA-2A
- MW-SEA-3Z
- MW-SEA-4A
- PZ-SEA-5Z
- PZ-SEA-6Z

A summary of the bedrock intervals that were tested in each bedrock core hole is provided below. Packer testing calculations are provided in Appendix F. Table 4 presents a summary of hydraulic conductivity values.

PZ-SEA-1Z

Straddle packer tests were performed on two (2) bedrock intervals in well PZ-SEA-1Z; 45-55 feet below ground surface (bgs) and 55-65 feet bgs. The 35-45 feet bgs bedrock interval was not tested due to poor bedrock quality (4 to 8% RQD) present in the interval. The highly fractured and rough nature of the borehole wall caused damage to the inflatable packer (puncture) and it was determined that hydraulically isolating the 35-45 foot test interval from adjacent intervals was not feasible.

MW-SEA-2A

Straddle packer tests were performed on three (3) bedrock intervals in well MW-SEA-2A; 22-32 feet bgs, 32-42 feet bgs and 42-52 feet bgs.

MW-SEA-3Z

Straddle packer tests were performed on four (4) bedrock intervals in well MW-SEA-3Z; 20-26 feet bgs, 26-36 feet bgs, 36-36 feet bgs and 46-58 feet bgs. The lowermost 58-68 foot interval was not tested due to damage sustained to the inflatable packer and the inability to produce a hydraulic seal from the upper interval. The monitoring well installed in MW-SEA-3Z was constructed to screen the 55-68 foot bedrock interval. A hydraulic conductivity estimate for the lower interval was calculated from a rising head test performed on the monitoring well.

MW-SEA-4A

One (1) straddle packer test was performed on monitoring well MW-SEA-4A at the 42-52 feet bgs bedrock interval. A hydraulic conductivity estimate for the upper bedrock interval (28-38 bgs) was previously calculated from adjacent monitoring well MW-SEA-4B. An attempt was made to perform a straddle packer test on the lower bedrock interval 52-68 feet bgs, however damage was sustained to the inflatable packer and it was determined that the zone could not be hydraulically isolated from adjacent intervals to perform the test. The monitoring well was constructed in the MW-SEA-4A borehole consists of a 20-foot long well screen, spanning an interval of 40.5-60.5 feet bgs. A hydraulic conductivity estimate for this interval was obtained through the performance of a rising head test.

PZ-SEA-5Z

Three (3) straddle packer tests were performed in the PZ-SEA-5Z core hole at the following intervals: 23-33 feet bgs, 32-42 feet bgs and 42-52 feet bgs. A one (1) foot overlap between the upper two (2) intervals was necessary in order to keep the two (2) foot long upper inflatable packer situated in the bedrock core hole, which began at 21 feet bgs.

MW-SEA-6Z

Four (4) straddle packer tests were performed in the PZ-SEA-6Z bedrock core hole at the following intervals: 30-40 feet bgs, 40-50 feet bgs, 50-60 feet bgs and 60-70 feet bgs.

For each bedrock interval tested, potable water (the same water source used for drilling) was injected at variable pressures between 15 and 45 psi at 15 psi increments. The volume of water pumped into the formation at each pressure increment was measured over a two (2) to three (3) minute time period and recorded. The observed values were related to hydraulic conductivity by the relationship below:

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

Where H_c (total head of water) is defined as:

$$H_C = \frac{p}{.433} + h - h_f$$

And L (Lugeons) is defined as:

$$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$

The packer testing procedure and calculation of hydraulic conductivity are generally consistent with methods used previously by H&A during the 1989 hydrogeologic characterization of the Mill Seat Landfill. Hydraulic conductivity data and a discussion of Lugeon patterns are presented in Section 5.0.

3.6 Groundwater Elevation Monitoring and Monitoring Well Sampling

A comprehensive round of groundwater elevations was measured in each newly installed monitoring well, existing piezometers and the following monitoring wells near the Mill Seat Landfill: M1, M2, M7, and M14 clusters. Groundwater elevations were measured on the following dates:

- September 24 – October 2, 2013
- November 12, 2013
- February 20, 2014
- April 3, 2014

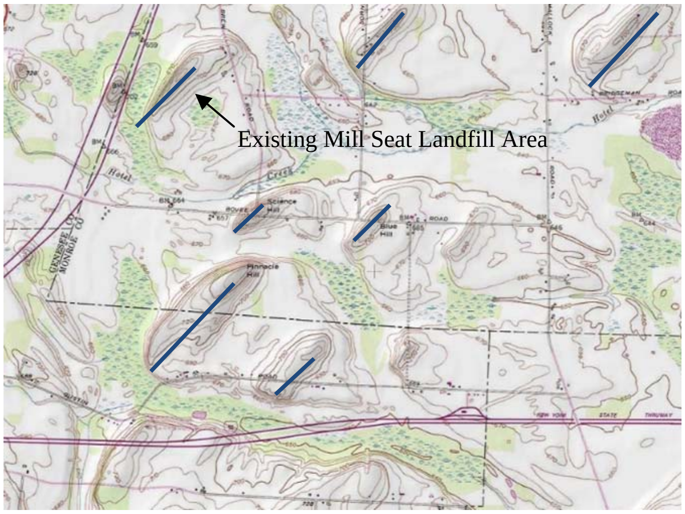
A summary of groundwater elevations for monitoring wells and piezometers installed in the Proposed Landfill Expansion and the Mill Seat Landfill monitoring network is provided in Table 5.

Two (2) rounds of groundwater samples were collected from the newly-installed monitoring wells by an Amherst, NY-based Test America Laboratory field sampling crew. The first sampling round was performed from October 31 through November 1, 2013 during the Fourth Quarter sampling event for the Mill Seat Landfill. Samples were analyzed for the 6 NYCRR Part 360 Expanded Parameter list. A second round of groundwater samples was collected by Test America between April 2 and April 8, 2014 during the Second Quarter 2014 sampling event for the Mill Seat Landfill. Second Quarter 2014 samples collected from the Proposed Landfill Expansion were analyzed for the 6 NYCRR Part 360 Baseline Parameter list and included special parameters listed in the current EMP. Water levels measured during each monitoring event are summarized in Table 5.

4. Regional Physical Setting

The Mill Seat Landfill is situated within the Erie-Ontario Lowlands physiographic province. The region is typified by broad plains of relatively low relief, underlain by gently south-southwestward dipping sedimentary bedrock of the early Paleozoic age. Land surface elevations in the lowlands province vary between 245 feet above sea level (fasl) at the Lake Ontario Shore, to nearly 1600 fasl in the Southern Tier of New York State, at the boundary of the Allegheny Plateau (Appalachian Uplands province). The regional bedrock is covered by a veneer of glacially derived sediments that exhibit four (4) distinct glacial successions during the Pleistocene Era.

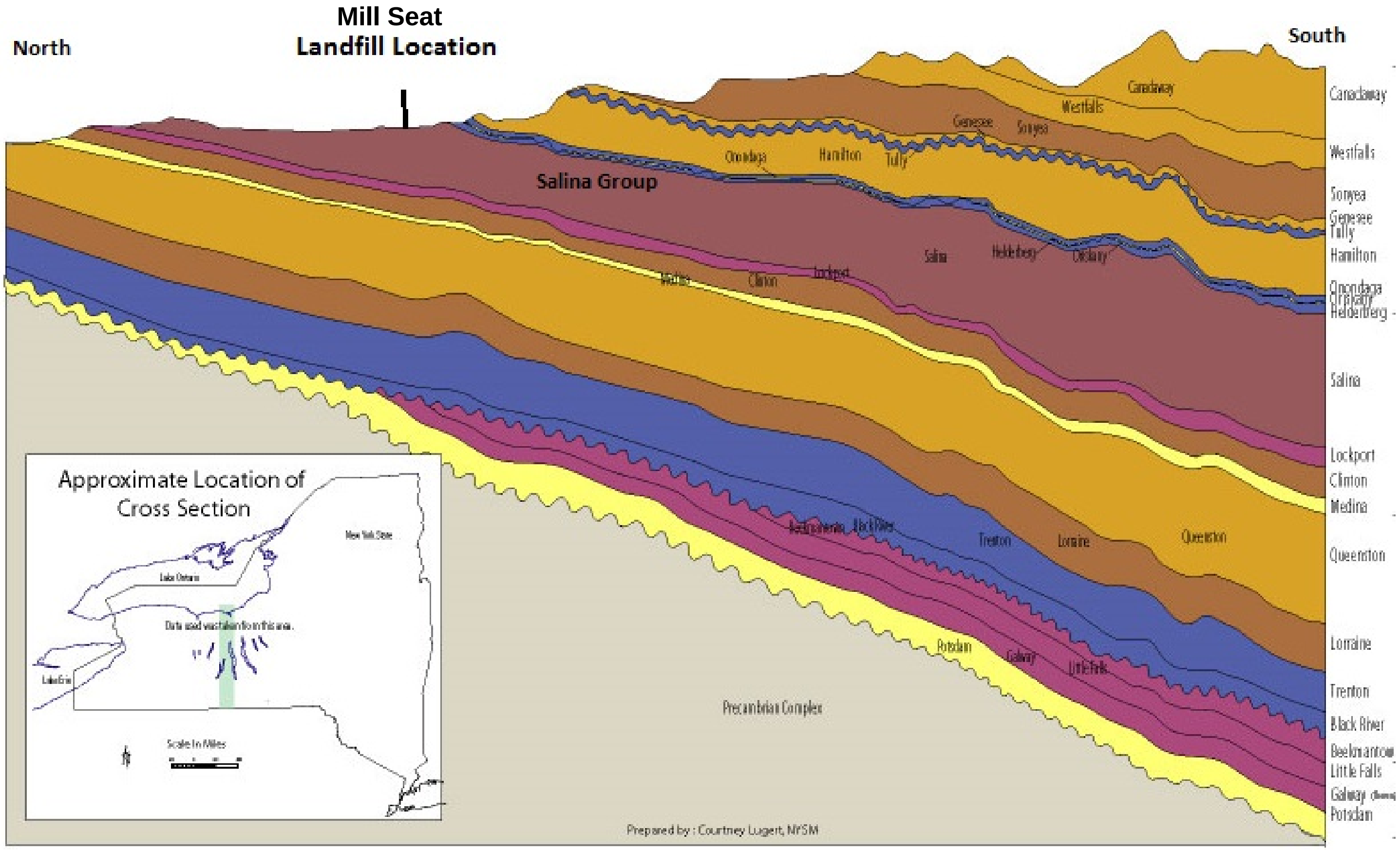
Fairchild (1907) described drumlin presence in central and west central New York State. Drumlins shape the topographic landscape in the southern portion of Monroe County as elongated hills. As shown in the topographic map below that pre-dates Mill Seat Landfill construction, numerous drumlins exist in the area of the Proposed Site. The northeast – southwest trending axial orientations of individual drumlins are highlighted.



The drumlins are composed of till consisting of densely packed clay, silt, sand, gravel, and boulder size material and are typically 0.5 to 1 mile in length.

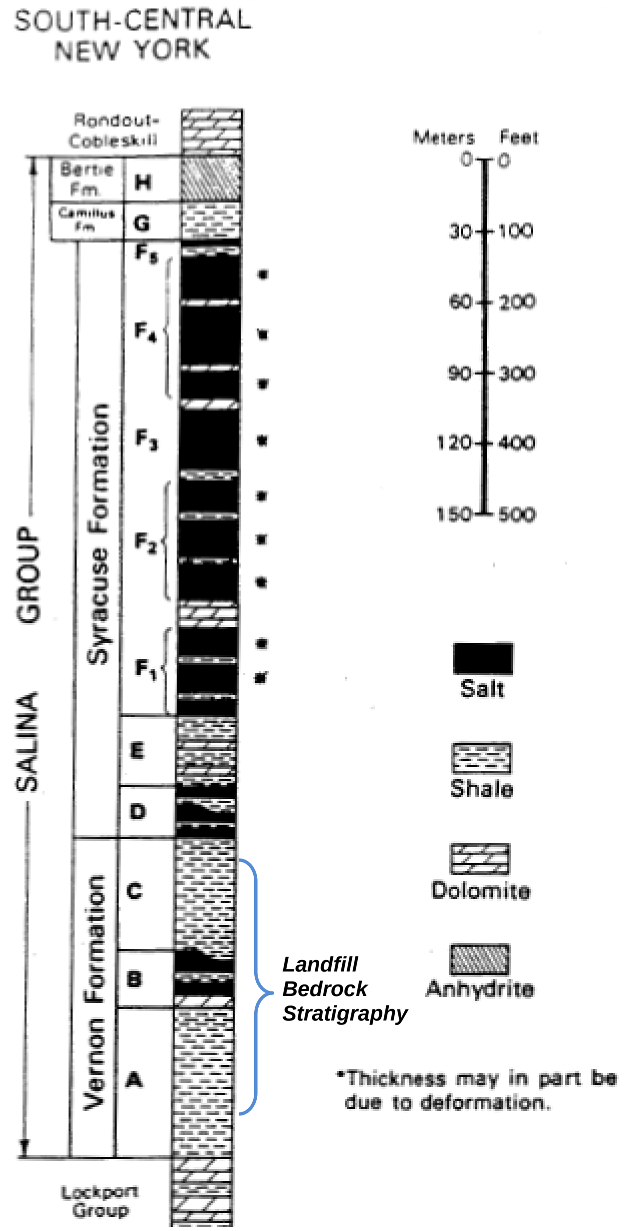
4.1 Bedrock Geology

Bedrock units in western New York strike east-west and dip south-southwest at an angle of 1^0 to 2^0 (50 to 80 ft./ mile). As shown in the figure below representing generalized New York State bedrock geology from North to South, bedrock units range in age from the upper Ordovician Queenston Formation near Lake Ontario to the Upper Devonian shales of the Allegheny Plateau near the Pennsylvania border.



From: Modified from C. Lugert 2006, NYS Museum

The bedrock in the southern portion of Monroe County consists of rock units of the Upper Silurian Salina Group (Rickard, 1969). The bedrock formations contain evaporite lithology (gypsum and halite {salt}) with interbedded dolomite, shale, and mudstone. Along the outcrop region in western and central New York, thickness of the Salina Group increases from 400 feet near Buffalo to 1000 feet near Syracuse. The Syracuse and Vernon Formations of the Salina Group outcrop in southern Monroe County. Bedrock surface exposures are limited to areas where excavations and streams and creeks have cut through glacial sediment to expose bedrock surfaces.



The bedrock underlying the Proposed Site consists of the Vernon Formation (see above). The Vernon Formation is typically a dolomitic shale with dolostone interbeds and has been further subdivided into three (3) units as follows:

- Vernon C Unit (includes a dolostone marker bed known as the CB Horizon)
- Vernon B Unit
- Vernon A Unit

Historic study of the Mill Seat Landfill area prior to site development (H&A, 1989) correlated the site bedrock strata to regional bedrock formations outcropping and subcropping in Monroe, Genesee and Livingston Counties within 15 miles of the Mill Seat Landfill. This was accomplished using correlated salt bed mapping cross-sectional data from Rickard (1969) with rock core description information and litho-density gamma ray logs from deep exploratory well P8S (previously abandoned by H&A) located beneath the Permitted Footprint. This work correlated the upper 100 feet of bedrock beneath the site to regional correlative members within the Vernon Formation. Based on rock core descriptions and gamma ray log information, it was determined that the Proposed Site, including the Proposed Landfill Expansion, overlies the Vernon C Unit of the Vernon Formation.

4.1.1 Geologic Structure and Seismicity

As shown in the regional geologic cross-section in Section 4.1, regional structure is a broad, south-southeastward dipping homocline produced by the upper surface of the Grenville Precambrian basement. Regionally, the sedimentary strata above the basement are unfolded. The Clarendon-Linden Fault system is the closest major, large scale structural feature in the area of the Proposed Site. The Clarendon-Linden Fault system trends in a north-south direction extending beneath Lake Ontario to the north and The Allegheny Plateau to the south. The fault zone has been extensively studied and is categorized as a Class C Fault Zone which is defined by the USGS as, “Geologic evidence is insufficient to demonstrate (1) the existence of tectonic faulting, or (2) Quaternary slip or deformation associated with the feature” (USGS Earthquake Hazards Program, 2000, 2014). The fault system has been mapped in detail in the subsurface by Van Tyne (1975) and work by Faukendiny and Pomeroy has shown it to consist of a series of high angle reverse faults with three (3) subparallel main segments and a southwest trending branch forming horst and graben type features. Most recently, Jacobi and Fountain (1997 and 1998) have studied gas seeps along the basement controlled faults to assess the extent of the fault system.

In recent recorded history, an earthquake having an epicenter near the fault zone in the area of Attica, NY occurred in 1929. Two (2) more recent earthquakes had epicentral locations inside the 14-km-wide fault zone with depths 2-3 km below ground (Herrmann, 1978). Johnston (1993) estimated that earthquakes of this size in stable continental regions like western New York State might typically have rupture zones with diameters of 0.6 km. Presumably rupture zones of this size would have occurred on faults at least several times larger, and the only large faults known in the area at the shallow depths of the hypocenters are the strands of the Clarendon-Linden fault zone. Thus, the locations, depths, rupture-zone sizes, and nodal-plane orientations of the 1966 and 1967 earthquakes are unusually good matches to the locations, depths, and orientations of the strands of the Clarendon-Linden fault zone. However, paleoseismological evidence was not found to suggest the fault zone slipped during the Quaternary. Several researches have searched for (Tuttle and others (1995; 1996)), but did not find, historic or prehistoric liquefaction features in the liquefiable deposits in the meizo-seismal area of the 1929 Attica earthquake and the area south of Attica along the fault zone. Various soft-sediment structures were observed, but all could be more reasonably attributed to glacial, sedimentological, or mass wasting processes (Tuttle and others, 1995; 1996; Young and Jacobi, 1998). The lack of observed paleoliquefaction features may indicate that earthquakes of magnitude larger than 6.0 have not occurred along the Clarendon-Linden fault zone during the last 12,000 years (Tuttle and others, 1995). However, smaller earthquakes could occur without leaving a detectable paleoliquefaction record. The USGS reports no paleoseismological evidence of prehistoric Quaternary seismic reactivation.

Jacobi et. al (2002) studied lineaments across Upstate New York using Earthsat and Lidar imagery and correlated zones of highly fractured bedrock (fracture intensification domains [FIDs]) with deeper basement structures. Their work identified a high frequency of joint and fracture networks across the entire state. New York State FID mapping is summarized in Figure 6. Regional bedrock joint systems are reported in a predominant northwest trending compressive stress during late Paleozoic Appalachian deformation producing orthogonal, nearly vertical fractures. Joints identified in the Bergen and Churchville topographic quadrangle, which encompass the site, have primary orientations of N40E, N10E, N63W and N45W, and an east-west trending set. Joint mapping and bedrock structural features in the Bergen and Churchville area are discussed in the H&A Report (1989) and shown on Figure 7.

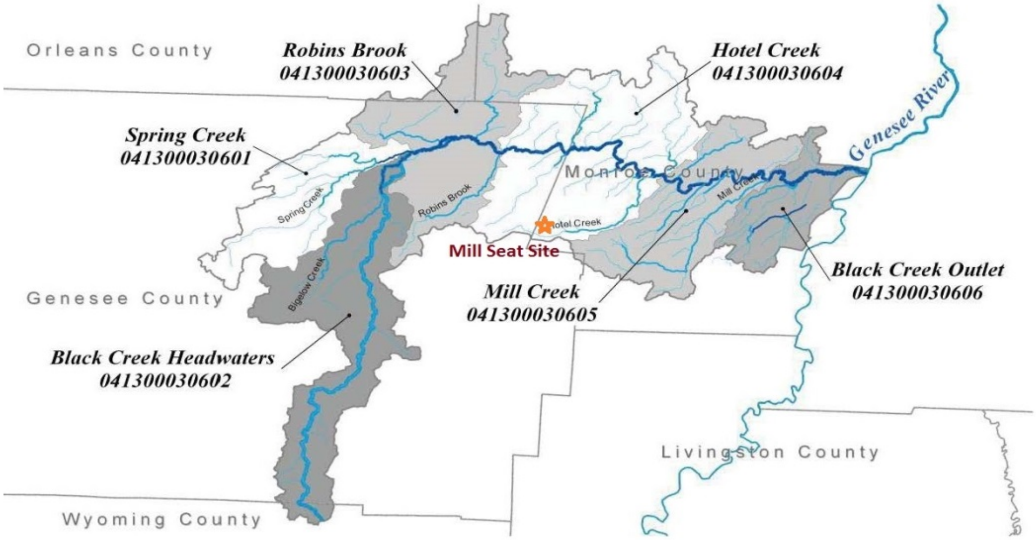
The H&A Report also described the potential for secondary fractures caused by tensile stresses from subsidence caused by dissolution of evaporites in the Salina Group. These features are oriented more commonly in an east-west direction parallel with bedrock strike and are described by Wallach and Prucha, (1979). Where present, these features produce higher frequencies of bedding plane fractures.

4.2 Regional Hydrogeology

4.2.1 Watershed

The Mill Seat Landfill is located within the Genesee River Basin. The Genesee River watershed encompasses approximately 2,500 square miles composed predominantly of agricultural areas. The Genesee River originates in the hills of northern Pennsylvania and flows northward to Lake Ontario. The 125 square mile Black Creek watershed is a sub-watershed of the Genesee River and its drainage area includes the Mill Seat Landfill, the towns of Riga, Chili, Wheatland, Sweden, and Ogden in Monroe County, as well as a large portion of eastern Genesee County. The Bergen Swamp in Genesee County is located in the extreme upper reach of the watershed, and acts as one of the major sources of Black Creek. The extent of the Black Creek Watershed is shown in the figure below. Six (6) sub-watersheds divide the Black Creek Watershed. Hotel Creek is a sub-watershed of Black Creek, and is the watershed potentially influenced by the site. The Hotel Creek watershed encompasses approximately 7.5 square miles from its origin in the Village of Bergen to the confluence with Black Creek northeast of the Proposed Site. The Mill

Seat Landfill is located in the southern portion of the Hotel Creek sub-watershed as shown below.



The Permitted Footprint covers approximately 0.18 square miles and the Proposed Footprint covers an additional 0.19 square miles. Collectively, the Permitted Footprint and Proposed Footprint, when fully developed, would encompass approximately 4.9 percent of the Hotel Creek sub-watershed. Hotel Creek has an average stream gradient of 3.6 feet per 1,000 feet (linear distance) as it travels approximately 5.5 miles just south of the Permitted Site to Black Creek. The low stream gradient combined with generally flat lying topography (excluding drumlins) indicates that stream base flow and peak discharge flows are controlled by the storage volume and hydrogeology of the numerous wetlands that the creek flows near or through.

4.2.2 Regional Groundwater Flow

Groundwater flow across the region occurs within the fractured bedrock and, to a lesser extent, the overlying unconsolidated glacial deposits (overburden). The fine grained nature of these deposits generally confines groundwater within the bedrock units and groundwater occurrence within a few feet of the ground surface may often exist as water table or perched conditions. Discharge areas for overburden groundwater include streams and seeps, springs, or wetlands where the overburden-bedrock interface intersects the land surface. Precipitation which falls on exposed areas of bedrock and precipitation that slowly infiltrates through the glacial overburden recharges bedrock groundwater throughout the region. Groundwater flow within the bedrock units occurs principally within the interconnected network of horizontal and high angle fractures and joints. Typically, the fracture frequency increases toward the bedrock surface, resulting from both weathering and erosional stress relief. As fracture frequency and interconnections decrease with depth, the volume of groundwater flow correspondingly decreases. Although several small-scale bedrock groundwater divides occur throughout the region, the dominant bedrock groundwater flow direction is northeast toward the Genesee River.

4.2.3 Primary/Principal Aquifers

Primary aquifers mapped in the vicinity of the Mill Seat Landfill are shown on GIS mapping (source: NYS GIS Clearinghouse, 2014) and provided on Figure 8. As shown on the figure, the Batavia Water Supply Aquifer and the Irondo-Genesee Aquifer are the closest mapped Primary Aquifers to the Permitted Site. The Batavia Water Supply Aquifer, also known as the Tonawanda Creek aquifer, is located approximately 12 miles southwest of the Mill Seat Landfill. The aquifer materials consist of unconfined, stratified and well sorted glacial outwash sand and gravel deposits (USGS Water Resources Investigation Report, 85-4096). The aquifer occurs within the Tonawanda Creek water shed and has no hydraulic connection to water-bearing deposits in the area of the Mill Seat Landfill. The Irondo-Genesee Aquifer is located approximately 18 miles northeast of the Mill Seat Landfill and is situated east of the Genesee River beneath the valley fill area of Irondequoit Creek. The aquifer materials consist of stratified glacial till, glacial drift, cemented sand and gravel, and deeply buried cobbles and boulder deposits. These deposits in-fill a remnant channel of the historic flow path of the Genesee River which were deposited during deglaciation of the Wisconsin ice sheet (USGS Water Resources Investigation Report, 88-4145). The Irondo-Genesee Primary Aquifer is located east of a major groundwater flow divide associated with the Genesee River and its water quality could not be affected by the Mill Seat Landfill.

NYSDEC TOGS 2.1.3 - Memorandum for Primary and Principal Aquifer Determinations, was prepared to clarify the meaning of the terms “Primary Water Supply Aquifer” and “Principal Aquifer” and to establish guidance for determining whether an aquifer is designated as such. The memorandum lists Primary and selected Principal aquifers in Upstate New York. Both the Irondo-Genesee and Batavia Primary Aquifers are listed in Table 1 of TOGS 2.1.3 which is consistent with NYS GIS mapping. A Principal Aquifer in close proximity to the Proposed Site is not listed in TOGS 2.1.3.

A search of current NYS GIS water resource mapping shows a “mid-yield unconfined aquifer” (not a Primary Aquifer) transecting the Proposed Site. The source of the GIS data , according to the NYS Clearinghouse metafile data, is historic mapping of surficial unconsolidated sand and gravel deposits mapped at a scale of 1:250,000 and reported by T. S. Miller (1988) in USGS Water Resources Investigation Report, 88-4076 . Miller based his maps mainly on area well yields and county and state surficial geologic mapping that was conducted prior to investigations completed in the Town of Riga related to the Mill Seat Landfill. Permeable, unconfined saturated sand and gravel deposits were not identified in the area of the Mill Seat Landfill during the numerous hydrogeologic investigations conducted for the Permitted Footprint. Consistent with those investigations, recent hydrogeologic investigations of saturated soils in and adjacent to the Proposed Landfill Expansion identified fine-grained soils having low hydraulic conductivity with low well yields. Based on guidance in TOGS 2.1.3 for classifying aquifers, it is concluded that a Principal Aquifer does not exist on property in the area of the Proposed Landfill Expansion.

This conclusion is consistent with findings presented in the Hydrogeologic Investigation Report prepared by H&A (1989). The report was submitted to the NYSDEC with the original permit application for existing Mill Seat Landfill construction. Section 3.2.4.4 of the H&A report documented that the NYSDEC reviewed available data concerning aquifers in the area of the Proposed Landfill Expansion during the DEIS process, and, in a May 25, 1989 comment letter, stated the following, “staff have reviewed the site-specific hydrogeologic information, and it is our official determination that a principal aquifer does not underlie the site”. Hydrogeologic data collected during investigations on property south of the Mill Seat Landfill are consistent with hydrogeologic conditions encountered in the area of the Mill Seat Landfill. Based on NYSDEC guidance described in TOGS 2.1.3 and site conditions found during subsequent investigations of the Proposed Site, evidence has not been found to contradict the 1989 NYSDEC determination that a principal aquifer does not underlie the Proposed Site.

4.2.4 Groundwater Usage

Prior to original landfill development, municipal water was not available in the area and an investigation of groundwater usage in the vicinity of the Permitted Site was conducted in 1989 by H&A as part of the original 6 NYCRR Part 360 Permit application for the Mill Seat Landfill. The survey documented properties having domestic and municipal groundwater wells within approximately one (1) mile of the Proposed Landfill Expansion. In addition, the Village of Bergen municipal well field and the production well field serving Comstock Foods were evaluated at that time to determine if the Mill Seat Landfill was situated within the well head areas for each of these well fields. The assessment concluded that the Mill Seat Landfill did not exist within the well head area for either well field based on the presence of a low-permeability stratigraphic unit subcropping between the Village and the Mill Seat Landfill.

The area within the 2014 water well survey area described in Section 3.2 is now serviced with municipal water provided by Monroe County Water Authority. Water lines were constructed in the area during the early 1990s and the majority of the wells within the H&A survey area were decommissioned. The Monroe County Water Authority conducts inspections once every five (5) years at residential properties where groundwater wells are used for residential irrigation.

To further assess groundwater in the area of the Proposed Landfill Expansion, Monroe County Department of Health and NYSDEC water well program database records were searched for private water wells installed within one-quarter mile upgradient and one (1) mile downgradient of the Proposed Site. Well locations are shown on Figure 9. Additionally, water well survey questionnaires were mailed to 83 property owners within the survey area described in Section

3.2. The database of survey results is included in Appendix G. Questionnaire respondents having either “in use” or “operable” (not in-filled or abandoned) wells are shown on Figure 9. The locations of public water supply lines installed by the Monroe County Water Authority are also shown on the figure.

5. Site Investigation Results

This section describes site geology and hydrologic conditions at the Mill Seat Landfill and Proposed Landfill Expansion.

5.1 Geology

Glacially-derived soils cover sedimentary bedrock in the Proposed Landfill Expansion and the area surrounding the Mill Seat Landfill. Principal geologic units encountered at both the Mill Seat Landfill and Proposed Landfill Expansion include:

- Isolated surficial sand and gravel deposits
- Coarser grained till
- Dense lodgment till
- Shale and limestone/dolostone bedrock

Geologic units identified above are described in the following sections and presented on geologic cross-section profiles oriented north-south and east-west on Figure 10 (Plate A) are shown on Figures 11and 12 (Plates B and C). The sections below describe geologic materials encountered.

5.1.1 Overburden

The United States Department of Agriculture (USDA) soils database was utilized to generate a map of surficial soil types present in the Mill Seat Landfill and Proposed Landfill Expansion and is provided as Figure 13. A description of soil types identified in the area of interest is included in Appendix H. The USDA soil mapping indicates that the Proposed Landfill Expansion and surrounding property are dominated by several silt-loam and silty clay-loam soils with surface slopes typically varying between 3 and 8% with slopes between 8 and 25% present along the flanks of the drumlins. Isolated areas of gravelly loam and gravelly fine sandy loam are also identified by USDA mapping within the Proposed Landfill Expansion. Wetland areas RG-5, RG-6 and RG-7 are identified as having a “muck” surficial soil expression. The surficial soil types identified in the USDA database are consistent with the USCS classifications of soil types identified in previous investigations. The presence of silty soil types with occasional, isolated areas of gravel loam were verified during site investigations completed south of the Permitted Footprint.

The thickness of the overburden materials encountered in borings completed in the Proposed Landfill Expansion area ranges from being absent (TP-9 2008) to 37 feet (SB02 2008). The greatest natural thickness of unconsolidated materials occurs in the central eastern portion of the Proposed Landfill Expansion area near Brew Road. Science Hill, located outside the Proposed Landfill Expansion area near the intersection of Brew and Bovee Roads southeast of the

Proposed Landfill Footprint, is a drumlin with over 40 feet of unconsolidated material. Areas having no or a thin cover of unconsolidated material occur in the southwestern portion of the investigation area in the wetland area (Wetland RG-5) of Hotel Creek and along Bovee Road west of the Science Hill drumlin. The isopach map shown on Figure 14 (Plate D) summarizes the total thickness of unconsolidated deposits in and around the Proposed Landfill Expansion area.

Based on a review of borings completed for the Mill Seat Landfill and Proposed Landfill Expansion area, laterally extensive overburden materials include: 1. Two (2) glacial till units: - a coarser-grained till and a dense lodgment till; and 2. a surficial deposit of sand and gravel. Overburden materials are described below:

Dense Lodgment Till: The dense lodgment till is laterally extensive beneath the Mill Seat Landfill and Proposed Landfill Expansion area. The till was found to directly overlay bedrock in the central and eastern portions of the Proposed Landfill Expansion area and was encountered beneath the sand and gravel unit (discussed below) in the southern and south-eastern portions of the Proposed Landfill Expansion. Where encountered, the dense lodgment till ranged in thickness between 3.6 feet (SB-2) and 28.8 feet (SB-02-2010) and was characterized as a dense to very dense red-brown to purple-red till composed of generally more than 50% fines (silt and clay fraction), with fine sand and trace to little gravel. The till exposed in test pits had a massive, blocky form, low moisture content, and was very hard. The till in several test pit exposures exhibited moderate plasticity. It was often difficult to excavate with a large track-mounted excavator due to its high degree of compaction. Typical N-values obtained from Standard Penetration Testing (SPT) were greater than 40 blows per foot. Permeability estimates for the till are very low (see Table 2). This would be expected based on grain size curves provided in Appendix C. As shown on grain, typical D_{10} coefficients of grain size are in the clay size particle range (<0.002 mm). D_{10} coefficients dictate soil permeability which is supported by Hazen's Approximation for permeability estimates from grain size.

Coarser-Grained Till: The coarser-grained till is also laterally extensive and was found to cover the dense lodgment till across much of the Mill Seat Landfill and Proposed Landfill Expansion area except in the central and south-central portion of the Proposed Landfill Expansion area where the lodgment till is absent. In the eastern portions of the Proposed Landfill Expansion area, the coarser-grained till is less prevalent and is replaced by the sand and gravel deposits (described below) which directly overly the dense lodgment till. This relationship is illustrated on geologic cross sections A-A' through C-C' presented on Plates B and C. The coarser-grained till unit was present at its greatest thickness (45.2 feet) at boring SB-11(2008) located on the flank of the Science Hill Drumlin southeast of the Proposed Landfill Expansion area. Where present and excluding boring SB-11(2008), the coarser-grained till varied in thickness between less than one (1) foot at the SEA-1 series monitoring wells and 21.7 feet at SB-08 (2008). The till is a dark brown to reddish brown sandy, clayey silt with little fine sand. Frequent large cobbles and small boulders were encountered within the coarser-grained till during the test pit investigation program and grain size analysis indicate the coarse-grained till frequently has higher percentages of gravel than the lodgment till. The coarser-grained till is less dense than the lodgment till as indicated by Standard Penetration Testing (SPT) N-values which are typically less than 20 blows per foot. The density and composition difference between the two (2) tills was readily apparent during the test pit program and most split spoon samples. The coarser-grained till was generally easier to excavate than the lodgment till and included cobble and boulder size material. Typical D_{10} coefficients for coarser-grained till samples were clay size particles suggesting low permeability similar to lodgement till.

The permeability of the till soil is low based on measured values obtained by slug tests completed in saturated till material and laboratory testing of remolded and in-situ soil (the till density was sufficient to obtain one Shelby tube at SB-7, collected during the 2006 Geomatrix investigation) by ASTM D5084 Method C. Till soil permeability is in a range of 7.96×10^{-6} cm/s to 2.7×10^{-8} cm/s.

Sand and Gravel Deposits: Sand and gravel deposits were encountered beneath the ground surface in the southeastern portion of the Proposed Landfill Expansion area near Brew Road and a few isolated areas in the western and southern portion of the Proposed Landfill Expansion area. The sand and gravel unit is described as loose to firm, well graded sand with medium to coarse subangular gravel. Substantial quantities of cobble size materials were observed in each of the test pit excavations. The lithology of the gravel and cobbles is generally shale and limestone. The subangular shape of the gravel and cobbles and compact nature of the sand and silt matrix suggests glacial deposition (non-fluvial or non-lacustrine).

A 2008 geophysical survey conducted by AMEC-Geomatrix proved successful in mapping the extent of sand and gravel in the 2006 and 2008 investigation areas. The geophysical survey results were field verified through test pit excavation and/or soil borings sampled in areas where sand and gravel presence/absence was inferred from the survey. The sand and gravel deposits encountered in the investigation area are isolated and discontinuous. Figure 15 (Plate E) depicts the mapped extent and thickness of sand and gravel deposits identified across the Proposed Landfill Expansion area. The most expansive area of surficial sand and gravel deposits occurs in the central-eastern portion of the Proposed Landfill Expansion area, in the vicinity of the MW-SEA-4 series monitoring wells. The sand and gravel deposits in that portion of the investigation area cover approximately 18 acres of the Proposed Site. Smaller areas covered by sand and gravel deposits (less than three {3} acres) were encountered at test pit TP-03 (2008) and soil borings SB-06 (2008), SB-08 (2006) and SB-01-2010. The maximum thickness of sand and gravel encountered was 17 feet at soil boring SB-01-2010 in the southeastern portion of the Proposed Landfill Expansion area. Seasonally saturated conditions were noted in the bottom one (1) to two (2) feet of the sand and gravel deposits during the 2008 AMEC-Geomatrix test-pit investigation which occurred during a high water table condition (March). However, the sand and gravel deposits are typically unsaturated and would be removed for base grade preparation during landfill construction.

5.1.2 Bedrock

The bedrock in the area of the Mill Seat Landfill is the Vernon Formation (C-Horizon) which has been extensively evaluated during investigations for the original permit application for the existing permitted footprint. The bedrock is composed of an interbedded shale and limestone/dolostone that frequently exhibits a high degree of weathering near its top and where shale is more prevalent than limestone. In most areas, the weathered bedrock is sufficiently soft to be recovered by a split-spoon sampler and was easily excavated during test pit excavation. The weathered bedrock is described as a gray to olive brown shale with interbedded clay and resistant layers of limestone. The weathered bedrock zone was typically one (1) to three (3) feet thick and as much as ten (10) feet thick at well MW-02 (2006) and 14 feet thick at TP09 (2008).

Figure 16 (Plate F) depicts the bedrock topography using a two (2) foot contour interval across the Mill Seat Landfill and the Proposed Landfill Expansion area. The bedrock surface generally slopes from west to east with its highest elevation occurring at Proposed Landfill Expansion area monitoring well MW-SEA-1B (671.08 feet msl) and its lowest elevation occurring east of Brew Road at SB-02-2010 (632.1feet msl). The bedrock occurs closest to the ground surface in the investigation area northwest of the Proposed Landfill Expansion area at monitoring well cluster MW-SEA-1, where less than one (1) foot of overburden material is present and beneath the nearby wetland RG-5 located directly west. Weathered shale bedrock is also exposed at the ground surface at test pit location TP-09 (2008), adjacent to Wetland RG-5 where it parallels Hotel Creek south of the proposed expansion.

In the Proposed Landfill Expansion area, the Vernon CB Horizon is a thin, one (1) to three (3) foot thick zone of argillaceous dolomite located within the Vernon C Horizon and is characterized by a grey color, abundant vugs and comparatively fewer joints and fractures than the surrounding C Horizon. The Vernon CB Horizon was encountered in the Proposed Landfill Expansion area in rock core at piezometer locations PZ-SEA-1Z (59 fbgs), PZ-SEA-3Z (75.5 fbgs) and PZ-SEA-5Z (48 fbgs).

The Vernon B Horizon was encountered at deep exploratory boring P-8S (at an approximate elevation of 618 fasl) and at monitoring wells M-8B and M-8Z (at an approximate elevation of 630 fasl) during the 1989 and 1991 H&A investigations, respectively. The Vernon B Horizon is described as a grey-green mudstone with interbedded dolomitic shale and dolostone beds, evaporite (gypsum) seams and a 10-foot thick highly evaporitic interval. The Vernon B Horizon reaches a thickness of approximately 40 feet in the study area.

The Vernon A Horizon was encountered in boring P-8S, at an approximate elevation of 578 fasl and is the lowermost stratigraphic unit characterized at the Mill Seat Landfill. The Vernon A Horizon consists locally of approximately 150 feet of grey-green interbedded shale, mudstone, dolomitic shales, dolostones and evaporate deposits, and is bounded at the base by the Lockport Formation. The stratigraphic relationship between the Vernon A, B, C and CB Horizons is shown on geologic cross- sections A-A’ through F-F’, provided on Plates B and C.

5.2 Hydrogeology

The hydrogeology of the Mill Seat Landfill and the Proposed Landfill Expansion area has been characterized as consisting of four (4) distinct flow zones. The results of the 2013-2014 GEI hydrogeologic investigation are discussed below and are based on the following flow zones documented in previous investigations at the Mill Seat Landfill:

- ***Water Table:*** occurring in the shallow unconsolidated materials generally within seven (7) to ten (10) feet of the ground surface.
- ***B Zone***: consisting of the lowermost portions of the unconsolidated overburden and a portion of the upper weathered bedrock.
- ***A Zone:*** consisting of unweathered portions of the Vernon Shale bedrock generally between 15 and 30 feet below the top of bedrock.
- ***Z Zone:*** consisting of deeper bedrock intervals generally between 30 and 80 feet below the top of bedrock.

A discussion of the hydrogeologic characteristics of each is provided in the following sections. Tables 6 and 7 summarize calculations of horizontal and vertical hydraulic gradients and groundwater seepage velocities for each of the zones above, respectively.

5.2.1 Water Table

Unconfined groundwater exists in the Proposed Landfill Expansion area. When compared to the existing Mill Seat Landfill, the thicker section of saturated, low permeability glacial material and limited areas of sand and gravel deposits in the Proposed Landfill Expansion area allow water table conditions to occur. The water table beneath the existing Permitted Landfill was generally eliminated during the excavation of overburden materials and installation of the groundwater suppression system (GWSS) during initial development.

In the Proposed Landfill Expansion area, the unconfined groundwater was studied by seven (7) piezometers and monitoring wells installed in the overburden materials and water table surface water expressions using four (4) staff gauges installed in Wetlands RG-5, RG-6 and in Hotel Creek. Groundwater elevations were measured at each of these monitoring locations in November 2013 and April 2014, considered to be representative of typical seasonal low and seasonal high groundwater conditions, respectively. Groundwater contour maps were prepared using the November 2013 and April 2014 events and are shown on Figures 17 and 18 (Plates G and H). Under current conditions (undeveloped), the movement of shallow groundwater (water table flow) is directed radially southward from Wetland RG-6 and discharges to Hotel Creek and Wetlands RG-5 and RG-7. Horizontal hydraulic conductivity estimates for unconfined groundwater in the Proposed Landfill Expansion area are based on rising head tests performed in piezometers PZ-01-2010 ($1.60\text{x}10^{-6}$ cm/s) and MW-1S (2006) ($7.92\text{x}10^{-6}$ cm/s). A geometric mean hydraulic conductivity value of $3.68\text{x}10^{-6}$ cm/s was calculated for the saturated unconsolidated materials at the Mill Seat Landfill (removed during site development) and in the Proposed Landfill Expansion. This hydraulic conductivity value for the unconsolidated deposits meets the landfill siting minimum permeability requirements presented in 6 NYCRR Part 360-2.12(a)(1)(vi).

The average linear groundwater flow velocity (seepage velocity) of unconfined groundwater was calculated between piezometers PZ-2 (2006) and PZ-05 (2008). Using a conservative effective porosity value (n_e) of 15% (Fetter, 1994) for the overburden till material, the average linear velocity of groundwater seepage in the saturated till is 1.72x10-7 cm/s (0.0005 ft/day).

As landfill development extends into the Proposed Landfill Expansion area, the relocation of Wetland RG-6, removal of overburden material, and construction of the landfill liner system will eliminate vertical beneath the Proposed Footprint. As a result, the water table in the Proposed Expansion Area will be lowered to levels corresponding to the B-Zone (see Section 5.2.2). This condition occurred beneath the Mill Seat Landfill where 22 of 23 gravity flow underdrain outlets beneath the landfill that collected overburden groundwater during early landfill development became dry.

5.2.2 B-Zone

Referred to as the B-Zone in studies completed for hydrogeologic characterization for the Permitted Footprint and the “upper water-bearing zone” in studies completed for the soil borrow areas, groundwater occurring in the till and shallow weathered bedrock comprise the upper saturated portion of the CSS described in Section 5.6. The weathered bedrock is described as bedrock which is soft enough to auger into and sample with a split spoon sampler. The saturated thickness of the B-Zone is variable ranging from approximately 15 to 20 feet within the low hydraulically conductive soil located in the central portion of the Proposed Landfill Expansion and thins to only one (1) to two (2) feet in a southerly direction toward Hotel Creek.

Groundwater elevation data for the water level monitoring events recorded in November 2013 and April 2014 for wells and piezometers screened in the B-Zone in the Proposed Landfill Expansion area are contoured on Figures 19 and 20 (Plates I and J), respectively. Groundwater flow in the B-Zone is east to northeastward beneath the Mill Seat Landfill with discharge to Wetland RG-7. The groundwater flow direction is also eastward across much of the Proposed Landfill Expansion area, with a southerly flow component discharging to Wetland RG-5 and Hotel Creek in the southernmost portions. A horizontal hydraulic gradient of 0.002 was calculated for the dominant easterly groundwater flow component in the B-Zone flow regime across the Proposed Landfill Expansion area for both the November 2013 and April 2014 groundwater elevation measurement events. The calculation was performed between the SEA-1 series and SEA-5 series monitoring wells.

Vertical hydraulic gradients between the B-Zone and A-Zone are generally flat, with a slightly downward component across the Proposed Landfill Expansion area ranging in magnitude from 0.01 at the SEA-1and SEA-4 series wells, to 0.23 at the SEA-5 series wells. Across the Mill Seat Landfill, upward vertical gradients from the A-Zone to the B-Zone flow system are seasonally persistent along the eastern and northeastern flank of the Mill Seat Landfill (at monitoring well series M14, M15, M16, M17 and M19) where B-Zone groundwater discharges to surface water in Wetland RG-7. Along the northern flank of the Mill Seat Landfill (monitoring well series M8, M19, M20 and M22) the vertical gradient was slightly downward from the B-Zone to the underlying A-Zone during the November (low groundwater) elevation monitoring event and upward during the April 2014 (high groundwater) monitoring event. Hydraulic conductivity estimates for B-Zone monitoring wells in the Proposed Landfill Expansion area range from a low of 5.2×10^{-6} cm/s at MW-SEA-5B to 2.3×10^{-3} cm/s at MW-SEA-2B. A geometric mean hydraulic conductivity value of 1.06×10^{-3} cm/s was calculated for wells screening the B-Zone flow system (Table 4). An average linear groundwater flow velocity of 3.2×10^{-4} cm/s (0.91 ft/day) was calculated for the B-Zone (see Table 7).

Hydraulic conductivity values for the weathered bedrock comprising the B-Zone flow system are substantially higher than the till above which suggests that nearly all shallow bedrock groundwater recharge occurs in wetland areas at the property boundaries (well beyond the extent of the Proposed Site) where little to no low permeability soil is present.

5.2.3 A-Zone

Groundwater flow in the A-Zone occurs primarily in bedding plane fractures and in moderately to severely weathered vertical and high angle joint sets identified in rock core retrieved from the Vernon C Horizon. Based on the review of boring logs completed during previous investigations and rock core obtained during the 2013-2014 GEI investigation, the A-Zone portion of the CSS extends to a depth of approximately 30 feet below the top of bedrock in the Proposed Landfill Expansion area. The upper-most portions of the A-Zone bedrock are characterized in bedrock core as having Rock Quality Designation values typically less than 20% and is described as “intensely fractured”.

Groundwater contour maps for the A-Zone bedrock flow were prepared for the November 2013 and April 2014 groundwater elevation measurement events and are provided as Figures 21 and 22, respectively (Plates K and L). A-Zone groundwater elevations are highest in the west-central portion of the Proposed Landfill Expansion area near monitoring well MW-SEA-1A. From this groundwater high, A-zone groundwater flow is northeasterly beneath the Permitted Footprint and easterly to southeasterly across the Proposed Landfill Expansion area. A horizontal hydraulic gradient of 0.003 was calculated between the MW-SEA-1 series and MW-SEA-5 series in the A-Zone flow regime for both the November 2013 and April 2014 groundwater elevation measurement events. As discussed in Section 5.2.2, vertical hydraulic gradients between the A-Zone and overlying B-Zone are slightly downward in the Proposed Landfill Expansion area and are seasonally and spatially variable across the Mill Seat Landfill. Calculated vertical gradients between the A-Zone and deeper Z-Zone flow in the Proposed Landfill Expansion were generally flat and ranged from slightly upward (-0.003 to -0.06) toward the A-Zone in monitoring well series MW-SEA-1 and MW-SEA-3 and slightly downward (0.003 to 0.17) in well series MW-SEA-5 and MW-SEA-6 for both groundwater elevation measurement events. No definitive vertical groundwater flow direction was observed in bedrock below the Proposed Landfill Expansion area and flow is generally horizontal.

Beneath the Permitted Site and Proposed Landfill Expansion, vertical hydraulic gradients between the A-Zone and Z-Zone are spatially variable; however, the magnitude and direction of the gradients are generally consistent between seasonal high and low water level conditions in each well series. A summary of vertical hydraulic gradient calculations is presented in Table 6.

Horizontal hydraulic conductivity estimates for A-Zone flow (Vernon C & CB Horizons) were calculated for wells installed during the 2013-2014 GEI investigation and are compiled with hydraulic conductivity data from previous investigations. In the Proposed Landfill Expansion, A-Zone well hydraulic conductivity values calculated from rising head tests range between 7.8×10^{-3} cm/s at MW-SEA-3A to 2.6×10^{-1} cm/s at MW-SEA-1A with a geometric mean of 1.0×10^{-3} cm/s. An average linear groundwater flow velocity of 3.3×10^{-4} cm/s (0.93 ft/day) was calculated for the A-Zone flow regime (Table 7).

Hydraulic conductivity estimates were also calculated from straddle packer tests described in Section 3.5. Packer testing calculation sheets are presented in Appendix F. Hydraulic conductivity values for each tested interval are provided in Table 4. The values are derived from methods presented in Houlsby (1976) which establishes a representative hydraulic conductivity (or Lugeon value) based on the progression of Lugeon patterns for each tested interval. A-Zone hydraulic conductivity values estimated from packer tests were generally an order of magnitude lower than slug test data for comparable test intervals and packer test hydraulic conductivity values ranged from 8.9×10^{-4} cm/s (MW-SEA-3Z, 26-36' bedrock test interval) to 1.4×10^{-3} cm/s (MW-SEA-2A, 22-32 fbgs bedrock interval).

5.2.4 Z-Zone

The Z-Zone is the lowermost hydrogeologic unit characterized for the Permitted Footprint and Proposed Footprint. The Z-Zone consists of a bedrock interval generally between 40 and 80 feet below the top of bedrock which includes the Vernon C, CB and B Horizons beneath the Mill Seat Landfill where the stratigraphically lower Vernon B Horizon is closer to the ground surface and the Vernon C and CB Horizons beneath the Proposed Footprint (see Geologic Cross Sections A-A' through C-C' on Plate B) RQD values for Z-Zone rock core retrieved from borings in the Proposed Footprint vary between 27% and 63% indicating that groundwater flow within the Z-Zone is dominated by secondary porosity attributed to only slightly weathered bedding plane fractures and regional joint sets in the shale/dolostone bedrock. The groundwater flow direction in the Z-Zone is north-easterly beneath the Mill Seat Landfill and easterly beneath the Proposed

Footprint. Groundwater contour maps generated for the Z-Zone bedrock are provided on Figures 23 and 24 (Plates M and N) for the November 2013 and April 2014 groundwater elevation measurement events, respectively. Z-Zone groundwater elevations generally vary less than three (3) feet seasonally, and the vertical hydraulic gradients between the Z-Zone and the A-Zone are seasonally similar in magnitude and direction in each well series.

Horizontal hydraulic conductivity estimates for the Z-Zone bedrock were calculated from rising head tests performed on monitoring wells installed during the 2013-2014 GEI investigation which are compiled in Table 4 with hydraulic conductivity data from previous investigations performed for the Mill Seat Landfill. A site-wide geometric mean hydraulic conductivity value of 2.09×10^{-4} cm/s was calculated for monitoring points screening the deep Z-Zone flow regime, approximately an order of magnitude lower than the geometric mean for the overlying A-Zone bedrock interval (1.09×10^{-3} cm/s). Hydraulic conductivity estimates calculated from straddle packer testing at comparable Z-Zone bedrock intervals are generally an order of magnitude lower than data calculated from rising head tests from comparable test intervals. An average linear groundwater flow velocity of 8.36×10^{-5} cm/s (0.24 ft/day) was calculated for the Z-Zone flow regime (Table 7) which is about 75% lower than the A-Zone flow velocity.

5.3 Groundwater Quality

Groundwater quality at the Mill Seat Landfill has been monitored for nearly two (2) decades. The current groundwater quality monitoring program for the Mill Seat Landfill includes sampling of: 17 wells screened in the B-Zone (lower overburden/weathered bedrock interface), 18 wells screened in the A-Zone (upper 20 feet of bedrock), and seven (7) wells screened in the Z-Zone (approximately 40 to 80 below the top of bedrock).

Groundwater monitoring wells installed in and around the Proposed Landfill Expansion were sampled during the Fourth Quarter 2013 and the Second Quarter 2014, concurrent with the existing quarterly landfill monitoring program, to assess groundwater quality in the Proposed Landfill Expansion area. The timing of sampling was such that seasonal low and seasonal high groundwater conditions were represented. Laboratory analytical data are included in Appendix I. MAKuel Company reviewed the Category 4 laboratory data packages and five (5) percent of the sampled data were validated. The data validation report is included in Appendix J. Laboratory data for samples collected during each sampling event in the Proposed Landfill Expansion area are summarized in Tables 8 and 9.

Groundwater quality in the B-Zone, A-Zone, and Z-Zone in the Proposed Landfill Expansion area is discussed below and includes a comparison of constituent concentrations with NYS TOGS 1.1.1 Groundwater Quality Standards (NYGWQS), as well as, comparisons to general water quality results observed in the area of the Permitted Footprint. Hydrogeochemical plots (Stiff and Piper Diagrams) were prepared for groundwater samples collected from wells monitoring the Mill Seat Landfill and the Proposed Landfill Expansion area for both the November 2013 and April 2014 groundwater sampling events. Hydrochemical plots are provided in Appendix K. These plots support the evaluation of groundwater in the Proposed Landfill Expansion area.

5.3.1 B-Zone

In general, groundwater in the lower overburden and weathered bedrock is commonly high in total hardness having typical concentrations above 1,000 mg/L. Total dissolved solids (TDS) and dissolved concentrations of naturally-occurring metals including iron, magnesium and sodium are frequently elevated when compared to NYGWQS in groundwater. This is true in both the Mill Seat Landfill and in the Proposed Landfill Expansion area.

B-Zone groundwater in the Proposed Landfill Expansion area plots consistently on the left side of the central trilinear (Piper) diagram for both the November 2013 and April 2014 sampling events, indicating a dominance of calcium and magnesium type cations and bicarbonate and sulfate type anions. This would be expected for a calcareous shale bedrock having gypsum and dolomite mineralization. The variability in the B-Zone groundwater plot locations in the central field of the Piper diagram and on the Stiff plots is due to the varying sulfate and carbonate concentrations in groundwater samples. Locally variable sulfate concentrations in B-Zone groundwater is likely affected by well screen depth in bedrock, the presence of evaporate minerals (e.g., gypsum), and distance to Wetlands RG-5 and RG-7 which discharge/recharge upper bedrock groundwater. Comparing the B-Zone water quality from wells installed in the Proposed Landfill Expansion area to those monitoring the Mill Seat Landfill, the B-Zone wells in the Proposed Landfill Expansion area tend to have lower sulfate concentrations as they are more distant from the wetland areas. The Stiff diagrams prepared for B-Zone groundwater also reflect local variability in groundwater geochemistry for both the Mill Seat Landfill and the Proposed Landfill Expansion area, with calcium and sulfate concentrations largely dictating the shape of each plot.

The overall B-Zone groundwater quality in the Proposed Landfill Expansion area is comparable to groundwater quality at the Mill Seat Landfill. Sample results for B-Zone wells monitoring the Proposed Landfill Expansion area frequently exhibit naturally elevated concentrations of TDS, iron, magnesium and, to a lesser extent, sodium when compared to NYGWQS. Color and turbidity were also frequently elevated. These constituents are also found to occur naturally at elevated concentrations in upgradient and downgradient wells that monitor the Mill Seat Landfill. In addition to the above mentioned constituents that are naturally elevated in background groundwater quality, the following constituents were detected above NYGWQS in the B-Zone groundwater from wells in the Proposed Landfill Expansion area during the November 2013 sampling event:

- Arsenic (0.027 mg/L – NYGWQS is 0.025 mg/L) and selenium (0.068 mg/L – NYGWQS is 0.010 mg/L) at MW-SEA-2B; and

- Hexavalent chromium (0.011 mg/L- NYGWQS is 0.05 mg/L) at MW-SEA-4B

The metals listed above were not detected at elevated concentrations in other B-Zone wells. Volatile organic compounds, semi-volatile organic compounds, and PCBs were either not detected or detected at concentrations below NYGWQS. Alpha-BHC, an organochlorine pesticide (insecticide), was detected in the sample collected from well MW-SEA-4B at a concentration of 0.011 ug/L, slightly above the NYGWQS of 0.01 ug/L.

During the April 2014 sampling event, the following constituents were detected above NYGWQS in Proposed Landfill Expansion groundwater from the B-Zone:

- Nitrate in MW-1S (10.8 mg/L) and MW-SEA-2B (15.6 mg/L) which are above the NYGWQS of 10 mg/L

Arsenic and selenium were not detected in at MW-SEA-2B during the second sampling event. Hexavalent chromium was not detected in well MW-SEA-4B during the second sampling event. The detections of these metals may be a false positive and four (4) quarters of background sampling will confirm the positive detections of these metals in B-zone groundwater. Nitrate presence in B-Zone wells is not surprising since much of the property surrounding and including the Proposed Footprint has been used as farmland and nitrogen-based fertilizers were applied for nutrient addition for crop growth.

5.3.2 A-Zone

Shallow bedrock groundwater at both the Mill Seat Landfill and in the Proposed Landfill Expansion area is generally comparable to the B-Zone although sulfate, total hardness and TDS concentrations are typically higher in A-Zone groundwater. A-Zone groundwater samples from both the Mill Seat Landfill and the Proposed Landfill Expansion area occupy similar plot locations as B-Zone groundwater on the Piper diagram with a more prevalent dominance of the sulfate anion (see Appendix K). Samples from wells that plot lower on the diagram are likely reflective of locally lower sulfate concentrations. Similarly to B-Zone groundwater, Stiff diagram shape is driven largely by the relative concentrations of calcium and sulfate ions, with no significant variability in overall geochemistry between the November 2013 and April 2014 sampling events.

Besides the B-Zone mentioned constituents that are naturally elevated in background groundwater quality, bromide (3.3 mg/L) was the other naturally occurring constituent detected above NYGWQS in Proposed Landfill Expansion A-Zone wells during the April 2014 sampling event. Bromide was not detected in samples collected from the well during the November 2013 sampling event. Bromide is a constituent found in salt and is occasionally detected at elevated concentrations in wells monitoring the Mill Seat Landfill. Salt presence is natural to the Vernon Formation and bromide detection is not considered anomalous in bedrock groundwater at the Mill Seat Landfill or Proposed Landfill Expansion.

5.3.3 Z-Zone

The deep bedrock Z-Zone groundwater quality is generally marked by increased concentrations of sulfate, TDS and total hardness when compared to the A- and B- Zones at the Mill Seat Landfill and in the Proposed Landfill Expansion area. Deeper bedrock groundwater samples also reflect increased concentrations of dissolved metals, including boron, calcium, magnesium, potassium and sodium. Slightly to moderately reducing conditions are often encountered in the deeper bedrock flow system beneath the Mill Seat Landfill, however; Proposed Landfill Expansion deep bedrock wells exhibited slightly to moderately oxidizing conditions during the November 2013 and April 2014 sampling events. Piper plots generated for the Mill Seat Landfill and Proposed Landfill Expansion Z-Zone groundwater samples indicate a dominance of the sulfate and calcium ions for both the November 2013 and April 2014 sampling events (see Appendix K). Excluding well M1Z in November 2013 and PZ-SEA-3Z in April 2014, located in the southwest corner of the Mill Seat Landfill which exhibits higher concentrations of carbonate alkalinity and lower sulfate concentrations driving its plot location lower in the central field for both sampling events, Z-Zone wells plot at apex of the Piper Plot. Stiff diagram shapes differ from B- and A-Zone groundwater due to higher concentrations of cations and anions.

Besides the naturally elevated constituent concentrations in background groundwater quality (boron, iron, magnesium, sulfate, TDS, color and turbidity), no other constituents were detected above NYGWQS in the Z-Zone groundwater samples analyzed from the Proposed Landfill Expansion.

5.4 Surface Water Quality

Surface water quality in Hotel Creek and surrounding wetland areas is monitored on a quarterly basis at seven (7) locations shown on Figure 25. Monitoring locations S-3 and S-4 monitor surface water quality in Wetland RG-7 and location S-6 monitors surface water quality in the northwest corner of Wetland RG-5. Monitoring locations S-1, S-2 and S-5 monitor surface water quality in Hotel Creek south of the Mill Seat Landfill. Monitoring location S-8 is located approximately three (3) miles downstream of the Mill Seat Landfill and monitors surface water quality in Hotel Creek at an intersection with State Route 33. Time-series plots of several leachate indicator parameters were generated for each surface water quality monitoring point using historic analytical data dating from pre-landfill construction monitoring to present and are presented in Appendix L. Plots were generated for the following parameters:

- Dissolved Oxygen
- Chemical Oxygen Demand (COD)
- Biological Oxygen Demand (BOD)
- Total Dissolved Solids (TDS)
- Chloride

- Sulfate
- pH

A linear regression analysis trend line is provided on each time-series plot to establish the overall trend in concentration of each analyte. Monitoring locations that are situated nearby public or landfill access roadways (locations S-2, S-3, S-4, S-5 and S-8) exhibit a slightly upward chloride concentration trend over the duration of the 27 year monitoring period. This trend is most likely attributable to the application of deicing materials (road salt) on roadways during the winter months.

Dissolved oxygen concentrations at wetland surface water monitoring locations (S-3, S-4 and S-6) have exhibited a slight decrease over the monitoring period. These wetland areas are generally characterized as containing abundant organic matter and minimal water flow leading to more stagnant conditions and oxygen deprived conditions than the Hotel Creek monitoring locations. It is hypothesized that this somewhat oxygen-depleted surface water from Wetlands RG-5 and RG-7 that discharge to Hotel Creek south of the Permitted Site may influence dissolved oxygen concentrations at surface water sampling locations S-2 and S-5, which also exhibit a slight downward trend over time. Upgradient surface water sampling monitoring location S-1 exhibits a neutral to slightly upward dissolved oxygen trend.

As reported in quarterly environmental monitoring reports, landfill related constituents have not been detected in groundwater or surface water discharging from the Mill Seat Landfill. Changes in surface water quality to nearby wetlands or Hotel Creek are not landfill related.

5.5 Groundwater/Surface Water Interaction

Surface water is present in the Proposed Landfill Expansion area at Wetland RG-6 and the drainage swale that flows south to Hotel Creek. Surface water is also present west and east of the Proposed Landfill Expansion area at Wetland RG-5 and Wetland RG-7, respectively. The wetlands serve as temporal recharge/discharge areas of overburden and, in the case of Wetlands RG-5 and RG-7, upper bedrock groundwater. Wetland RG-6 is uniquely different from RG-5 and RG-7 in that RG-6 is comparatively small, isolated, lies in an elevated area of thicker till deposits, and is recharged almost exclusively by on-site precipitation and surface runoff (AMEC Geomatrix, 2011).

The surface water elevation in Wetland RG-6 (SG-2) varied by less than 0.6 feet during water level monitoring conducted during several years of monitoring. H&A (1989) also noted a near static head in the wetland during the hydrogeologic investigation of the Permitted Site. Surface water elevation in the wetland is held relatively constant through surface water discharge to the drainage swale that flows south across the investigation area to Hotel Creek. As reported by AMEC Geomatrix (2011), heads in wells located in close proximity to Wetland RG-6 (M-7B and PZ-2) were higher than the wetland surface water elevations recorded in 2007; however, the head at well M-7B was lower in 2008. During the 2013/2014 investigation, heads in M-7B and PZ-2 were lower than the surface water elevation at SG-2 in November 2013 and February 2014 but higher in April 2014. These data indicate that Wetland RG-6 is a seasonally dependent area of both groundwater recharge and discharge.

Precipitation that falls on Wetland RG-6 and precipitation that falls on the land surface near the wetland and on the south side of the Mill Seat Landfill flows overland (runoff) and recharges surface water in Wetland RG-6. As mentioned previously, groundwater temporally recharges the wetland. However, the volume of recharge from groundwater is substantially lower compared to the volume of recharge from precipitation and runoff. This is due to the low hydraulic conductivity of the saturated till and the low hydraulic gradients in the area of the wetland that effectively constrain the volume of groundwater that discharges to the wetland.

As reported by AMEC Geomatrix (2011), the volume of precipitation that annually falls in the area of Wetland RG-6 that could flow overland into the wetland is estimated to be 9,900 cubic feet per day. During hydraulic conditions that favor groundwater discharge to the wetland, the volume of groundwater discharging to the wetland is conservatively estimated to be 20 cubic feet per day. Precipitation and runoff is the dominant mechanism of recharge to Wetland RG-6, with groundwater discharge accounting for less than one half of one percent (<0.5%) of the total flow to the wetland. The calculation was performed by AMEC Geomatrix and is provided in Appendix M.

Surface water elevations measured in Wetland RG-5 (SG-3) are nearly ten (10) feet lower than Wetland RG-6. In fact, the surface water elevation in Wetland RG-5 is similar to the elevation of the bedrock surface and bedrock groundwater elevations measured in well M-1A (the B-well at that location is dry). These data support a conclusion that Wetland RG-5 is a receptor of overburden and shallow bedrock groundwater (B-zone groundwater flow) west of the investigation area in addition to precipitation and surface water runoff. Similar conditions are anticipated for Wetland RG-7 which is located more than 1,000 feet east of the Proposed Footprint. The ground surface topography drops rapidly into the wetland area east of Brew Road and the overburden thickness thins allowing bedrock groundwater to discharge to the wetland. Precipitation and surface water runoff are the primary mechanisms of recharge to these wetland areas. The discussion below supports this statement.

As mentioned above, Wetlands RG-5 and RG-7 are recharged by direct precipitation falling on the wetland, overland transport of precipitation falling within the wetland watershed area, and the discharge of groundwater from bedrock and, to a lesser extent, overburden. GEI estimated the average annualized recharge rate to Wetland RG-5 and Wetland RG-7 under current site conditions in Appendix M. The calculation assumes 50% of the annual precipitation that falls directly on the wetland areas and 20% of the precipitation that falls within the watershed area of each wetland reaches the wetland areas via overland flow. The calculation also estimates a Darcy groundwater discharge rate using the average hydraulic conductivity of the B-zone (lower overburden and upper bedrock), B-zone horizontal hydraulic gradient, and cross-sectional flow inclusive of the length of the wetland perpendicular to groundwater flow and the upper 30-feet of the bedrock (inclusive of B- and A-Zone groundwater). Based on this calculation, annualized recharge rates to the adjacent wetlands are as follows:

Wetland RG-5

- Recharge via direct precipitation and overland flow = 33,065 cubic ft/ day
- Recharge via groundwater discharge = 1,744 cubic ft/day
- Recharge via RG-6 outlet (outlet flows through RG-5 before discharging to Hotel Creek) = 9,900 cubic ft/day

<u>Estimated Total Annualized Wetland RG-5 Recharge Rate = 44,700 cubic ft/day</u>

Wetland RG-7

- Recharge via direct precipitation and overland flow = 36,312 cubic ft/ day
- Recharge via groundwater discharge = 2,066 cubic ft/day

<u>Estimated Total Annualized Wetland RG-7 Recharge Rate = 38,400 cubic ft/day</u>

Based on these calculations, 95% or more of wetland recharge is derived from precipitation and overland flow to the nearby wetlands.

The surface water elevation of Hotel Creek near Brew Road (SG-1) was approximately 651 feet msl during each of the three (3) monitoring events. The creek is situated in a topographic low approximately 3,500 feet south of the Mill Seat Landfill and approximately 400 feet south of the southernmost portion of the Proposed Footprint. As observed by site reconnaissance and in test pit excavations completed immediately north of Hotel Creek, bedrock outcrops in the topographically low area near Hotel Creek in the area of Wetland RG-5. Where shallow water table conditions exist in the bedrock, bedrock groundwater discharges to Hotel Creek in the area of Wetland RG-5. Hotel Creek receives overland flow from surface area within its watershed (see Section 4.2.1).

Landfill construction will alter the annualized recharge rates calculated for Wetland RG-5, RG-6, and RG-7. Wetland RG-6 lies within the Proposed Footprint and will be relocated to the Proposed Wetland Mitigation Property south of Bovee Road. As a result, discharge from the Proposed Footprint will be diverted to either RG-5 or RG-7. In addition, the contour of the proposed final landfill cover and slope of landfill perimeter drainage ditches will redirect a portion of surface water drainage currently flowing to Wetland RG-5 (approximately 57 acres) to Wetland RG-7 via the proposed eastern storm water detention pond. The calculation of watershed flow diversion after landfill construction is included in Appendix M. As shown in the calculation, landfill construction is estimated to result in an approximate 10% increase in recharge to the southern portion of Wetland RG-7 and an approximate 9% reduction in the annualized recharge to the eastern portion of Wetland RG-5 paralleling Hotel Creek west of Brew Road. Since surface water in Wetlands RG-5 and RG-7 ultimately discharge to Hotel Creek, no net decrease or increase in annualized flow would be measured in Hotel Creek east of the Proposed Footprint at Johnson Road as a result of landfill expansion.

5.6 Critical Stratigraphic Section

The CSS below a solid waste facility is defined in 6 NYCRR Part 360 as all stratigraphic units into which contaminants that theoretically escape from the facility might reasonably be expected to enter and cause contamination. Definition of the CSS at the Mill Seat Landfill was a major goal of the 1989 Hydrogeologic Investigation, which concluded that the CSS is composed of the overburden and upper 30 feet of the Vernon Shale bedrock (B-Zone and A-Zone groundwater). During the initial investigation for the Mill Seat Landfill, the bedrock portion of the CSS was established from approximation of groundwater flow paths inferred from pumping tests and packer tests. The conclusion was based on bedrock hydraulic conductivity values that were two (2) orders of magnitude greater for wells screened in the upper 30 feet of bedrock compared to those estimated for bedrock deeper than 40 feet (Z-Zone).

For the Permitted Site, previous hydrogeologic investigations defined the CSS as “groundwater flow in the unconsolidated glacial deposits and upper 30 to 40 feet of bedrock.” The detection monitoring well network at the Mill Seat Landfill monitors two (2) distinct sections of the CSS:

- B Zone wells – screened to monitor the upper portion of the CSS that includes the overburden and a portion of the weathered upper bedrock surface; and

- A Zone wells – screened to monitor the lower portion of the CSS, generally between 15 to 30 feet below the top of bedrock.

During a meeting between NYSDEC, WMNY and GEI on July 26, 2013 and documented in e-mail correspondence dated August 6, 2013 (Appendix A), NYSDEC set forth a requirement that the Proposed Landfill Expansion area investigation include a detailed characterization of the deep bedrock (Z-Zone) groundwater flow regime and a re-evaluation of the vertical extent of the CSS in the Proposed Landfill Expansion area. Similar to the hydrogeologic investigation for the existing Mill Seat Landfill, the investigation of the Proposed Landfill Expansion area included characterization of the upper 100 feet of geologic material. Following a review of physical hydrogeologic data and groundwater chemistry in the Proposed Landfill Expansion area, the definition of the CSS for the active Mill Seat Landfill described above applies to the Proposed Landfill Expansion area. This conclusion is based on the following observations:

- RQD values increase and fracture frequency decreases in bedrock core retrieved from the deepest wells and geometric mean hydraulic conductivity values calculated from rising head tests are an order of magnitude higher in B-Zone and A-Zone wells (upper 30 to 40 feet of bedrock) compared to deeper Z-Zone wells which indicates preferential groundwater flow in B-Zone and A-Zone well depths.

- Pumping test results for P-8S at the Mill Seat Landfill during the H&A investigation indicated that groundwater flowing at the bedrock/overburden interface was not in strong hydraulic communication with deeper sections of the pumping well (Z-zone well equivalent).
- Groundwater flow in bedrock is nearly horizontal with little to no vertical component of flow which is demonstrated by very low vertical head gradients.
- Average linear groundwater flow velocity in the Z-Zone bedrock is about 75% lower than the A-Zone flow velocity.
- Deeper bedrock background groundwater chemistry (Z-Zone wells) is substantially elevated in naturally occurring cations (boron, calcium, magnesium, potassium and sodium) and anions (chloride and sulfate) when compared with shallower (B-Zone and A-Zone) groundwater for wells more distant from wetland areas, indicating little mixing between the shallow and deeper bedrock groundwater.

The CCS for the Mill Seat Landfill and Proposed Landfill Expansion is highlighted on the general stratigraphic section shown on Figure 26.

In the unlikely scenario where landfill leachate leakage occurs in the Proposed Landfill Expansion area, the dissolved phase constituents present in leachate would migrate very slowly in low permeability till. Seepage velocities calculated for the groundwater flowing in the till were calculated to flow at a rate of a few inches per year. Attenuation to soil particles and organic matter in the till would further retard the rate of constituent migration. Investigation data indicates water in the till flows toward the upper weathered bedrock (B-Zone). If constituents reached the bottom of the till, they would travel laterally in the B-Zone. Dispersion and diffusion could allow constituents to migrate laterally downward into shallow bedrock groundwater (A-Zone). Groundwater flow in bedrock is uniform and predominantly horizontal. Flow vectors are upward near the wetland areas east of the landfill as evidenced by artesian flow conditions in some existing wells located closest to Wetland RG-7. Dissolved phase constituents present in the A-Zone would not migrate vertically deeper based on essentially horizontal hydraulic gradients measured between the A-Zone and Z-Zone wells and a much greater horizontal flow component. Water quality deeper than 40 feet in the bedrock would not be affected by a hypothetical release of leachate from the Proposed Landfill Expansion.

6. Environmental Monitoring

An Environmental Monitoring Plan (EMP) is currently in place for the Mill Seat Landfill. The EMP for the site was most recently updated in May 2011. The EMP describes the on-site and off-site monitoring programs for all environmental media, including groundwater, surface water, leachate, landfill gas, noise and dust. The EMP includes descriptions of sampling locations and schedule, analyses to be performed, statistical methods, and reporting requirements. The EMP was prepared consistent with regulations in 6 NYCRR Part 360-2.11(c).

The Proposed Landfill Expansion would expand disposal operations into adjoining double-composite lined cells on the Proposed Site. As a result, the EMP will require an update to incorporate monitoring of environmental media to include the Proposed Landfill Expansion. Based on CCS definition for the Mill Seat Landfill and Proposed Landfill Expansion, operational groundwater quality monitoring at the Proposed Site will focus the assessment of water quality at the overburden/bedrock interface (B-Zone) and the shallow bedrock (A-Zone).

Elements of the revised EMP include:

- A schedule for B-Zone and A-Zone monitoring well installation around the perimeter of the Proposed Footprint allowing sufficient time to collected background water quality data per Part 360-2.11(c)(5)(b)
- A schedule for sampling frequency of groundwater monitoring wells located around the perimeter of the Permitted Footprint as construction progresses in the Proposed Expansion Area
- Monitoring of groundwater elevations in Z-Zone wells to monitor the horizontal and vertical gradient below the CCS
- A schedule for monitoring well/piezometer decommissioning as Proposed Landfill Expansion occurs
- Identification of landfill system monitoring points (i.e., primary and secondary leachate collection systems, landfill GWSS) and storm water retention ponds
- Identification of surface water monitoring points in adjacent wetlands and Hotel Creek
- Identification of landfill gas (LFG), noise and particulate monitoring stations and frequency of monitoring

The revised EMP for the Mill Seat Landfill (inclusive of the Permitted Footprint and Proposed Expansion) is included as Appendix N to support the permit application for the Proposed Landfill Expansion.

7. Design Considerations and Conclusions

The geologic, hydrogeologic and hydrochemical conditions were investigated for the Proposed Landfill Expansion on to property adjacent to and south of the Permitted Footprint. Site hydrogeologic conditions were previously characterized through investigations performed to support permit applications for development of the Permitted Footprint and the eastern and western soil borrow areas. The site investigations for the Proposed Landfill Expansion were conducted as described in the Draft Site Investigation Plan to expand the existing database of physical and chemical conditions for the Proposed Landfill Expansion area.

The investigation assessed the suitability of the Proposed Landfill Expansion area for development of landfill operations (6 NYCRR Part 360-2.12 Landfill Siting), provided information to develop an EMP, and provided geotechnical information for landfill design.

The following is concluded for the Proposed Landfill Expansion regarding landfill siting:

- The Proposed Landfill Expansion is not located in an area of prohibited siting (identified in 6 NYCRR Part 360-1.7(a)(2)) as Wetland RG-6 will be located to the Proposed Wetland Mitigation Area south of Bovee Road.

- The Proposed Landfill Expansion is not situated above bedrock subject to rapid or unpredictable groundwater flow.

- The Proposed Landfill Expansion is not in the proximity of any mines, caves or other anomalous features that may alter groundwater flow.

- The soil thickness below the Proposed Footprint meets the siting requirement of ten (10) feet of soil above bedrock (or could be constructed to have such) for Permitted Footprints operating under an active 6 NYCRR Part 360 permit.

- The soils in the Proposed Landfill Expansion have a geometric mean hydraulic conductivity of $3.68\text{x}10^{-6}$ cm/s which meets 6 NYCRR Part 360-2.12 siting requirements of 50% of the soil having a maximum in-situ permeability of 5×10^{-6} cm/s.

- The Proposed Landfill Expansion is not located over or within the recharge area of a primary water supply aquifer or a principal aquifer, nor is it located within an area of hydraulic influence from a public water supply.

- The Proposed Landfill Expansion is not located within a minimum distance of 100 feet to surface waters that are actively used as sources of municipal supply.

- The Proposed Landfill Expansion is not located over unstable soils or karst terrain and is not located within 200 feet of a fault with known displacement in Holocene time.

- The Proposed Landfill Expansion is more than 10,000 feet from the nearest airport runway.

The following is concluded for the Proposed Landfill Expansion regarding environmental monitoring:

- The investigation sufficiently characterized groundwater and surface water flow to identify upgradient and downgradient directions and existing water quality in the Proposed Landfill Expansion has been characterized.

- The hydrogeologic investigation has demonstrated that groundwater in the Proposed Landfill Expansion is monitorable with highly predictable groundwater flow.

- The critical stratigraphic section for the Proposed Landfill Expansion area, which is consistent with the Mill Seat Landfill, includes the following units:
    - ➢ Low permeability soil consisting of till and the upper weathered bedrock characterized as the B-Zone
    - ➢ Bedrock groundwater flowing in the upper 40 feet of bedrock (A-Zone)

- The EMP to be developed for the entire Permitted Site and Proposed Landfill Expansion should focus long-term groundwater quality monitoring of the B-Zone and A-Zone and is submitted as Appendix N.

The following is concluded for the Proposed Landfill Expansion regarding landfill design and construction:

- A small localized area in the northwestern and southwestern corner of the Proposed Footprint would require the placement of additional low permeability soil to meet a 10-foot separation between the landfill double composite liner base and the top of bedrock.

- Based on existing data, the thickness of the overburden below Wetland RG-6 is greater than 10 feet; however, a soil boring should be completed in that area prior to design of cells in that portion of the property for the purpose of verification.

- Isolated areas of surficial sand and gravel deposits containing boulders and cobbles within the Proposed Footprint should be removed during landfill base grade preparation/construction.

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Tables

TABLE 1
Stratigraphic Summary- Proposed Landfill Expansion
Mill Seat Landfill
Town of Riga, New York

Test Pit, Soil Boring or Well / Piezometer ID	Installation Date	Surface Elevation (fasl)	Statigraphic Unit Thickness (ft.)			Depth to Bedrock (ft.)	Bedrock Elevation (fasl)	Thickness of Weathered Bedrock Zone (ft.)
			Sand and Gravel	Coarser Grained Till	Dense Lodgment Till			
Soil Borings								
SB-1	Dec-06	678.26	0	8	7.2	15.2	663.1	2.8
SB-2	Dec-06	677.49	0	14.4	3.6	18.0	659.5	0.1
SB-3	Dec-06	667.93	0	4.6	9.4	14.0	653.9	2.1
SB-4	Dec-06	668.22	0	0	15.2	15.2	653.0	1.3
SB-5	Dec-06	671.03	0	0	16.7	16.7	654.3	0.2
SB-6	Dec-06	669.02	0	4	30	34.0	635.0	1.2
SB-7	Dec-06	669.28	0	6	18.7	24.7	644.6	0.1
SB-8	Dec-06	672.61	8.4	5.6	18.2	32.2	640.4	1.0
SB-9	Dec-06	670.65	0	4	14.2	18.2	652.5	2.3
SB-10	Dec-06	677.01	0	0	16	16.0	661.0	0.0
SB01 (2008)	Mar-08	671.04	12	0	12	24.0	647.0	0.0
SB02 (2008)	Mar-08	674.09	13	0	24	37.0	637.1	1.2
SB03 (2008)	Mar-08	669.70	0	21.7	0	21.7	648.0	2.5
SB04 (2008)	Mar-08	676.01	10	6	13	29.0	647.0	0.2
SB05 (2008)	Mar-08	669.47	0	14	0	14.0	655.5	0.0
SB06 (2008)	Mar-08	672.16	8	4	0	12.0	660.2	2.7
SB07 (2008)	Mar-08	664.82	0	11	0	11.0	653.8	2.7
SB08 (2008)	Mar-08	665.83	0	17.7	0	17.7	648.1	0.3
SB09 (2008)	Mar-08	674.33	12	0	15.7	27.7	646.6	2.3
SB10 (2008)	Mar-08	673.88	16	6.5	0	22.5	651.4	0.0
SB11 (2008)	Mar-08	695.63	0	45.2	0	45.2	650.4	2.8
SB12 (2008)	Mar-08	657.75	0	2	0	2.0	655.8	8.1
SB13 (2008)	Mar-08	655.62	0	1	0	1.0	654.6	5.0
SB14 (2008)	Apr-08	664.42	0	2	0	2.0	662.4	7.2
SB15 (2008)	Apr-08	661.71	0	1	0	1.0	660.7	5.9
SB16 (2008)	Apr-08	662.16	0	1.5	0	1.5	660.7	4.6
SB17 (2008)	Mar-08	652.44	0	2	0	2.0	650.4	1.1
SB-01-2010	Aug-10	672.48	19	0	11	30.0	642.5	3.0
SB-02-2010	Aug-10	666.11	0	5.2	28.8	34.0	632.1	3.0
SB-03-2010	Aug-10	671.70	1	0	27	28.0	643.7	0.8
B-SEA-1	Sep-13	677.66	0	7.5	8.5	16.0	661.7	4.9
B-SEA-2	Sep-13	674.67	0	0	37	37.0	637.7	0.5
Monitoring Wells								
MW-1S/1D (2006) (1)	Dec-06	676.08	16	0	17	33	643.1	2.5
MW-2 (2006)	Dec-06	668.10	0	6	0	6.0	662.1	10
PZ-SEA-1Z	Sep-13	671.64	0	0.75	0	0.75	670.89	0.75
MW-SEA-1A	Sep-13	671.82	0	0.75	0	0.75	671.07	0.75
MW-SEA-1B	Sep-13	671.83	0	0.75	0	0.75	671.08	0.75
MW-SEA-2A	Sep-13	667.29	2	0	6.2	8.2	659.09	0.3
MW-SEA-2B	Sep-13	667.29	2	0	6.2	8.2	659.09	0.3
MW-SEA-3A	Sep-13	666.48	0	12	4.3	16.3	650.18	0.1
MW-SEA-3B	Sep-13	666.13	0	12	4.3	16.3	649.83	0.1
MW-SEA-3Z	Sep-13	666.82	0	12	4.3	16.3	650.52	0.1
PZ-SEA-3Z	Sep-13	666.27	0	12	4.3	16.3	649.97	0.1
MW-SEA-4A	Sep-13	675.82	12.5	0	20.1	32.6	643.22	0.6
MW-SEA-5A	Sep-13	656.82	0	0	20.7	20.7	636.12	1
MW-SEA-5B	Sep-13	656.99	0	0	20.7	20.7	636.29	1
PZ-SEA-5Z	Sep-13	656.94	0	0	20.7	20.7	636.24	1
MW-SEA-6A	Sep-13	669.62	0	0	19	19	650.62	1.9
MW-SEA-6B	Sep-13	669.73	0	0	19	19	650.73	1.9
PZ-SEA-6Z	Sep-13	669.7	0	0	19	19	650.70	1.9
Piezometers								
PZ-1	Dec-06	680.13	0	14	4.2	18.2	661.9	3.3
PZ-2	Dec-06	673.68	0	11.5	6.5	18.0	655.7	5.1
PZ-3	Dec-06	676.59	0	8	22	30.0	646.6	0.5
PZ-4	Dec-06	673.63	0	6	23.5	29.5	644.1	0.5
PZ-01 (2008)	Mar-08	668.04	0	14	0	14.0	654.0	0.4
PZ-02 (2008)	Mar-08	667.18	0	5	0	5.0	662.2	8.0
PZ-03 (2008)	Mar-08	660.26	0	8.5	0	8.5	651.8	0.1
PZ-04 (2008)	Mar-08	654.20	0	4	0	4.0	650.2	4.2
PZ-05 (2008)	Mar-08	656.92	0	6	0	6.0	650.9	4.0
PZ-06 (2008)	Mar-08	673.88	16	6.5	0	22.5	651.4	0.0
PZ-01-2010	Aug-10	665.96	1.5	0	25.5	27.0	639.0	1.0
Test Pits								
TP-1	Dec-06	673.80	0	10	>9	>19.0	<654.7	NA
TP-2	Dec-06	676.20	11	0	>11	>21.0	<655.2	NA
TP-3	Dec-06	671.20	0	9	7	16.0	655.2	0.0
TP-4	Dec-06	675.40	0	11	7	18.0	657.4	4.0
TP-01 (2008)	Mar-08	674.71	14	0	>2	>16	<658.7	NA
TP-02 (2008)	Mar-08	663.91	0	11	>3	>14	<649.9	NA
TP-03 (2008)	Mar-08	660.90	14	0	0	>14	<646.9	NA
TP-04 (2008)	Mar-08	663.27	0	1	0	1.0	662.3	9.0
TP-05 (2008)	Mar-08	660.53	0	4	3	7.0	653.5	NA
TP-06 (2008)	Mar-08	662.18	0	8	1	9.0	653.2	1.0
TP-07 (2008)	Mar-08	661.96	0	5	2	7.0	655.0	1.0
TP-08 (2008)	Mar-08	669.54	0	17	0	17.0	652.5	0.0
TP-09 (2008)	Mar-08	663.66	0	0	0	0.0	663.6	14.0
TP-10 (2008)	Mar-08	671.61	0	8	>6	>14	<657.6	NA

Notes:

(1) Well MW-1D (2006) is often referred to as MW-SEA-4B since it monitors B-Zone groundwater and it is paired with MW-SEA-4A.

fasl- feet above sea level

NA- unit not encountered at specified location

TABLE 2
Summary of Soil Physical Testing

Mill Seat Landfill
Town of Riga, New York

SOIL CLASSIFICATION, GRAIN SIZE, ATTERBURG LIMITS AND DENSITY

Soil Boring or Piezometer ID	Sample Depth (fbgs)	USCS Classification/Description	% Gravel	% Sand	% Silt	% Clay	Plastic Limit	Liquid Limit	Plasticity Index	Density (N) Value & Sample Depth (fbgs)
Soil Borings 2006										
SB-1	8-12	SC-SM/ Silty, clayey SAND with Gravel	19.0	38.3	28.4	14.3	13.3	18.9	5.6	30 (10-12)
SB-2	2-6	SC/ Clayey SAND	10.7	42.6	25.1	21.6	14.0	22.4	8.4	7 (4-6)
SB-3	4-6	ML/ Sandy SILT	11.1	31.9	42.0	15.0	13.9	NP	NP	14 (4-6)
SB-4	2-6	CL-ML/ Sandy clayey SILT	9.3	33.6	31.9	25.2	13.7	21.5	7.8	18 (4-6)
SB-5	2-6	CL-ML/ Sandy clayey SILT	9.5	40.5	31.8	18.2	12.5	18.3	5.8	23 (4-6)
SB-6	4-8	CL-ML/ Sandy clayey SILT	7.5	36.9	31.5	24.1	12.2	18.5	6.3	32 (4-6)
SB-7	2-6	SC-SM/ Silty, Clayey SAND	13.6	37.2	32.7	16.5	12.9	17.9	5.0	13 (4-6)
SB-8	8-12	SC-SM/ Silty, Clayey SAND	16.5	38.9	28.4	16.2	11.9	17.5	5.6	13 (8-10)
SB-9	4-8	CL-SM/ Sandy Clayey SILT	8.8	38.4	35.1	17.7	11.8	18.0	6.2	35 (4-6)
Soil Borings 2008										
SB03 (2008)	14-16	SC-SM/ Gray silty, clayey sand with gravel	15.9	35.8	32.3	16.0	10.9	16.6	5.7	82 (14-16)
SB07 (2008)	4-8	CL/ Brown, sandy lean clay	12.7	33.6	29.5	24.2	12.3	21.3	9.0	51 (6-8)
SB09 (2008)	14-16	CL/ Brown, sandy lean clay	6.1	33.6	29.7	30.6	10.9	19.4	8.5	>100 (14-16)
Piezometers (2006)										
PZ-1	4-6	CL-ML/ Sandy clayey SILT	2.6	43.8	53.6(1)		NP	NP	NP	31 (4-6)
PZ-2	10-14	CL-ML/ Sandy clayey SILT	9.0	37.2	35.2	18.6	11.2	16.7	5.5	25 (12-14)
PZ-4	2-6	SC-SM/ Sandy Clayey SILT	14.6	35.7	31.8	17.9	13.4	19.9	6.5	26 (2-4)
Test Pits 2008										
TP-1 (2008)	8-10	GP-GC/ Poorly graded gravel with silty clay and sand	47.5	46.3	6.2(1)	0.0	20.9	27.9	7.0	NA
TP-2 (2008)	11-12	SM/ Brown silty sand	13.1	38.8	34.9	13.2	NP	NP	NP	NA
TP-3 (2008)	8-10	GW-GC/ Well graded gravel with clay and sand	52.5	39.7	7.8(1)	0.0	16.4	23.7	7.3	NA
TP-5 (2008)	5-6	SC-SM/ Brownish gray, silty, clayey sand	14.6	38.5	32.6	14.3	11.2	14.9	3.7	NA
TP-6 (2008)	6-8	CL-ML/ Brown, sandy, silty clay	10.4	35.2	30.4	24.0	12.6	19.3	6.7	NA
TP-7 (2008)	4-5	CL/ Brown lean clay with sand	8.1	20.9	37.7	33.3	22.4	34.4	12.0	NA
TP-8 (2008)	8-10	CL/ Brown lean clay with sand	2.8	23.5	34.5	39.2	14.2	26.9	12.7	NA
TP-10 (2008)	12-14	SM/ Brown, silty sand	11.9	48.2	31.9	8.0	15.5	19.0	3.5	NA
Borings/Wells (2013)										
B-SEA-1	4-16	SC-SM/Silty, clayey sand	14.4	37.9	21.5	26.2	13.0	18.0	5.0	83 (10-12) / 122 (12-14)
B-SEA 2	0-14	SC-SM/Silty, clayey sand with gravel	18.3	33.0	28.9	19.8	16.0	22.0	6.0	+75 (8-10) / +75 (10-12)
B-SEA-2	14-36	CL/ Sandy lean clay	8.7	26.2	39.2	25.9	12.0	20.0	8.0	59 (10-12) / 89 (12-14)
MW-SEA-3	12-15	CL-ML/ sandy silty clay	13.3	33.7	28.2	24.8	11.0	18.0	7.0	71 (12-14)
MW-SEA-5	0-20	CL-ML/ sandy silty clay	13.7	35.3	28.4	22.6	13.0	18.0	5.0	85 (18-20) / 98 (20-22)
MW-SEA-6	0-19	CL-ML/ sandy silty clay	14.7	34.1	29.5	21.7	14.0	20.0	6.0	41 (8-10) / 53 (12-14)

SOIL PERMEABILITY (LABORATORY IN-SITU OR REMOLDED)

		Permeability by ASTM D5084 Method C			
Location	**Depth (fbgs)**	**% Moisture**	**Wet/Dry Density (pcf)**	**Type**	**Average Permeability (cm/s)**
ST-1/SB-7 (2006)	4-6	9.4	135.8/124.1	In-situ	1.6x10^{-7}
B-SEA-2	14-36	8.4	151.7/139.9	Remolded	2.7x10^{-8}
B-SEA-3	12-15	9.3	148.7/136.1	Remolded	5.8x10^{-8}
B-SEA-5	0-20	9.6	149.7/136.6	Remolded	4.1x10^{-8}

SOIL PERMEABILITY (SATURATED SOIL SLUG TEST)

Well I.D.	Material Screened	Screened Interval Elevation (famsl)	Depth (fbgs)	Analysis Method	Estimated Hydraulic Conductivity (cm/s)
MW-1S(2006)	Till	661.08-651.08	15-25	Bouwer-Rice	7.92 x 10^{-6}
PZ-3 (2006)	Till	649.30-659.30	17-27	Hvorslev	1.30 x 10^{-6}
PZ-01 (2010)	Till	638.96-648.96	17-27	Hvorslev	1.60 x 10^{-6}
MW-SEA-5B	Till	636.49-646.49	10-20	Hvorslev	5.20 x 10^{-6}

Notes:

(1) - Presented as a total fines value.

- Grainsize distribution by ASTM D422
- Atterberg Limits Analysis by ASTM D4318

fbgs - feet below ground surface

NP - Not Present NA - Not Available

TABLE 3
Monitoring Well Construction Summary

Mill Seat Landfill
Town of Riga, New York

Well I.D.	Installation Date	Surface Elevation (fasl)	Reference Elevation (fasl)	Screen Length (ft.)	Total Depth (fbgs)	Bottom Elevation (fasl)	Monitored Formation	Depth to Bedrock (fbgs)	Top of Bedrock Elevation (fasl)
Existing Landfill									
M1A	Apr-87	703.70	706.17	15.0	67.5	636.20	Vernon Formation	40.1	663.60
M1B	Apr-87	703.52	706.36	5.0	43.3	660.20	OB/Bedrock Interface	39.9	663.60
M1Z	Jun-89	702.03	704.53	21.0	119.0	583.03	Vernon Formation	37.0	665.03
M2A	May-87	673.20	675.56	15.0	54.0	619.20	Vernon Formation	26.0	647.20
M2B	May-87	673.30	675.86	5.0	29.0	644.30	OB/Bedrock Interface	26.1	647.20
M2Z	Jun-89	673.10	675.00	21.0	89.4	583.70	Vernon Formation	27.5	645.60
M4A	May-87	651.10	653.99	15.0	39.8	611.27	Vernon Formation	13.0	638.10
M4B	May-87	651.80	654.38	5.0	15.9	635.88	OB/Bedrock Interface	13.7	638.10
M6A	May-87	652.20	654.68	20.0	40.9	611.30	Vernon Formation	11.5	640.70
M6B	May-87	653.00	654.54	5.0	13.3	639.70	OB/Bedrock Interface	12.3	640.70
M7A	May-87	669.00	672.01	10.0	35.9	633.10	Vernon Formation	10.9	658.10
M7B	May-87	669.30	671.87	5.0	14.0	655.30	OB/Bedrock Interface	11.2	658.10
M8A	May-87	653.70	655.12	10.0	35.1	618.62	Vernon Formation	7.5	646.20
M8B	May-87	653.50	656.01	5.0	10.8	642.70	OB/Bedrock Interface	7.3	646.20
M8Z	Apr-91	653.08	657.55	10.0	56.2	596.88	Vernon Formation	5.7	647.38
M10A	Jun-89	647.14	648.74	15.0	39.0	608.14	Vernon Formation	2.0	645.14
M10B	Jun-89	646.76	649.86	10.5	18.0	628.76	OB/Bedrock Interface	2.0	644.76
M14A	Apr-91	666.34	668.59	15.0	52.0	614.34	Vernon Formation	21.4	644.94
M14B	May-91	666.03	668.24	15.0	32.0	634.03	OB/Bedrock Interface	21.0	645.03
M15A	May-91	648.93	651.78	15.0	36.0	612.93	Vernon Formation	10.0	638.93
M15B	May-91	648.63	651.04	10.0	17.0	631.63	OB/Bedrock Interface	10.0	638.63
M16A	May-91	651.17	653.94	15.0	33.0	618.17	Vernon Formation	10.5	640.67
M16B	May-91	650.40	653.31	7.0	14.0	636.40	OB/Bedrock Interface	9.9	640.50
M16Z	May-91	651.46	654.32	10.0	53.0	598.46	Vernon Formation	12.0	639.46
M17A	May-91	678.66	681.32	15.1	69.0	609.66	Vernon Formation	38.5	640.16
M17B	May-91	678.86	681.40	15.3	49.0	629.86	OB/Bedrock Interface	39.0	639.86
M18A*	May-91	650.94	653.69	15.1	36.0	614.94	Vernon Formation	13.5	637.44
M18B*	May-91	650.70	653.38	10.1	17.5	633.20	OB/Bedrock Interface	13.5	637.20
M18Z*	May-91	651.16	653.84	10.0	54.0	597.16	Vernon Formation	14.0	637.16
M19A	Apr-91	654.51	659.50	15.0	40.0	614.51	Vernon Formation	10.0	644.51
M19B	Apr-91	654.21	659.35	12.0	19.0	635.21	Vernon (CB) Formation	9.0	645.21
M19Z	Apr-91	654.35	659.17	10.0	54.5	599.85	Vernon Formation	9.5	644.85
M20A	Apr-91	655.99	660.97	15.0	37.2	618.79	Vernon Formation	8.0	647.99
M20B	Apr-91	656.21	661.29	12.2	18.0	638.21	OB/Bedrock Interface	8.0	648.21
M22A	May-91	655.30	660.25	15.1	39.0	616.30	Vernon Formation	4.8	650.50
M22B	May-91	655.38	660.51	12.3	19.0	636.38	OB/Bedrock Interface	4.7	650.68
M23A	Jun-91	664.74	667.28	15.1	43.5	621.24	Vernon Formation	13.4	651.34
M23B	Apr-91	665.09	667.69	15.1	22.5	642.59	OB/Bedrock Interface	12.0	653.09
M23Z	Apr-91	664.46	666.56	10.1	63.5	600.96	Vernon Formation	10.9	653.56
M24A	Apr-91	661.98	664.49	15.0	42.3	619.68	Vernon Formation	1.0	660.98
M24B	Apr-91	661.86	664.40	15.0	22.0	639.86	OB/Bedrock Interface	1.0	660.86
M25A	Jun-91	660.94	663.35	15.1	37.0	623.94	Vernon Formation	7.0	653.94
M25B	Jun-91	660.79	663.08	10.1	17.0	643.79	OB/Bedrock Interface	7.3	653.49
South Expansion Area (SEA)									
MW-1S (2006)	Dec-06	676.08	678.03	10	25.0	651.08	Overburden	33	643.08
MW-2 (2006)	Dec-06	668.1	670.5	10	16.0	652.10	OB/Bedrock Interface	6	662.10
PZ-SEA-1Z	Sep-13	671.64	672.81	10	66.0	605.64	Vernon Formation	0.75	670.89
MW-SEA-1A	Sep-13	671.82	673.06	15	51.0	620.82	Vernon Formation	0.75	671.07
MW-SEA-1B	Sep-13	671.83	673.22	10	21.0	650.83	Vernon Formation	0.75	671.08
MW-SEA-2A	Sep-13	667.29	668.62	20	51.8	615.54	Vernon Formation	8.2	659.09
MW-SEA-2B	Sep-13	667.29	669.09	10	19.5	647.79	Vernon Formation	8.2	659.09
MW-SEA-3A	Sep-13	666.48	669.01	15	45.0	621.48	Vernon Formation	16.3	650.18
MW-SEA-3B	Sep-13	666.13	668.64	10	16.5	649.63	Vernon Formation	16.3	649.83
MW-SEA-3Z	Sep-13	666.82	669.94	10	67.0	599.82	Vernon Formation	16.3	650.52
PZ-SEA-3Z	Sep-13	666.27	668.37	10	100.0	566.27	Vernon Formation	16.3	649.97
MW-SEA-4A	Sep-13	675.82	677.35	20	61.0	614.82	Vernon Formation	32.6	643.22
MW-SEA-4B(1)	Dec-06	676.08	677.82	10	38.0	638.08	OB/Bedrock Interface	33	643.08
MW-SEA-5A	Sep-13	656.82	659.29	15	38.5	618.32	Vernon Formation	20.7	636.12
MW-SEA-5B	Sep-13	656.99	659.44	10	20.5	636.49	Overburden	20.7	636.29
PZ-SEA-5Z	Sep-13	656.94	659.04	10	52.5	604.44	Vernon Formation	20.7	636.24
MW-SEA-6A	Sep-13	669.62	672.27	15	48.0	621.62	Vernon Formation	19	650.62
MW-SEA-6B	Sep-13	669.73	672.22	10	19.5	650.23	Vernon Formation	19	650.73
PZ-SEA-6Z	Sep-13	669.7	671.27	10	70.5	599.20	Vernon Formation	19	650.70

Notes:
(1) also referred to as MW-1D (2006)
*Approximately 12 feet of fill material has been added to the ground surface surrounding the M-18 well series.
Depths on this table reflect survey and depth data compiled directly following monitoring well installation.
fasl-feet above sea level
fbgs-feet below ground surface

TABLE 4
Hydraulic Conductivity Estimates
Mill Seat Landfill
Town of Riga, New York

Well I.D.	Surface Elevation (fasl)	Screen Interval Elevation (fasl)	Formation Screened	Calculation Method	Estimated Hydraulic Conductivity (cm/sec)	Estimated Hydraulic Conductivity (ft/day)
Shallow Overburden Piezometers				**Geometric Mean: 1.42E-06 cm/s (4.02E-03 ft/day)**	**Range: 3.2E-09 to 2.5E-05 cm/sec : 9.07E-06 to 7.09E-02 ft/day**	
PC1-D	712.99	675.49 - 681.49	Overburden	Hvorslev	3.20E-09	0.00000907
PC2-D	687.88	672.88 - 676.88	Overburden	Hvorslev	2.50E-05	0.0709
PC3-D	692.96	677.96 - 682.46	Overburden	Hvorslev	2.80E-06	0.00794
PC7-D	687.88	709.14 - 716.39	Overburden	DM-7	1.80E-05	0.0510
Deep Overburden Piezometers				**Geometric Mean: 3.68E-06 cm/s (1.04E-02 ft/day)**	**Range: 8.1E-08 to 4.6E-04cm/sec : 2.3E-04 to 1.3E+0 ft/day**	
DH-2-80	~712	643.70 - 670.70	Overburden	Hvorslev	5.50E-07	0.002
DH-1-82	653.79	646.79 - 650.29	Overburden	Hvorslev	4.60E-04	1.30
DH-2-82	662.95	653.54 - 657.54	Overburden	Hvorslev	8.10E-06	0.023
DH-4-82	689.74	640.74 - 655.24	Overburden	Hvorslev	2.20E-05	0.062
DH-6-82	700.07	648.07 - 663.57	Overburden	Hvorslev	8.30E-08	0.000
PC1-C	714.02	662.02 - 668.02	Overburden	DM-7	3.20E-06	0.009
PC2-C	687.88	661.75 - 667.75	Overburden	Hvorslev	3.50E-07	0.001
PC3-C	692.85	664.85 - 670.85	Overburden	Hvorslev	8.10E-08	0.000
PC5-C	688.52	665.82 - 652.52	Overburden	Hvorslev	3.40E-06	0.010
PC7-C	687.88	684.34 - 692.64	Overburden	DM-7	2.10E-05	0.060
PC7-P	696.46	666.46 - 678.66	Overburden	Hvorslev	4.20E-06	0.012
B-201	680.24	655.04 - 666.74	Overburden	Hvorslev	2.00E-04	0.567
B-205	688.63	653.63 - 666.13	Overburden	Hvorslev	5.30E-06	0.015
B-206	696.26	666.51 - 678.46	Overburden	Hvorslev	2.20E-06	0.006
B-211	684.22	655.72 - 668.42	Overburden	Hvorslev	2.80E-06	0.008
MW-1S(2006)	676.08	661.08-651.08	Overburden	Bouwer-Rice	7.92E-06	0.022
PZ-3 (2006)	676.59	649.30-659.30	Overburden	Hvorslev	1.30E-06	0.004
PZ-01-2010	665.96	638.96-648.96	Overburden	Hvorslev	1.60E-06	0.005
MW-SEA-5B	656.99	636.49-646.49	Overburden	Hvorslev	5.20E-06	0.015
Overburden/ Bedrock Interface Monitoring Wells				**Geometric Mean: 1.06E-03 cm/s (3.46E+0 ft/day)**	**Range: 7.1E-05 to 6.6E-02 cm/sec : 2.0E-01 to 1.87E+2 ft/day**	
B-202	655.49	642.99 - 649.99	Overburden/ Vernon C Fm.	Hvorslev	2.20E-04	0.623
B-203	654.83	645.63 - 651.33	Overburden/ Vernon C Fm.	Hvorslev	7.10E-05	0.201
M-14B	666.03	634.03 - 649.03	Overburden/ Vernon C Fm.	Hvorslev	1.40E-04	0.397
M-15B	648.63	631.63 - 641.63	Overburden/ Vernon C Fm.	Hvorslev	2.30E-03	6.52
M-16B	650.40	636.40 - 643.40	Overburden/ Vernon C Fm.	Hvorslev	2.50E-04	0.709
M-17B	678.86	629.86 - 645.16	Overburden/ Vernon C Fm.	Hvorslev	4.00E-03	11.3
M-18B	650.70	633.20 - 643.30	Overburden/ Vernon C Fm.	Hvorslev	2.90E-04	0.822
M-19B	654.21	635.21 - 647.21	Overburden/ Vernon C/CB Fm.	Hvorslev	1.10E-02	31.2
M-20B	656.21	638.21 - 650.41	Overburden/ Vernon C Fm.	Hvorslev	6.60E-02	187
M-23B	665.09	642.59 - 657.69	Overburden/ Vernon C Fm.	Hvorslev	8.70E-05	0.247
M-25B	660.79	643.79 - 653.89	Overburden/ Vernon C Fm.	Hvorslev	1.10E-02	31.2
MW-2 (2006)	668.10	662.10-652.10	Overburden/ Vernon C Fm.	Bouwer-Rice	9.73E--03	27.6
MW-SEA-2B	667.29	647.79-657.79	Overburden/ Vernon C Fm.	Hvorslev	2.30E-03	6.52
MW-SEA-3B	666.13	649.63-659.63	Overburden/ Vernon C Fm.	Hvorslev	5.10E-04	1.45
MW-SEA-4B	676.08	639.82-649.82	Overburden/ Vernon C Fm.	Hvorslev	1.80E-03	5.10
MW-SEA-6B	669.73	649.93-659.93	Overburden/ Vernon C Fm.	Hvorslev	1.20E-03	3.40
Well I.D.	***Surface Elevation (fasl)***	***Screen Interval Elevation (fasl)***	***Formation Screened***	***Calculation Method***	***Estimated Hydraulic Conductivity (cm/sec)***	***(ft/day)***
Intermediate Bedrock Monitoring Wells				**Geometric Mean: 1.00E-03 cm/s (2.83 E+0 ft/day)**	**Range: 4.9E-08 to 3.4E-01 cm/sec : 1.39E-04 to 9.6E+02 ft/day**	
B-204	663.43	653.23 - 659.23	Vernon C Fm.	Hvorslev	2.00E-05	0.057
B103	665.28	639.65 - 650.0	Vernon C Fm.	Method 2 GWM	3.53E-04	1.00
PC2-A	687.60	624.10 - 630.93	Vernon C Fm.	Hvorslev	2.40E-04	0.680
PC4-A	691.40	609.40 - 618.40	Vernon C Fm.	Hvorslev	4.90E-06	0.014
PC5-A	688.52	618.52 - 633.77	Vernon C Fm.	Hvorslev	4.90E-08	0.000
PC6-A	668.3	628.30 - 641.30	Vernon C Fm.	DM-7	4.90E-04	1.39
PC7-A	729.14	635.14 - 647.94	Vernon C Fm.	DM-7	1.70E-04	0.482
M-3A*	659.70	614.95 - 630.53	Vernon C Fm.	Hvorslev	5.65E-04	1.60
M-4A*	651.10	611.27 - 628.35	Vernon C Fm.	Hvorslev	1.77E-05	0.050
M-6A*	652.20	611.37 - 632.45	Vernon C Fm.	DM-7	1.67E-05	0.047
M-9A*	661.80	623.80 - 641.80	Vernon C Fm.	DM-7	5.30E-04	1.50
M-14A	666.34	614.34 - 629.34	Vernon C/CB Fm.	Hvorslev	5.60E-02	159
M-15A	648.93	612.93 - 627.93	Vernon C Fm.	Hvorslev	1.20E-04	0.34
M-16A	651.17	618.17 - 633.17	Vernon C Fm.	Hvorslev	5.40E-04	1.53
M-17A	678.66	609.66 - 624.76	Vernon C Fm.	Hvorslev	3.40E-05	0.096
M-18A	650.94	614.94 - 630.04	Vernon C Fm.	Hvorslev	2.20E-04	0.623
M-19A	654.51	614.51 - 629.51	Vernon C Fm.	Hvorslev	4.50E-02	128
M-20A	655.99	618.79 - 633.79	Vernon C Fm.	Hvorslev	4.40E-05	0.125
M-22A	655.30	616.30 - 631.40	Vernon C/CB Fm.	Hvorslev	8.20E-04	2.32
M-22B	655.38	636.38 - 648.68	Vernon C Fm.	Hvorslev	6.50E-02	184
M-23A	664.74	621.24 - 636.34	Vernon C Fm.	Hvorslev	5.90E-02	167
M-24A	661.98	619.68 - 634.68	Vernon C Fm.	Hvorslev	3.20E-02	90.7
M-24B	661.86	639.86 - 654.86	Vernon C Fm.	Hvorslev	3.80E-02	108
M-25A	660.94	623.94 - 639.04	Vernon C/CB Fm.	Hvorslev	1.70E-04	0.482
MW-SEA-1A	671.82	620.82-635.82	Vernon C Fm.	Hvorslev	2.60E-01	737
MW-SEA-1B	671.83	650.83-660.83	Vernon C Fm.	Hvorslev	1.70E-03	4.82
MW-SEA-2A	667.29	615.49-635.49	Vernon C Fm.	Hvorslev	9.70E-02	275
MW-SEA-3A	666.48	621.48-636.48	Vernon C Fm.	Hvorslev	7.80E-03	22.1
MW-SEA-4A	675.82	614.82-634.82	Vernon C Fm.	Hvorslev	2.80E-02	79.4
MW-SEA-5A	656.82	618.32-633.82	Vernon C Fm.	Hvorslev	2.90E-02	82.2
MW-SEA-6A	669.62	621.62-636.32	Vernon C Fm.	Hvorslev	4.30E-02	122
Deep Bedrock Monitoring Wells				**Geometric Mean: 2.81E-04 cm/s (7.9E-01 ft/day)**	**Range: 2.4E-06 to 2.1E-01 cm/sec : 6.8E-03 to 6.0E+2 ft/day**	
B101	660.76	632.9 - 643.3	Vernon C Fm.	Method 2 GWM	1.52E-03	4.30
B102	649.33	629.5 - 639.8	Vernon C Fm.	Method 2 GWM	1.77E-03	5.00
M-8Z	653.08	596.88 - 606.88	Vernon B Fm.	Hvorslev	2.40E-06	0.007
M-16Z	651.46	598.46 - 608.46	Vernon C Fm.	Hvorslev	8.90E-05	0.252
M-18Z	651.16	597.16 - 607.16	Vernon C Fm.	Hvorslev	3.30E-06	0.009
M-19Z	654.35	599.85 - 609.85	Vernon C Fm.	Hvorslev	6.00E-05	0.170
M-23Z	664.46	600.96 - 611.06	Vernon C Fm.	Hvorslev	9.50E-04	2.69
PZ-SEA-1Z	671.64	605.64-615.64	Vernon C Fm.	Hvorslev	2.00E-03	5.67
PZ-SEA-3Z	666.27	566.27-576.27	Vernon C Fm.	Hvorslev	5.20E-05	0.147
MW-SEA-3Z	666.82	599.82-609.82	Vernon C Fm.	Hvorslev	2.10E-01	595
PZ-SEA-5Z	656.94	604.44-614.44	Vernon C/CB Fm.	Hvorslev	9.40E-05	0.266
PZ-SEA-6Z	669.70	599.20-609.20	Vernon C/CB Fm.	Hvorslev	1.10E-03	3.12

Hydraulic Conductivity Estimastes from Packer Tests

Well I.D.	Ground Surface Elevation(fasl)	Packer Test Interval (fasl)	Formation Tested	Calculation Method	Estimated Hydraulic Conductivity (cm/sec)	Estimated Hydraulic Conductivity (ft/day)
PZ-SEA-1Z	671.64	636.82-626.82 (45-55')	Vernon C Fm.	Lambe & Whitman	1.30E-03	3.68
		626.82-616.82 (55-65')	Vernon C/CB Fm.	Lambe & Whitman	1.10E-03	3.12
MW-SEA-2A	667.29	645.29-635.29	Vernon C Fm.	Lambe & Whitman	1.10E-03	3.12
		635.29-625.29	Vernon C Fm.	Lambe & Whitman	1.40E-03	3.97
		625.29-615.29	Vernon C Fm.	Lambe & Whitman	9.50E-04	2.69
MW-SEA-3Z	666.82	646.82-640.82	Vernon C Fm.	Lambe & Whitman	1.50E-03	4.25
		640.82-630.82	Vernon C Fm.	Lambe & Whitman	8.90E-04	2.52
		630.82-620.82	Vernon C Fm.	Lambe & Whitman	9.90E-04	2.81
		620.82-608.82	Vernon C Fm.	Lambe & Whitman	9.20E-04	2.61
MW-SEA-4A	675.82	619.82-607.82	Vernon C Fm.	Lambe & Whitman	1.10E-03	3.12
MW-SEA-5Z	656.94	634.94-624.94	Vernon C Fm.	Lambe & Whitman	7.20E-04	2.04
		624.94-614.94	Vernon C Fm.	Lambe & Whitman	1.10E-03	3.12
		614.94-604.94	Vernon C/CB Fm.	Lambe & Whitman	7.69E-06	0.022
MW-SEA-6Z	669.70	639.70-629.70	Vernon C Fm.	Lambe & Whitman	1.10E-03	3.12
		629.70-619.70	Vernon C Fm.	Lambe & Whitman	1.20E-03	3.40
		619.70-609.70	Vernon C Fm.	Lambe & Whitman	8.10E-04	2.30
		609.70-599.70	Vernon C/CB Fm.	Lambe & Whitman	3.60E-04	1.02

Notes:
-Hydraulic conductivities were measured by Dunn Geoscience, Inc. during the period of November, 1986 to January, 1987 for the monitoring wells and piezometers on Site. H&A measured hydraulic conductivities during July 1989 in selected previous wells and piezometers as well as new explorations
-Hydraulic conductivities in the Southern Expansion Area (SEA) were measured by GEI Consultants, Inc. in 2013
- DM-7 method developed by Dunn Geoscience, Inc.
fasl = feet above sea level
fbgs = feet below ground surface
cm/sec = centimeters per second
ft/day = feet per day

TABLE 5
Groundwater Elevation Summary

Mill Seat Landfill
Town of Riga, New York

					Date: September 24/October 2, 2013		Date: November 14, 2013		Date: February 20, 2014		Date: April 3, 2014	
Well I.D.	**Installation Date**	**Surface Elevation (fasl)**	**Reference Elevation (fasl)**	**Monitored Formation**	**Depth To Groundwater below Reference El.**	**Groundwater Elevation (fasl)**	**Depth To Groundwater below Reference El.**	**Groundwater Elevation (fasl)**	**Depth To Groundwater below Reference El.**	**Groundwater Elevation (fasl)**	**Depth To Groundwater below Reference El.**	**Groundwater Elevation (fasl)**
Existing Landfill												
M1A	Apr-87	703.70	706.17	Vernon Formation	49.5	656.63	47.7	658.43	47.7	658.43	46.9	659.28
M1B	Apr-87	703.52	706.36	OB/Bedrock Interface	dry	<660.20	dry	<660.20	dry	<660.20	DRY	<660.20
M1Z	Jun-89	702.03	704.53	Vernon Formation	47.76	656.77	46.05	658.48	45.90	658.63	44.59	659.94
M2A	May-87	673.20	675.56	Vernon Formation	27.08	648.48	26.02	649.54	26.38	649.18	25.33	650.23
M2B	May-87	673.30	675.86	OB/Bedrock Interface	25.98	649.88	24.98	650.88	25.12	650.74	24.01	651.85
M2Z	Jun-89	673.10	675.00	Vernon Formation	27.26	647.74	26.02	648.98	25.96	649.04	24.89	650.11
M4A	May-87	651.10	653.99	Vernon Formation	5.55	648.44	4.43	649.56	Frozen	NA	2.41	651.58
M4B	May-87	651.80	654.38	OB/Bedrock Interface	5.33	649.05	4.25	650.13	3.87	650.51	2.38	652.00
M6A	May-87	652.20	654.68	Vernon Formation	6.05	648.63	4.22	650.46	Frozen	NA	2.25	652.43
M6B	May-87	653.00	654.54	OB/Bedrock Interface	4.02	650.52	2.81	651.73	Frozen	NA	1.81	652.73
M7A	May-87	669.00	672.01	Vernon Formation	15.62	656.39	13.68	658.33	13.49	658.52	12.52	659.49
M7B	May-87	669.30	671.87	OB/Bedrock Interface	9.81	662.06	5.13	666.74	5.16	666.71	3.94	667.93
M8A	May-87	653.70	655.12	Vernon Formation	4.83	650.29	3.90	651.22	Frozen	NA	1.89	653.23
M8B	May-87	653.50	656.01	OB/Bedrock Interface	3.92	652.09	3.67	652.34	3.56	652.45	3.33	652.68
M8Z	Apr-91	653.08	657.55	Vernon Formation	4.64	652.91	3.77	653.78	2.96	654.59	2.21	655.34
M10A	Jun-89	647.14	648.74	Vernon Formation	10.16	638.58	9.57	639.17	8.15	640.59	2.00	646.74
M10B	Jun-89	646.76	649.86	OB/Bedrock Interface	10.95	638.91	10.50	639.36	9.17	640.69	2.95	646.91
M14A	Apr-91	666.34	668.59	Vernon Formation	22.89	645.70	22.19	646.40	22.41	646.18	21.69	646.90
M14B	May-91	666.03	668.24	OB/Bedrock Interface	22.73	645.51	31.94	636.30	22.21	646.03	21.38	646.86
M15A	May-91	648.93	651.78	Vernon Formation	0.60	651.18	-0.89	652.67	-0.10	651.88	NA	>651.78
M15B	May-91	648.63	651.04	OB/Bedrock Interface	8.23	642.81	6.82	644.22	6.90	644.14	5.26	645.78
M16A	May-91	651.17	653.94	Vernon Formation	2.40	651.54	0.34	653.60	Frozen	NA	NA	>653.94
M16B	May-91	650.40	653.31	OB/Bedrock Interface	8.84	644.47	6.11	647.20	7.03	646.28	3.89	649.42
M16Z	May-91	651.46	654.32	Vernon Formation	4.23	650.09	0.73	653.59	Frozen	NA	NA	>654.32
M17A	May-91	678.66	681.32	Vernon Formation	29.30	652.02	27.69	653.63	27.21	654.11	26.00	655.32
M17B	May-91	678.86	681.40	OB/Bedrock Interface	31.45	649.95	28.24	653.16	27.80	653.60	26.61	654.79
M18A	May-91	650.94	653.69	Vernon Formation	9.18	644.51	8.28	645.41	7.79	645.90	6.50	647.19
M18B	May-91	650.70	653.38	OB/Bedrock Interface	8.63	644.75	7.63	645.75	7.18	646.20	5.90	647.48
M18Z	May-91	651.16	653.84	Vernon Formation	9.25	644.59	8.16	645.68	7.75	646.09	6.48	647.36
M19A	Apr-91	654.51	659.50	Vernon Formation	7.74	651.76	6.74	652.76	6.48	653.02	4.72	654.78
M19B	Apr-91	654.21	659.35	Vernon (CB) Formation	7.15	652.20	6.58	652.77	6.09	653.26	5.67	653.68
M19Z	Apr-91	654.35	659.17	Vernon Formation	8.03	651.14	7.01	652.16	6.32	652.85	4.98	654.19
M20A	Apr-91	655.99	660.97	Vernon Formation	8.65	652.32	7.19	653.78	6.45	654.52	5.09	655.88
M20B	Apr-91	656.21	661.29	OB/Bedrock Interface	8.90	652.39	7.46	653.83	6.79	654.50	5.43	655.86
M22A	May-91	655.30	660.25	Vernon Formation	6.78	653.47	5.82	654.43	5.05	655.20	3.71	656.54
M22B	May-91	655.38	660.51	OB/Bedrock Interface	7.02	653.49	6.06	654.45	5.34	655.17	5.09	655.42
M23A	Jun-91	664.74	667.28	Vernon Formation	13.72	653.56	12.29	654.99	11.46	655.82	10.02	657.26
M23B	Apr-91	665.09	667.69	OB/Bedrock Interface	12.04	655.65	10.67	657.02	9.90	657.79	7.93	659.76
M23Z	Apr-91	664.46	666.56	Vernon Formation	13.12	653.44	11.85	654.71	Frozen	NA	9.85	656.71
M24A	Apr-91	661.98	664.49	Vernon Formation	9.97	654.52	8.94	655.55	8.28	656.21	6.71	657.78
M24B	Apr-91	661.86	664.40	OB/Bedrock Interface	8.02	656.38	6.75	657.65	6.28	658.12	4.54	659.86
M25A	Jun-91	660.94	663.35	Vernon Formation	6.31	657.04	5.21	658.14	5.62	657.73	3.64	659.71
M25B	Jun-91	660.79	663.08	OB/Bedrock Interface	6.25	656.83	5.14	657.94	5.55	657.53	3.60	659.48
Southern Expansion Area (SEA)												
MW-1S (2006)	Dec-06	676.08	678.03	Overburden	18.22	659.81	24.68	653.35	19.75	658.28	17.73	660.30
MW-2 (2006)	Dec-06	668.1	670.5	OB/Bedrock Interface	10.34	660.16	8.8	661.70	10.46	660.04	5.13	665.37
PZ-SEA-1Z	Sep-13	671.64	672.81	Vernon Formation	15.75	657.06	14.25	658.56	15.79	657.02	13.24	659.57
MW-SEA-1A	Sep-13	671.82	673.06	Vernon Formation	16	657.06	14.55	658.51	16.15	656.91	13.5	659.56
MW-SEA-1B	Sep-13	671.83	673.22	Vernon Formation	15.9	657.32	14.53	658.69	16.14	657.08	13.33	659.89
MW-SEA-2A	Sep-13	667.29	668.62	Vernon Formation	12.61	656.01	11.25	657.37	12.93	655.69	10.08	658.54
MW-SEA-2B	Sep-13	667.29	669.09	Vernon Formation	12.95	656.14	11.39	657.70	12.94	656.15	9.6	659.49
MW-SEA-3A	Sep-13	666.48	669.01	Vernon Formation	14.11	654.90	12.88	656.13	14.57	654.44	11.78	657.23
MW-SEA-3B	Sep-13	666.13	668.64	Vernon Formation	10.53	658.11	9.59	659.05	11.66	656.98	8.06	660.58
MW-SEA-3Z	Sep-13	666.82	669.94	Vernon Formation	13.77	656.17	12.27	657.67	13.99	655.95	11.22	658.72
PZ-SEA-3Z	Sep-13	666.27	668.37	Vernon Formation	15.07	653.30	not recovered 75.85	653.20	14.87	653.50	12.17	656.20
MW-SEA-4A	Sep-13	675.82	677.35	Vernon Formation	24.31	653.04	23	654.35	24.75	652.60	22.22	655.13
MW-SEA-4B(1)	Dec-06	676.08	677.82	OB/Bedrock Interface	24.99	652.83	23.22	654.60	24.95	652.87	22.46	655.36
MW-SEA-5A	Sep-13	656.82	659.29	Vernon Formation	10.43	648.86	9.76	649.53	11.8	647.49	9.44	649.85
MW-SEA-5B	Sep-13	656.99	659.44	Overburden	8.8	650.64	6.13	653.31	8.73	650.71	6.04	653.40
PZ-SEA-5Z	Sep-13	656.94	659.04	Vernon Formation	11.11	647.93	9.67	649.37	11.86	647.18	11.96	647.08
MW-SEA-6A	Sep-13	669.62	672.27	Vernon Formation	18.21	654.06	16.72	655.55	18.45	653.82	15.76	656.51
MW-SEA-6B	Sep-13	669.73	672.22	Vernon Formation	17.34	654.88	15.92	656.30	17.37	654.85	14.52	657.70
PZ-SEA-6Z	Sep-13	669.7	671.27	Vernon Formation	17.36	653.91	15.79	655.48	17.51	653.76	14.85	656.42
Piezometers												
PZ-1 (2006)	Dec-06	680.13	683.25	Overburden	Not Located	NA	Not Located	NA	Not Located	NA	Not Located	NA
PZ-2 (2006)	Dec-06	673.68	675.44	OB/Bedrock Interface	10.82	664.62	11.08	664.36	11.38	664.06	6.95	668.49
PZ-3 (2006)	Dec-06	676.59	679.3	Overburden	12.58	666.72	11.45	667.85	12.77	666.53	9.89	669.41
PZ-4 (2006)	Dec-06	673.63	677.17	Overburden	16.42	660.75	12.69	664.48	16.02	661.15	11.91	665.26
PZ-01 (2008)	Mar-08	668.04	671.14	Overburden	6.1	661.94	5.9	662.14	Frozen	NA	Frozen	NA
PZ-02 (2008)	Mar-08	667.18	669.23	OB/Bedrock Interface	9.7	659.53	6.2	663.03	7.4	661.83	3.45	665.78
PZ-03 (2008)	Mar-08	660.26	663.91	Overburden	7.57	656.34	6.08	657.83	7.39	656.52	5.35	658.56
PZ-04 (2008)	Mar-08	654.2	657.1	OB/Bedrock Interface	5.62	651.48	4.45	652.65	6.49	650.61	2.71	654.39
PZ-05 (2008)	Mar-08	656.92	659.17	OB/Bedrock Interface	6.43	652.74	5.09	654.08	6.7	652.47	3.38	655.79
PZ-06 (2008)	Mar-08	673.88	676.28	Overburden	19.93	656.35	19.45	656.83	21.29	654.99	18.56	657.72
PZ-01-2010	Aug-10	665.96	668.44	Overburden	7.07	661.37	6.24	662.2	8.03	660.41	5.4	663.04
Staff Gauges												
SG-1	Dec-06	na	649.45	surface water	NA	NA	1.6	651.05	1.51	650.96	2.4	651.85
SG-2	Dec-06	na	666.57	surface water	NA	NA	0.4	666.97	1	667.57	0.72	667.29
SG-3	Dec-06	na	658.51	surface water	NA	NA	0.58	659.09	0.62	659.13	0.9	659.41
SG-4	Mar-08	na	655.56	surface water	NA	NA	0.36	655.92	Frozen	NA	1.15	656.71

Notes:
(1) Well was formerly MW-1D (2006)
fasl-feet above sea level
fbgs-feet below ground surface

TABLE 6
Hydraulic Gradient Summary

Mill Seat Landfill
Town of Riga, New York

Horizontal Hydraulic Gradient Calculations

Monitoring Wells Used In Calculation	Groundwater Flow Zone	November 14, 2013	April 3, 2014
		Hydraulic Gradient Value (dH/dL)	Hydraulic Gradient Value (dH/dL)
PZ-2 (2006) & PZ-05 (2008)	Water Table	0.006	0.007
MW-SEA-1B & MW-SEA-5B	B-Zone	0.002	0.002
MW-SEA-1A & MW-SEA-5A	A-Zone	0.003	0.003
PZ-SEA-1Z & PZ-SEA-5Z	Z-Zone	0.003	0.004

Notes: Linear distance of 3180 feet used in calculation of horizontal hydraulic gradients for A,B and Z-Zone. Distance of 1750 feet used for Water Table flow zone calculations.

Vertical Hydraulic Gradient Calculations

Monitoring Well Cluster	Groundwater Flow Zones Compared	November 14, 2013		April 3, 2014	
		Hydraulic Gradient Value (dH/dL)	Hydraulic Gradient Direction	Hydraulic Gradient Value (dH/dL)	Hydraulic Gradient Direction
Existing Landfill					
M1	A and B	**-- (1)**	--	**-- (1)**	**-- (1)**
	A and Z	**-0.001**	upward	**-0.013**	upward
	B and Z	**-- (1)**	--	**-- (1)**	**-- (1)**
M2	A and B	**0.07**	downward	**0.08**	downward
	A and Z	**0.02**	downward	**0.004**	downward
	B and Z	**0.04**	downward	**0.03**	downward
M4	A and B	**0.03**	downward	**0.02**	downward
M6	A and B	**0.06**	downward	**0.01**	downward
M7	A and B	**0.43**	downward	**0.43**	downward
M8	A and B	**0.05**	downward	**-0.03**	upward
	A and Z	**-0.12**	upward	**-0.1**	upward
	B and Z	**-0.03**	upward	**-0.06**	upward
M10	A and B	**0.01**	downward	**0.01**	downward
M14	A and B	**-0.51**	upward	**-0.002**	upward
M15	A and B	**-0.52**	upward	**>-0.37(2)**	upward
M16	A and B	**-0.45**	upward	**>-0.32(2)**	upward
	A and Z	**0.0005**	downward	**>-0.017(2)**	upward
	B and Z	**-0.18**	upward	**-0.13**	upward
M17	A and B	**-0.02**	upward	**-0.03**	upward
M18	A and B	**0.02**	downward	**0.02**	downward
	A and Z	**-0.56**	upward	**-0.35**	upward
	B and Z	**0.002**	downward	**0.003**	downward
M19	A and B	**0.001**	downward	**-0.057**	upward
	A and Z	**0.03**	downward	**0.03**	downward
	B and Z	**0.02**	downward	**-0.01**	upward
M20	A and B	**0.003**	downward	**-0.001**	upward
M22	A and B	**0.001**	downward	**-0.06**	upward
M23	A and B	**0.10**	downward	**0.12**	downward
	A and Z	**0.01**	downward	**0.02**	downward
	B and Z	**0.05**	downward	**0.07**	downward
M24	A and B	**0.10**	downward	**0.1**	downward
M25	A and B	**-0.01**	upward	**-0.01**	upward
Southern Expansion Area (SEA)					
MW-SEA-1	A and B	**0.01**	downward	**0.01**	downward
	A and Z	**-0.003**	upward	**-0.001**	upward
	B and Z	**0.003**	downward	**0.007**	downward
MW-SEA-2	A and B	**0.01**	downward	**0.003**	downward
MW-SEA-3	A and B	**0.11**	downward	**0.13**	downward
	A and Z	**-0.06**	upward	**-0.06**	upward
	B and Z	**0.03**	downward	**0.04**	downward
MW-SEA-4	A and B	**0.01**	downward	**0.01**	downward
MW-SEA-5	A and B	**0.24**	downward	**0.23**	downward
	A and Z	**0.01**	downward	**0.17**	downward
	B and Z	**0.12**	downward	**0.2**	downward
MW-SEA-6	A and B	**0.03**	downward	**0.05**	downward
	A and Z	**0.003**	downward	**0.004**	downward
	B and Z	**0.02**	downward	**0.03**	downward

Notes:
1: B-Zone well dry during monitoring event.
2: Monitoring wells M15A, M16A and M16Z were artesian (flowing) during the April 2014 groundwater elevation monitoring event. The reference elevation (top of casing) for each well has been used as the groundwater elevation in the calculation of hydraulic gradients for these wells for the April 2014 event.

TABLE 7
Average Linear Velocity Calculations

Mill Seat Landfill
Town of Riga, New York

Average Linear Velocity (Vx)=(K/Ne)*(dh/dl)

Flow Regime	Hydraulic Conductivity (cm/s) (1)	Effective Porosity (n_e) (2)	Hydraulic Gradient (dh/dl) (3)	Average Linear Velocity (cm/s)	Average Linear Velocity (ft/day)
Water Table (overburden)	3.68E-06	0.15	0.007	1.72E-07	0.0005
B- Zone	1.60E-03	0.01	0.002	3.20E-04	0.91
A- Zone	1.09E-03	0.01	0.003	3.27E-04	0.93
Z- Zone	2.09E-04	0.01	0.004	8.36E-05	0.24

Notes:

(1) Geometric mean hydraulic conductivity values for each flow regime are presented on Table 4.

(2) Effective porosity values for fractured bedrock and unconsolidated materials appear in Fetter, 1994.

(3) Horizontal hydraulic gradient values are presented on Table 6.

TABLE 8
November 2013 Groundwater Analytical Summary
6NYCRR Part 360 Expanded Parameter List

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	NYSDEC Standard$^{(1)}$	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-3Z		MW-SEA-4A	
			11/01/2013		10/31/2013		11/01/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/2013		10/31/2014		10/31/2013	
Volatile Organic Compounds																						
Acetone	ug/L	50	3.5	J	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Carbon disulfide	ug/L	60	0.65	J	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U
Chloroform	ug/L	7	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U
Semi-Volatile Organic Compounds/ Pesticides/Herbicide/PCBs																						
4,4'-DDD	ug/L	0.3	0.011	J	0.0091	U	0.0088	U	0.0087	U	0.0087	U	0.0088	U	0.0087	U	0.0087	U	0.0088	U	0.009	U
4,4'-DDT	ug/L	0.2	0.012	J	0.011	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.011	U
alpha-BHC	ug/L	0.01	0.011	J	0.0096	J	0.0063	U	0.0091	J	0.0089	J	0.01	J	0.01	J	0.0063	U	0.011	J	0.0064	U
beta-BHC	ug/L	0.04	0.033	J	0.025	U	0.024	U	0.023	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U
delta-BHC	ug/L	0.04	0.018	J B	0.0099	U	0.012	J B	0.011	J B	0.0095	U	0.0095	U	0.0095	U	0.012	J B	0.011	J B	0.012	J B
gamma-BHC (Lindane)	ug/L	0.05	0.0086	J B	0.0059	U	0.0057	U	0.0078	J B	0.0078	J B	0.0078	J B	0.0057	U	0.0081	J B	0.0078	J B	0.0058	U
Heptachlor Epoxide	ug/L	0.03	0.0056	U	0.0052	U	0.0051	U	0.0050	U	0.0050	U	0.0051	U	0.0050	U	0.0050	U	0.0050	U	0.0052	U
Metals																						
Aluminum, Total Recoverable	ug/L	NS	4430		1250		60	U	625		154		2380		931		842		145		60	U
Antimony, Total Recoverable	ug/L	3	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U
Arsenic, Total Recoverable	ug/L	25	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	**27.8**	U	5.6	U	5.6	U	5.6	U	5.6	U
Barium, Total Recoverable	ug/L	1000	111	J	50.4	J	47.5	J	98.7	J	99.7	J	107	J	120	J	119	J	24.5	J	27.5	J
Beryllium, Total Recoverable	ug/L	NS	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
Boron, Total Recoverable	ug/L	1000	131	J	27.2	J B	222	J	42.8	J	71.2	J B	32.3	J B	86.6	J B	89.6	J	283	J B	316	J B
Cadmium, Total Recoverable	ug/L	5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	3.3		0.5	U	0.5	U	0.5	U	0.5	U
Calcium, Total Recoverable	ug/L	NS	77100		79000		328000		109000		113000		94200		109000		77100		396000		381000	
Chromium, Total Recoverable	ug/L	50	10.5	J	2.1	J	1	U	1.3	J	1	U	3.6	J	1.2	J	1.4	J	1	U	1	U
Cobalt, Total Recoverable	ug/L	NS	2.9	J	0.63	U	0.63	U	1.1	J	0.63	U	3.7	J	0.74	J	0.81	J	0.63	U	0.63	U
Copper, Total Recoverable	ug/L	200	5.2	J	2.5	J	1.6	U	2	J	1.6	U	3.6	J	1.6	U	1.6	U	2	J	1.7	J
Iron, Total Recoverable	ug/L	300	**5520**		**1040**		**757**		**568**		253		**1890**		**902**		**1040**		**996**		**665**	
Lead, Total Recoverable	ug/L	25	5.6		3	U	3	U	3	U	3	U	29.8	B	3	U	3	U	3	U	3	U
Magnesium, Total Recoverable	ug/L	35000	**62100**		**37100**		**45500**		**61700**		**38100**		**42400**		**37200**		**67400**		**43700**		30700	
Manganese, Total Recoverable	ug/L	300	111		10.7	J	10	J	22.6	J	5.1	J	46.7		24	J	81.7		10.6	J	8.7	J
Mercury, Total Recoverable	ug/L	0.7	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
Nickel, Total Recoverable	ug/L	100	6.8	J	1.3	J	1.3	U	1.6	J	1.3	U	8.2	J	2.2	J	1.7	J	1.3	U	1.3	U
Potassium, Total Recoverable	ug/L	NS	8470		1500	J	3060		2670	J	1710	J	2410	J	2280	J	7830		3860		4020	
Selenium, Total Recoverable	ug/L	10	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	**68**		8.7	U	8.7	U	8.7	U	8.7	U
Silver, Total Recoverable	ug/L	50	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Sodium, Total Recoverable	ug/L	20000	**20400**		2790		16600		6390		4600		3370		4280		10500		15700		6030	
Thallium, Total Recoverable	ug/L	NS	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U
Tin, Total Recoverable	ug/L	NS	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U
Vanadium, Total Recoverable	ug/L	NS	7.2	J	1.8	J	1.5	U	1.5	U	1.5	U	3.6	J	1.7	J	1.7	J	1.5	U	1.5	U
Zinc, Total Recoverable	ug/L	5000	20.6		2.2	J B	12.1		5	J	1.5	U	4.8	J B	2.9	J B	4.3	J	17.1	B	1.5	U
General Chemistry																						
Bromide	mg/L	2	0.073	U	0.073	U	0.073	U	0.08	J	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U
Chloride	mg/L	250	9.4		4.6		55.3		6		8.9		6		10.1		16.1		58.8		15.3	
Sulfate	mg/L	250	127		13.5		**635**		165		103		21.6		59.2		78.5		**770**		**741**	
Ammonia, distilled	mg/L as N	2	0.12	J	0.12	J	0.5	B	0.1	U	0.1	U	0.1	U	0.11	J B	0.14	J	0.18	J	0.2	B
Total Kjeldahl Nitrogen	mg/L as N	NS	0.98		0.15	U	0.31		0.55		0.15	U	0.15	U	0.15	U	0.77		0.45		0.27	
Chemical Oxygen Demand	mg/L	NS	5	U	5.2	J	5	U	5	U	5	U	5	U	7.1	J	5	U	5.2	J	9.3	J
Phenolics, Total Recoverable	mg/L	0.005	0.0062	J	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	**0.0052**	J	0.005	U	0.005	U
Chromium, hexavalent	mg/L	0.05	0.005	U	0.026		0.005	U	0.005	U	0.0066		0.005	U	0.0084		0.005	U	0.005	U	0.005	U
Cyanide, Total	mg/L	0.2	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.019	
Nitrate	mg/L as N	10	2.9		2.6		0.02	U	0.038	J	0.02	U	9.1		2		5.9		0.02	U	0.02	U
Color	Color Units	15	**20**		10		**25**		**20**		0.01	U	0.01	U	0.01	U	10		**25**		**30**	
Alkalinity, Total	mg/L	NS	340		316		321		370		319		331		342		350		305		287	
Hardness	mg/L	NS	560		350		1060		620		390		390		420		520		1090		1060	
Total Dissolved Solids	mg/L	500	**536**		327		**1290**		**586**		449		387		427		493		**1510**		**1400**	
Sulfide	ug/L	NS	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U
Biochemical Oxygen Demand	mg/L	NS	7.5		2	U	8.3		10.6		2	U	2	U	2	U	10.5		2	U	2	U
Total Organic Carbon	mg/L	1000	2.8		1.2		2.2		0.87	J	0.82	J	0.89	J	1.1		1.2		1.3		2.3	
Field Parameters																						
Temperature	Degrees C	NS	10.7		13		10.4		14.2		10.7		13.4		11		14		10.5		10.3	
Oxidation Reduction Potential	millivolts	NS	171		231		89		176		188		163		122		183		123		89	
Turbidity	NTU	5	**50.3**		**6.61**		0.8		**37.8**		4.7		**32**		4.9		**24.4**		**3.7**		**10.1**	
Field pH	SU	NS	7.25		7.29		7.19		7.37		6.94		7.4		7.26		6.7		7.07		7.24	
Specific Conductance	umhos/cm	NS	805		580		1490		820		637		627		656		747		1656		1610	

See last page for notes.

TABLE 8
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Mill Seat Landfill
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Parameter	Units	NYSDEC Standard[(1)]	MW-SEA-4B		MW-SEA-5A		MW-SEA-5B		MW-SEA-6A		MW-SEA-6B		PZ-SEA-1Z		PZ-SEA-3Z		PZ-SEA-5Z		PZ-SEA-6Z	
			10/31/2013		10/31/2013		11/01/2013		10/31/2013		10/31/2013		11/01/2013		11/1/2013		11/01/2013		10/31/2013	
Volatile Organic Compounds																				
Acetone	ug/L	50	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Carbon disulfide	ug/L	60	0.19	U	0.19	U	0.19	U	0.19	U	0.35	J	0.19	U	0.19	U	0.19	U	0.19	U
Chloroform	ug/L	7	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.63	
Semi-Volatile Organic Compounds/ Pesticides/Herbicide/PCBs																				
4,4'-DDD	ug/L	0.3	0.0089	U	0.0087	U	0.0088	U	0.0089	U	0.012	J	0.0088	U	0.014	J	0.0087	U	0.0087	U
4,4'-DDT	ug/L	0.2	0.011	U	0.01	U	0.011	U	0.011	U	0.011	U	0.011	U	0.014	J	0.01	U	0.01	U
alpha-BHC	ug/L	0.01	**0.011**	J	0.0063	U	0.0063	U	0.0064	U	0.01	J	0.0063	U	0.0098	J	0.0063	U	0.0063	U
beta-BHC	ug/L	0.04	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U
delta-BHC	ug/L	0.04	0.0097	U	0.011	J B	0.012	J B	0.0097	U	0.0095	U	0.0096	U	0.0095	U	0.012	J B	0.0095	U
gamma-BHC (Lindane)	ug/L	0.05	0.0058	U	0.0057	U	0.0082	J B	0.0058	U	0.008	J B	0.0057	U	0.0091	JB	0.008	J B	0.0057	U
Heptachlor Epoxide	ug/L	0.03	0.0051	U	0.0050	U	0.0051	U	0.0051	U	0.0051	U	0.0051	U	0.02	J	0.0050	U	0.005	U
Metals																				
Aluminum, Total Recoverable	ug/L	NS	6110		181		201		203		7530		73		4300		96.9		60	U
Antimony, Total Recoverable	ug/L	3	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U
Arsenic, Total Recoverable	ug/L	25	15.1		5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U
Barium, Total Recoverable	ug/L	1000	60.2	J	39.1	J	63.3	J	378	J	182	J	33.8	J	50.5	J	9.5	J	16.7	J
Beryllium, Total Recoverable	ug/L	NS	0.39	J	0.3	U	0.3	U	0.3	U	0.33	J	0.3	U	0.3	U	0.3	U	0.3	U
Boron, Total Recoverable	ug/L	1000	252	J B	232	J B	82.7	J	246	J B	38.4	J B	439	J	**4070**		**1500**		2090	B
Cadmium, Total Recoverable	ug/L	5	0.5	U	0.5	U	0.5	U	0.5	U	0.89	J	0.5	U	0.5	U	0.5	U	0.5	U
Calcium, Total Recoverable	ug/L	NS	177000		210000		94000		372000		137000		584000		375000		582000		588000	
Chromium, Total Recoverable	ug/L	50	9	J	1.2	J	1	U	1	U	12.4	J	1	U	7.7	J	1	U	1	U
Cobalt, Total Recoverable	ug/L	NS	2.7	J	0.63	U	0.63	U	0.63	U	6.1		0.63	U	2.6	J	0.63	U	0.63	U
Copper, Total Recoverable	ug/L	200	5.4	J	2.4	J	1.6	U	1.7	J	8.4	J	1.6	U	5.9	J	2.1	J	1.7	J
Iron, Total Recoverable	ug/L	300	**6620**		**358**		125		291		**8220**		**693**		**4450**		**500**		**673**	
Lead, Total Recoverable	ug/L	25	5.4	B	3	U	3	U	3.3	J B	7.8	B	3	U	3.9	J	3	U	3	U
Magnesium, Total Recoverable	ug/L	35000	**42000**		**54000**		**86100**		**39900**		**74000**		**47200**		**63600**		**45600**		**57000**	
Manganese, Total Recoverable	ug/L	300	115		19.7	J	59.5		16.8	J	245		12.8	J	78.3		41.4		59	
Mercury, Total Recoverable	ug/L	0.7	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
Nickel, Total Recoverable	ug/L	100	7.2	J	1.3	U	1.5	J	1.3	U	13.9	J	1.3	U	7.8	J	1.3	U	1.3	U
Potassium, Total Recoverable	ug/L	NS	5570		3210		10900		3590		5440		4120		28300		12000		16200	
Selenium, Total Recoverable	ug/L	10	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U
Silver, Total Recoverable	ug/L	50	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Sodium, Total Recoverable	ug/L	20000	18200		14700		9550		7110		7530		**23600**		16700		**40500**		**56200**	
Thallium, Total Recoverable	ug/L	NS	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U
Tin, Total Recoverable	ug/L	NS	5.1	U	5.1	U	5.1	U	7	J	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U
Vanadium, Total Recoverable	ug/L	NS	9.7	J	1.5	U	1.5	U	1.5	U	12.5	J	1.5	U	6.7	J	1.5	U	1.5	U
Zinc, Total Recoverable	ug/L	5000	11.6	B	1.5	U	7.3	J	2.4	J B	19.5	B	2.5	J	11.4		2.9	J	1.6	J B
General Chemistry																				
Bromide	mg/L	2	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U
Chloride	mg/L	250	2.7		14.9		37.2		19.8		9.6		56.1		69.6		19.4		27.4	
Sulfate	mg/L	250	**378**		**515**		213		**698**		64.2		**1300**		**1170**		**1490**		**1510**	
Ammonia, distilled	mg/L as N	2	0.14	J B	0.15	J	0.15	J	0.36		0.11	J	0.26		1.1		0.68		0.92	
Total Kjeldahl Nitrogen	mg/L as N	NS	0.22		0.22		0.15	U	0.66		0.65		0.39		2.6		1.1		1	
Chemical Oxygen Demand	mg/L	NS	5	U	11.8		5	U	20.6		5	U	6.1	J	5	U	7.7	J	5	U
Phenolics, Total Recoverable	mg/L	0.005	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Chromium, hexavalent	mg/L	0.05	**0.11**		0.005	U	0.0084		0.005	U	0.097		0.005	U	0.005	U	0.005	U	0.005	U
Cyanide, Total	mg/L	0.2	0.005	U	0.0064		0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.01	
Nitrate	mg/L as N	10	0.02	U	0.02	U	0.02	U	0.02	U	0.91		0.02	U	3.7		0.02	U	0.02	U
Color	Color Units	15	0.01	U	10		5		**25**		0.01	U	10		**20**		10		15	
Alkalinity, Total	mg/L	NS	202		270		400		334		460		310		279		258		227	
Hardness	mg/L	NS	596		770		620		1160		570		1640		1760		1700		1700	
Total Dissolved Solids	mg/L	500	**790**		**1050**		**755**		**1410**		**561**		**2240**		**2140**		**2410**		**2410**	
Sulfide	ug/L	NS	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U
Biochemical Oxygen Demand	mg/L	NS	2	U	2	U	7.2		2	U	2	U	5.8		7.2	B	6.8		2	U
Total Organic Carbon	mg/L	1000	0.8	J	2		1.3		6.9		2		2		2.1		3.6		1	
Field Parameters																				
Temperature	Degrees C	NS	10.6		12		11.6		10.9		10.7		10.1		11.5		10.6		10.9	
Oxidation Reduction Potential	millivolts	NS	77		210		153		201		193		101		196		180		200	
Turbidity	NTU	5	**47.5**		2.5		**8.62**		2.16		**113**		2.2		**479**		3.19		0.7	
Field pH	SU	NS	7.42		7.01		7.11		7		7.34		7.18		7.37		6.97		7.03	
Specific Conductance	umhos/cm	NS	1037		1160		1020		1447		848		2224		2475		2312		2357	

See last page for notes.

TABLE 8
November 2013 Groundwater Analytical Summary
6NYCRR Part 360 Expanded Parameter List

Mill Seat Landfill
Town of Riga, New York

Notes:

[1] Groundwater standards from: New York State Department of Environmental Conservation (NYSDEC) Division of Water Technical and Operation Guidance Series (TOGS 1.1.1), August 1999.

*shaded cells indicate exceedance of of TOGS 1.1.1 Class GA Guidance Criteria

µg/L: micrograms per liter (parts per billion)

µmho/cm: micromhos per centimeter (equivalent to microSiemens per centimeter)

mg/L: milligrams per liter (parts per million)

ntu: Nephelometric Turbidity Units

s.u.: Standard Unit for pH

U : Indicates that the analyte was analyzed for, but was not detected. The sample quantitation limit is presented. This qualifier is also used in the validation process to signify that the reporting limit of an analyte was raised due to blank contamination.

J : Indicates that the concentration of the result should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process. This qualifier is also applied by the laboratory when the analyte concentration was greater than the method detection limit (MDL) but less than the reporting limit. For inorganic results, the qualifier “J” was applied by the laboratory when the analyte concentration was greater than the instrument detection limit (IDL) or MDL but less than the QL.

UJ : Indicates that the analyte was analyzed for, but was not detected. The sample quantitation limit is presented, and should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process.

TABLE 9
April 2014 Groundwater Analytical Summary
6NYCRR Part 360 Baseline Parameter List

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	NYSDEC Standard(1)	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-3Z		MW-SEA-4A		MW-SEA-4B	
			04/02/2014		04/04/2014		04/07/2014		04/07/2014		04/03/2014		04/03/2014		04/07/2014		04/08/2014		04/07/2014		04/01/2014		04/02/2014	
Volatile Organic Compounds																								
Acetone	ug/L	50	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	8.9		3	U	3	U
Semi-Volatile Organic Compounds																								
None Detected																								
Metals																								
Aluminum, Total Recoverable	ug/L	NS	69.4		84.8		60	U	95.6		79.8		893		60	U	219		60	U	314		210	
Antimony, Total Recoverable	ug/L	3	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U
Arsenic, Total Recoverable	ug/L	25	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	8.8	J
Barium, Total Recoverable	ug/L	1000	62.8	J	14	J	46.5	J	87.1	J	148	J	55	J	103	J	128	J	26.4	J	29.1	J	37.8	J
Beryllium, Total Recoverable	ug/L	NS	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
Boron, Total Recoverable	ug/L	1000	71.9	J	21.3	J	200	J	28	J	105	J	15.5	J	68.7	J	34.6	J	240	J	265	J	205	J
Cadmium, Total Recoverable	ug/L	5	0.5	U	0.68	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Calcium, Total Recoverable	ug/L	NS	90400		49800		300000		103000		166000		87500		93000		78100		334000		353000		102000	
Chromium, Total Recoverable	ug/L	50	1.3	J	1	U	1.6	J	1.2	J	1	U	1.7	J	1	U	2	J	1.4	J	1.3	J	1.7	J
Cobalt, Total Recoverable	ug/L	NS	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
Copper, Total Recoverable	ug/L	200	2.8	J	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U
Iron, Total Recoverable	ug/L	300	120		60.7		**910**		88.1		**885**		**1030**		86.6		218		**847**		**798**		**445**	
Lead, Total Recoverable	ug/L	25	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Magnesium, Total Recoverable	ug/L	35000	**59300**		26100		**42200**		**59100**		**40900**		**42600**		33300		**57000**		**40600**		29800		34300	
Manganese, Total Recoverable	ug/L	300	23.4	J	2.7	J	10.9	J	4.4	J	7.6	J B	49.5	B	9.5	J	45.4		9.2	J	8.6	J	37.2	
Mercury, Total Recoverable	ug/L	0.7	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.13	J
Nickel, Total Recoverable	ug/L	100	3.5	J	1.3	U	1.3	U	1.4	J	1.3	U	1.3	U	1.3	U	1.4	J	1.3	U	1.3	U	1.3	U
Potassium, Total Recoverable	ug/L	NS	6470		326	J	3120		2040	J	2100	J	1260	J	1790	J	3730		3730		5800		2610	J
Selenium, Total Recoverable	ug/L	10	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U
Silver, Total Recoverable	ug/L	50	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Sodium, Total Recoverable	ug/L	20000	**28700**		2460		16300		6330		7480		3410		3550		8030		15400		7020		19200	
Thallium, Total Recoverable	ug/L	NS	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U
Vanadium, Total Recoverable	ug/L	NS	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U
Zinc, Total Recoverable	ug/L	5000	5.3	J	6	J	1.5	U	1.5	U	3.6	J B	4.5	J B	1.9	J	2.6	J	1.5	U	1.5	U	2.1	J
General Chemistry																								
Bromide	mg/L	2	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	**3.3**		0.073	U
Chloride	mg/L	250	6.2		1.7		50.8		5.9		23.7		8.5		9.5		11.6		55.6		20.4		2.4	
Sulfate	mg/L	250	201		8.3		**629**		150		**293**		16.4		50.3		70		**704**		**676**		**277**	
Ammonia (as N)	mg/L as N	2	0.009	U	0.009	U	0.048		0.03		0.009	U	0.026		0.022		0.009	U	0.041		0.12		0.009	U
Total Kjeldahl Nitrogen	mg/L as N	NS	0.15	U	0.24		0.43	B	0.15	U	0.26		0.15	U	0.15	U	0.15	U	0.17	J	0.27		0.15	U
Chemical Oxygen Demand	mg/L	NS	5	U	6.2	J	5	U	5	U	10.3		10.3		5	U	14.1		5	U	5	U	5	U
Phenolics, Total Recoverable	mg/L	0.005	0.005	U	0.0054	J B	0.005	U	0.005	U	0.005	U	**0.0052**	J	0.005	U	0.0059	J B	0.005	U	0.005	U	0.005	U
Chromium, hexavalent	mg/L	0.05	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.0056	J	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Cyanide, Total	mg/L	0.2	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Nitrate	mg/L as N	10	**10.8**		1.5		0.02	U	0.087		0.02	U	**15.6**		1.9		8.6		0.02	U	0.02	U	0.11	
Color	Color Units	15	15		5		**20**		0.01	U	**25**		0.01	U	0.01	U	10		**20**		**20**		0.01	U
Alkalinity, Total	mg/L	NS	373		236		317		364		310		295		328		351		301		289		193	
Total Hardness	mg/L	NS	470		228		1100		530		560		364		390		460		1100		1250		400	
Total Dissolved Solids	mg/L	500	**713**		218		**1330**		**561**		**731**		355		420		**511**		**1400**		**1370**		**660**	
Biochemical Oxygen Demand	ug/L	NS	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Total Organic Carbon	mg/L	NS	2.5		1.2		3		1.2		1.9		2.1		1.6		1.5		3.5		4.1		2.2	
Sulfide	mg/L	1000	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U
Field Parameters																								
Temperature	Degrees C	NS	9.3		3.8		10.2		9		9.5		5.6		10.3		5.4		10.1		10.1		9.5	
Oxidation Reduction Potential	millivolts	NS	110		183		0		113		57		118		64		102		7		31		96	
Turbidity	NTU	5	**5.8**		4.3		3		**10.9**		**5.5**		**21.1**		3.8		**13.4**		4.4		3.5		**6.3**	
Field pH	SU	NS	7.4		6.3		7.26		6.93		7.31		7.35		7.41		7.83		7.27		6.9		7.23	
Specific Conductance	umhos/cm	NS	862		372		1539		789		956		609		652		743		1608		1487		752	

See last page for notes.

TABLE 9
April 2014 Groundwater Analytical Summary
6NYCRR Part 360 Baseline Parameter List

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	NYSDEC Standard$^{(1)}$	MW-SEA-5A		MW-SEA-5B		MW-SEA-6A		MW-SEA-6B		PZ-SEA-1Z		PZ-SEA-5Z		PZ-SEA-6Z		PZ-SEA-3Z	
			04/01/2014		04/02/2014		04/02/2014		04/03/2014		04/07/2014		04/02/2014		04/02/2014		04/08/2014	
Volatile Organic Compounds																		
Acetone	ug/L	50	3	U	3	U	3	U	3	U	3	U	3	U	3	J	4.9	J
Semi-Volatile Organic Compounds																		
None Detected																		
Metals																		
Aluminum, Total Recoverable	ug/L	NS	75.9		129		60	U	313		60	U	60	U	60	U	60	U
Antimony, Total Recoverable	ug/L	3	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U
Arsenic, Total Recoverable	ug/L	25	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	7.5	J	5.6	U
Barium, Total Recoverable	ug/L	1000	33.6	J	50.8	J	426	J	113	J	28.6	J	6.5	J	9.9	J	47.7	J
Beryllium, Total Recoverable	ug/L	NS	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
Boron, Total Recoverable	ug/L	1000	255	J	37	J	207	J	14	J	413	J	**1370**		**1840**		45.9	J
Cadmium, Total Recoverable	ug/L	5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Calcium, Total Recoverable	ug/L	NS	342000		89400		303000		121000		513000		550000		517000		29600	
Chromium, Total Recoverable	ug/L	50	1.7	J	1.3	J	1.7	J	1	J	1.3	J	1.4	J	1	U	1.4	J
Cobalt, Total Recoverable	ug/L	NS	0.63	U	0.64	J	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	1.1	J
Copper, Total Recoverable	ug/L	200	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U
Iron, Total Recoverable	ug/L	300	**494**		273		**401**		270		**759**		**569**		**823**		19.3	U
Lead, Total Recoverable	ug/L	25	3	U	3	U	3.2	J	3	U	3	U	3	U	3	J	3	U
Magnesium, Total Recoverable	ug/L	35000	**57300**		**84900**		**41500**		**67500**		**41800**		**46400**		**54200**		**54700**	
Manganese, Total Recoverable	ug/L	300	22.7	J	46.9		13.9	J	17.8	J B	11	J	36.6		53		1	J
Mercury, Total Recoverable	ug/L	0.7	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
Nickel, Total Recoverable	ug/L	100	1.3	U	1.4	J	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U
Potassium, Total Recoverable	ug/L	NS	3670		4940		3550		740	J	4180		12400		15600		20100	
Selenium, Total Recoverable	ug/L	10	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U
Silver, Total Recoverable	ug/L	50	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Sodium, Total Recoverable	ug/L	20000	13200		10500		6840		6890		**20800**		**38300**		**53700**		18900	
Thallium, Total Recoverable	ug/L	NS	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U
Vanadium, Total Recoverable	ug/L	NS	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U
Zinc, Total Recoverable	ug/L	5000	1.5	U	1.5	U	1.5	U	3.3	J B	1.5	U	1.5	J	1.5	U	1.5	U
General Chemistry																		
Bromide	mg/L	2	0.16	J	0.073	U	0.15	U	0.073	U	0.37	U	0.37	U	0.37	U	0.073	U
Chloride	mg/L	250	15.4		32.3		17.9		12.1		52.5		13.5		25.8		13.1	
Sulfate	mg/L	250	**741**		176		**619**		99		**1160**		**1550**		**1430**		90.9	
Ammonia (as N)	mg/L as N	2	0.07		0.009	U	0.23		0.009	U	0.12		0.58		0.79		0.009	U
Total Kjeldahl Nitrogen	mg/L as N	NS	0.39		0.15	U	0.65	B	0.54		0.31	B	0.82		0.85		0.15	U
Chemical Oxygen Demand	mg/L	NS	18.2		5	U	5	U	5	U	6.6	J	5.6	J	12.6		12.6	
Phenolics, Total Recoverable	mg/L	0.005	**0.012**		0.007	J B	0.005	U	0.005	U	0.005	U	0.005	U	0.0077	J B	0.0082	B
Chromium, hexavalent	mg/L	0.05	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Cyanide, Total	mg/L	0.2	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Nitrate	mg/L as N	10	0.02	U	0.16		0.02	U	0.95		0.02	U	0.02	U	0.02	U	**12.4**	
Color	Color Units	15	15		10		**25**		0.01	U	10		10		5		15	
Alkalinity, Total	mg/L	NS	275		401		339		470		307		253		221		211	
Total Hardness	mg/L	NS	1140		520		1150		580		1650		1650		1750		310	
Total Dissolved Solids	mg/L	500	**1450**		**849**		**1370**		**631**		**2210**		**2490**		**2510**		**870**	
Biochemical Oxygen Demand	ug/L	NS	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Total Organic Carbon	mg/L	NS	2.9		1.2		7.8		2.6		2.6		3.6		2		2.2	
Sulfide	mg/L	1000	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U
Field Parameters																		
Temperature	Degrees C	NS	9.4		5.2		10.9		7.3		10.1		6.5		10.7		9.5	
Oxidation Reduction Potential	millivolts	NS	47		111		9		209		25		55		22		74	
Turbidity	NTU	5	**9.4**		**6.1**		2.7		**5.5**		3		4		3		**10.7**	
Field pH	SU	NS	7.26		6.54		7.09		6.54		7.08		6.77		7.19		7.45	
Specific Conductance	umhos/cm	NS	1468		1140		1399		905		2206		2257		2313		607	

See last page for notes.

TABLE 9
April 2014 Groundwater Analytical Summary
6NYCRR Part 360 Baseline Parameter List

Mill Seat Landfill
Town of Riga, New York

Notes:

(1) Groundwater standards from: New York State Department of Environmental Conservation (NYSDEC) Division of Water Technical and Operation Guidance Series (TOGS 1.1.1), August 1999.

*shaded cells indicate exceedance of of TOGS 1.1.1 Class GA Guidance Criteria

μg/L: micrograms per liter (parts per billion)

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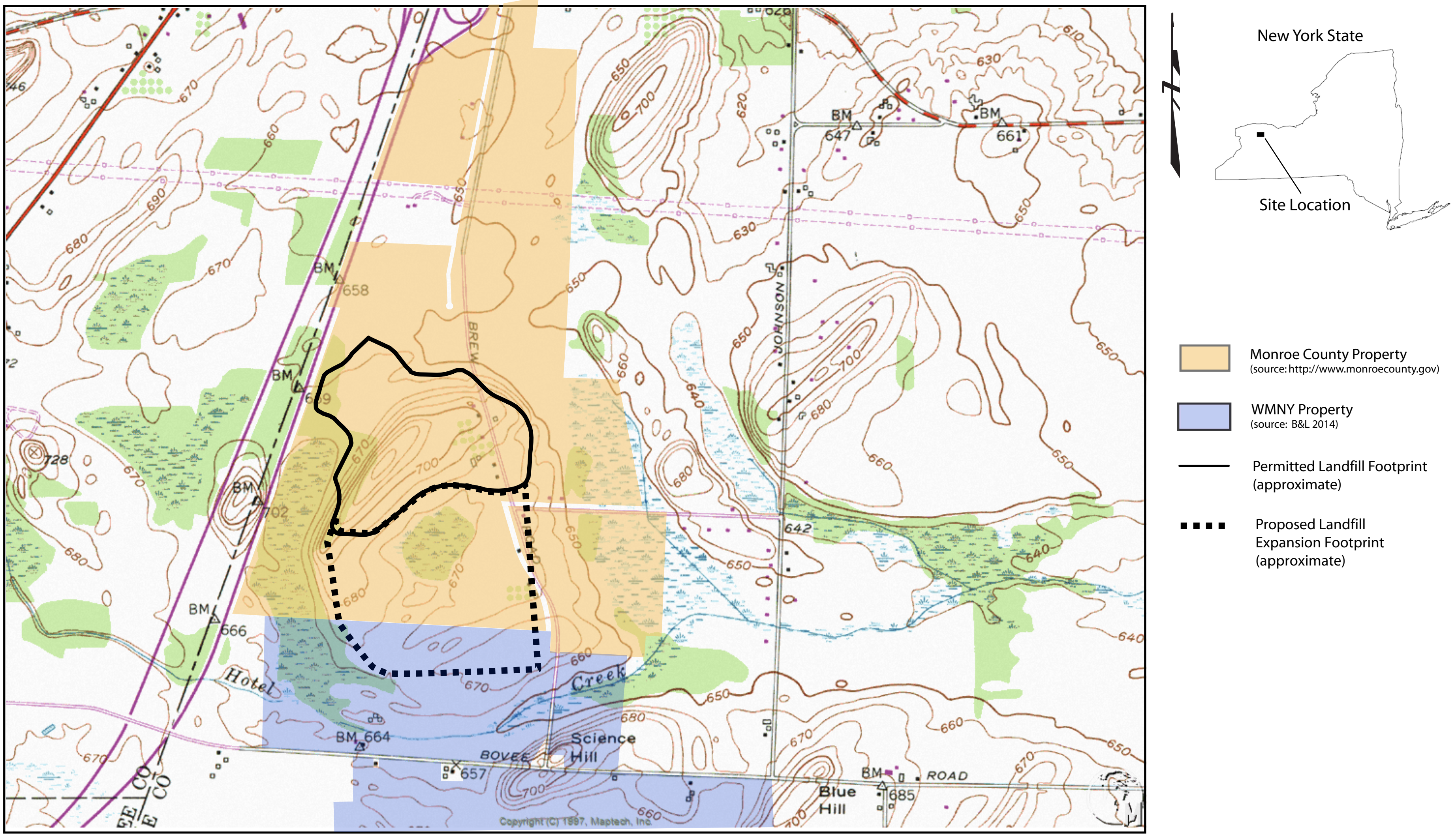
ntu: Nephelometric Turbidity Units

s.u.: Standard Unit for pH

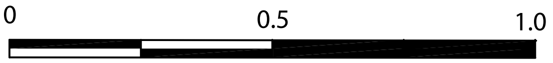
U : Indicates that the analyte was analyzed for, but was not detected. The sample quantitation limit is presented. This qualifier is also used in the validation process to signify that the reporting limit of an analyte was raised due to blank contamination.

J : Indicates that the concentration of the result should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process. This qualifier is also applied by the laboratory when the analyte concentration was greater than the method detection limit (MDL) but less than the reporting limit. For inorganic results, the qualifier “J” was applied by the laboratory when the analyte concentration was greater than the instrument detection limit (IDL) or MDL but less than the QL.

UJ : Indicates that the analyte was analyzed for, but was not detected. The sample quantitation limit is presented, and should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process.



🟧	Monroe County Property (source: http://www.monroecounty.gov)
🟦	WMNY Property (source: B&L 2014)
—	Permitted Landfill Footprint (approximate)
▪ ▪ ▪ ▪	Proposed Landfill Expansion Footprint (approximate)



SCALE

(miles, approximate)

Modified from original figure prepared by AMEC-Geomatrix, Inc. dated August 2010

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

Project 1328270

SITE LOCATION

January 2015

Figure 1

SOURCE:
1. 2011 BING MAPS ACCESSED VIA ARCGIS ONLINE (*www.arcgis.com*).
2. NYS GIS CLEARINGHOUSE

0 800 1,600

SCALE: 1" = 800'

Mill Seat Landfill
Proposed Landfill Expansion
Riga, New York

Town of Riga, New York
Monroe County

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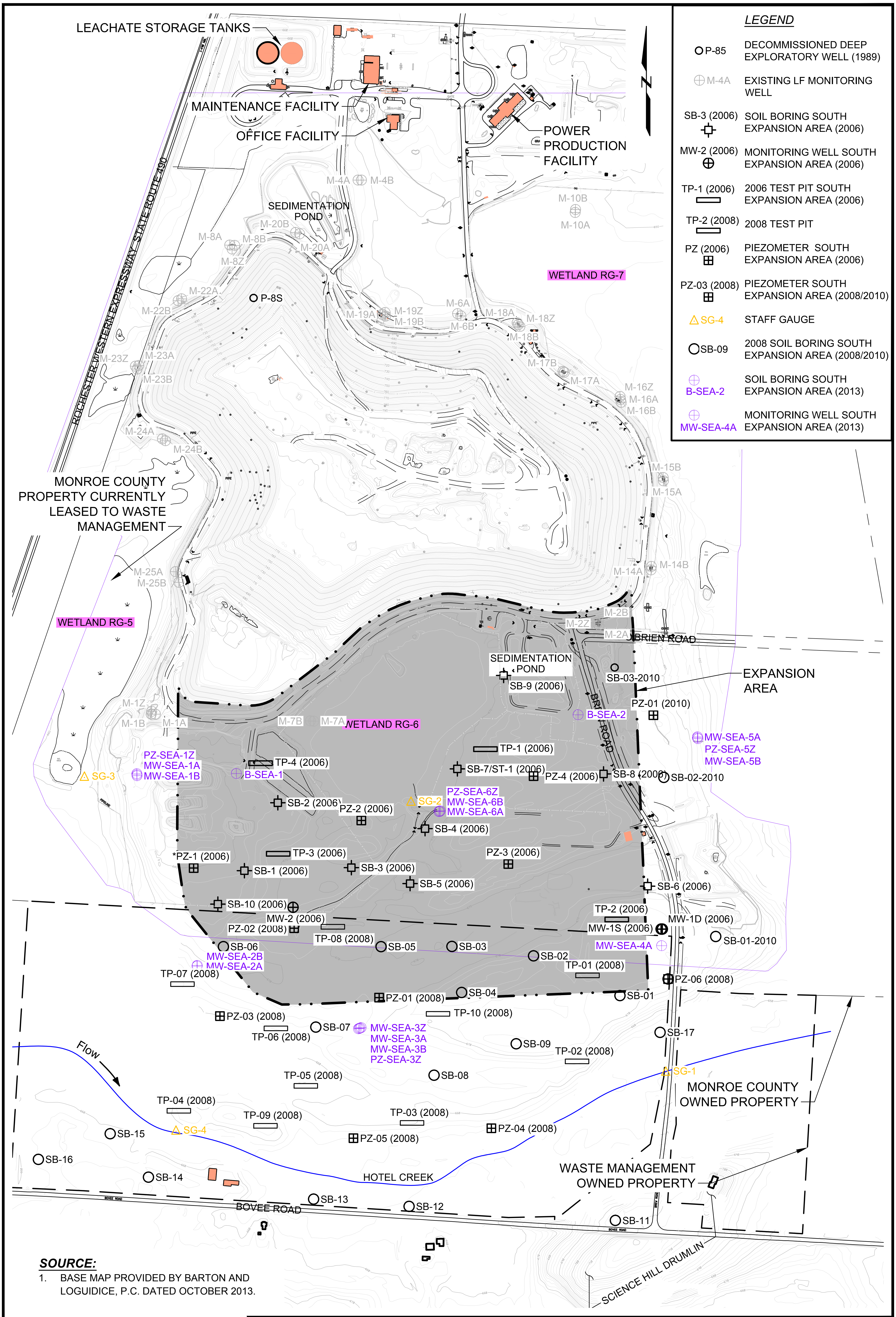
SITE FEATURES

Project 1328270

January 2015

Fig. 2

J:\Projects\Town of Riga NY\Mill Seat Landfill\MillSeat-Site Features.mxd



LEGEND

P-85	DECOMMISSIONED DEEP EXPLORATORY WELL (1989)
M-4A	EXISTING LF MONITORING WELL
SB-3 (2006)	SOIL BORING SOUTH EXPANSION AREA (2006)
MW-2 (2006)	MONITORING WELL SOUTH EXPANSION AREA (2006)
TP-1 (2006)	2006 TEST PIT SOUTH EXPANSION AREA (2006)
TP-2 (2008)	2008 TEST PIT
PZ (2006)	PIEZOMETER SOUTH EXPANSION AREA (2006)
PZ-03 (2008)	PIEZOMETER SOUTH EXPANSION AREA (2008/2010)
SG-4	STAFF GAUGE
SB-09	2008 SOIL BORING SOUTH EXPANSION AREA (2008/2010)
B-SEA-2	SOIL BORING SOUTH EXPANSION AREA (2013)
MW-SEA-4A	MONITORING WELL SOUTH EXPANSION AREA (2013)

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 500' 1000'

SCALE: 1" = 500'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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PROPOSED EXPANSION FOOTPRINT

January 2015

Fig. 3

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\3 - Landfill Expansion Footprint.dwg - 1/15/2015

SOURCE:
1. 2011 BING MAPS ACCESSED VIA ARCGIS ONLINE *(www.arcgis.com)*.
2. NYS GIS CLEARINGHOUSE

0 0.5 1
Miles

Mill Seat Landfill
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Riga, New York

Town of Riga, New York
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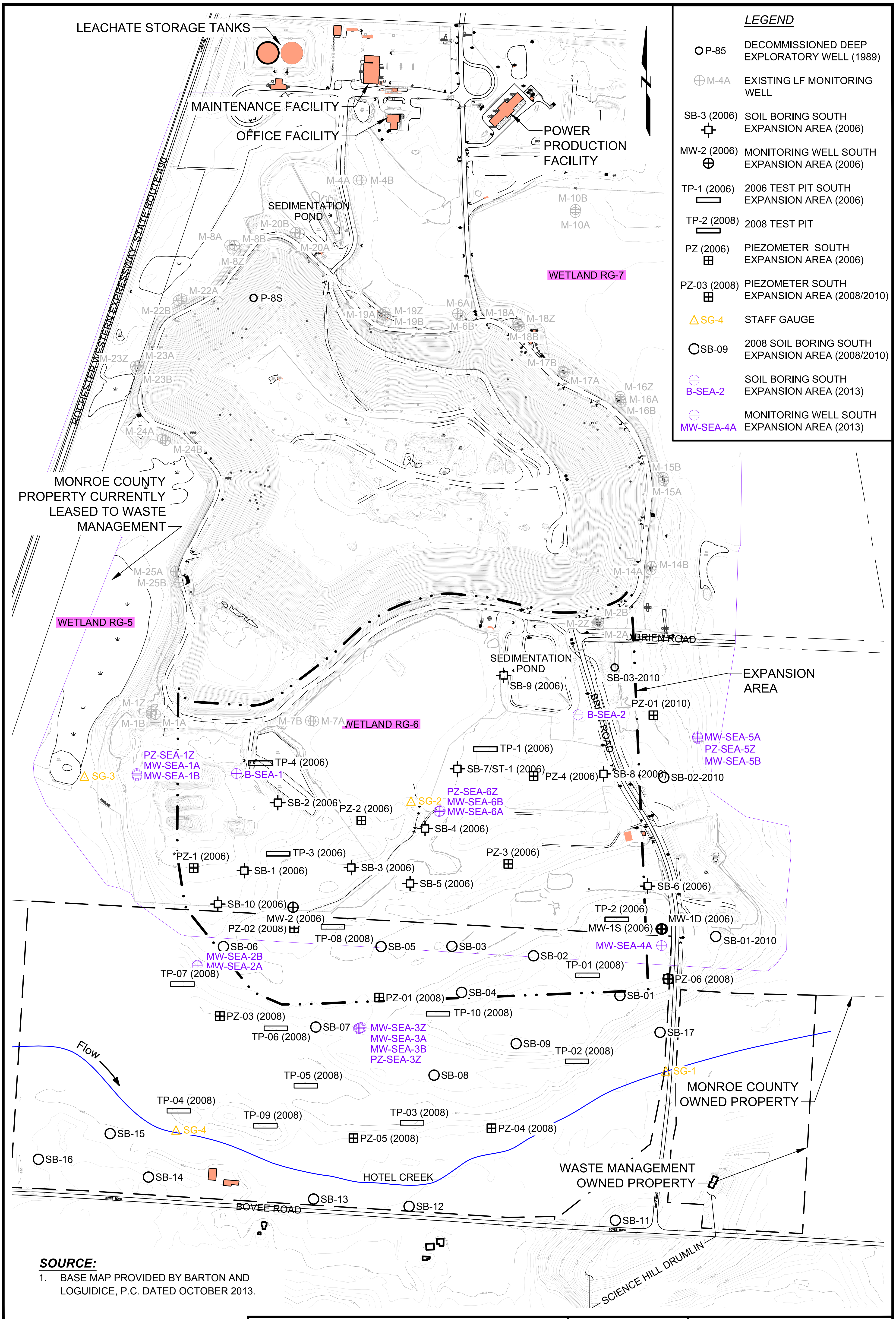
WATER WELL SURVEY AREA

January 2015

Fig. 4

J:\Projects\Town of Riga NY\Mill Seat Landfill\MillSeat-Landfill Well radius update.mxd



SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
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Town of Riga, New York
Monroe County

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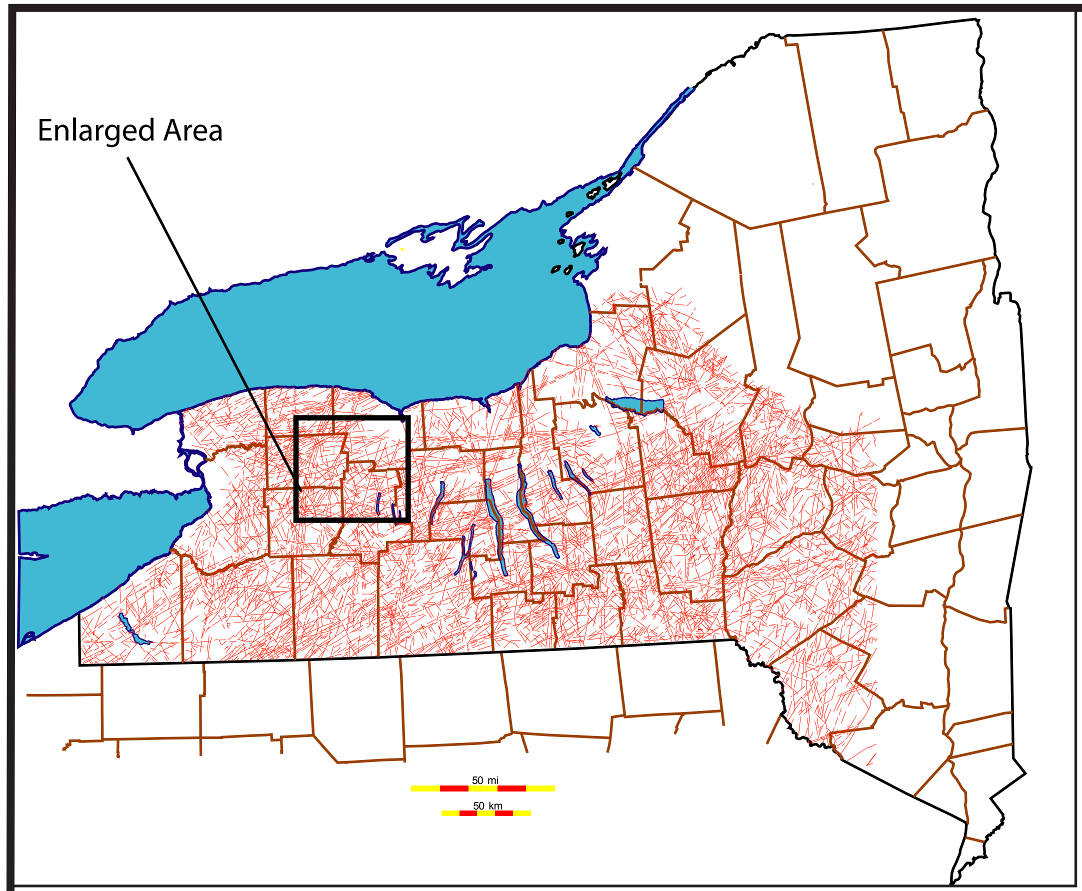
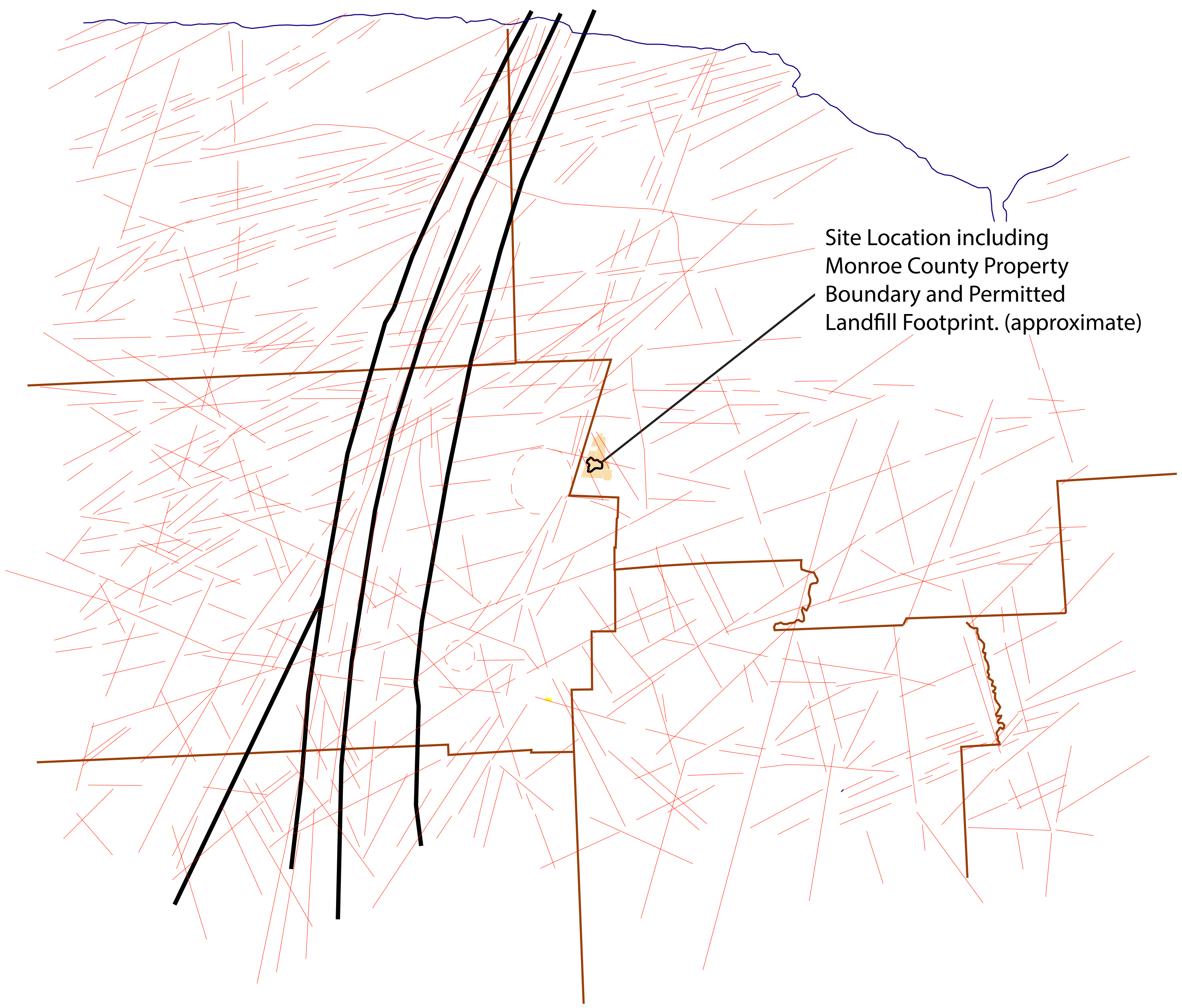
MONITORING WELL, PIEZOMETER, SOIL BORING, AND TEST PIT LOCATIONS

January 2015

Fig. 5

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\5 - Monitoring Well Piezometer Soil Boring and Test Pits.dwg - 1/15/2015





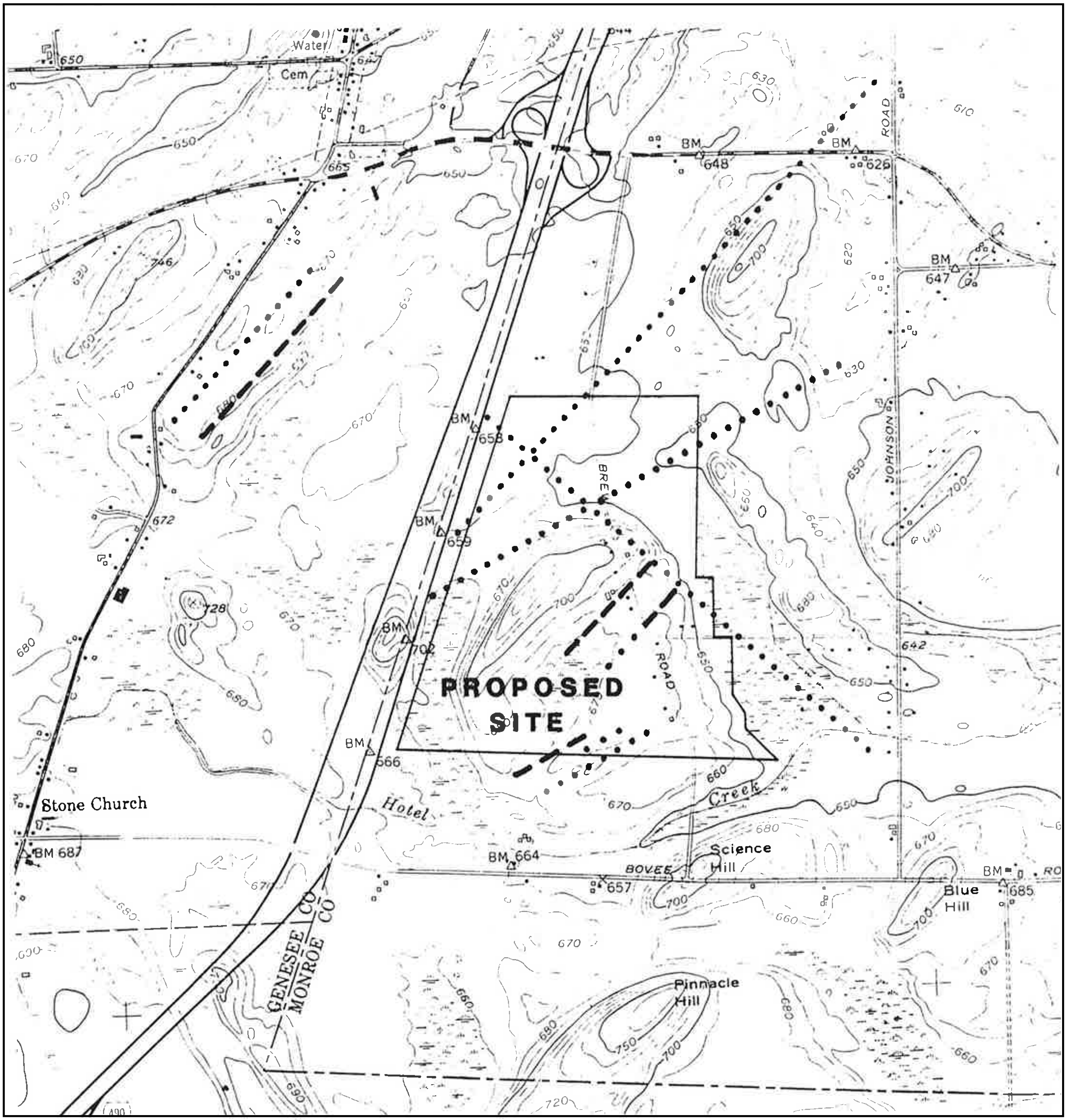
EXPLANATION

Surface lineament

Clarendon-Linden Fault System

Figure modified from original by Jacobi, R.D., et al., 2002 entitled "Fig. 2. Map of Landsat Lineaments",
Basement Faults and Seismicity in the Appalachian Basin of New York State. Tectonophysics, Volume 353, Issue 1, p. 75-113

Mill Seat Landfill Proposed Landfill Expansion Hydrogeologic Investigation	GEI Consultants	INTERPRETED REGIONAL LINEAMENTS	
Town of Riga, New York Monroe County	Project 1328270	January 2015	Figure 6



LEGEND

— — — — Topographic Linear Feature

• • • • • • Tonal Linear Feature

Modified from original figure prepared by Haley and Aldrich, entitled "Figure 3-5: Site Structural Features", Mill Seat Solid Waste Landfill Hydrogeologic Report, 1989

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

SITE STRUCTURAL FEATURES

Project 1328270

January 2015

Figure 7

SOURCE:
2011 ESRI WORLD IMAGERY ACCESSED VIA ARCGIS ONLINE
(www.arcgis.com).
2. AQUIFER DATA FROM U.S. GEOLOGICAL SURVEY AND THE NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION.

0 20,000 40,000
SCALE: 1" = 20000'

Mill Seat Landfill
Proposed Landfill Expansion
Riga, New York

Town of Riga, New York
Monroe County

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REGIONAL NEW YORK STATE AQUIFERS

Project 1328270
January 2015
Fig. 8

J:\Projects\Town of Riga NY\Mill Seat Landfill\MillSeat-Landfill Aquifers.mxd

LEGEND

- ⊕ NYSDEC WATER WELL PROGRAM
- MCWA WATER SUPPLY LINE
- PROPERTIES WITH AN OPERABLE WELL
- PROPERTIES RECEIVING WELL SURVEY QUESTIONAIRE
- APPROXIMATE EXPANSION FOOTPRINT

0 950 1,900

SCALE: 1" = 950'

SOURCE:
1. 2011 BING MAPS ACCESSED VIA ARCGIS ONLINE (www.arcgis.com).
2. NYS GIS CLEARINGHOUSE
3. MONORE COUNTY GIS
4. WATER SUPPLY LINE FROM MONROE COUNTY WATER AUTHORITY.

Mill Seat Landfill
Proposed Landfill Expansion
Riga, New York

Town of Riga, New York
Monroe County

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WATER WELL SURVEY RESULTS

January 2015

Fig. 9

J:\Projects\Town of Riga NY\Mill Seat Landfill\MillSeat-Landfill Well radius update results.mxd

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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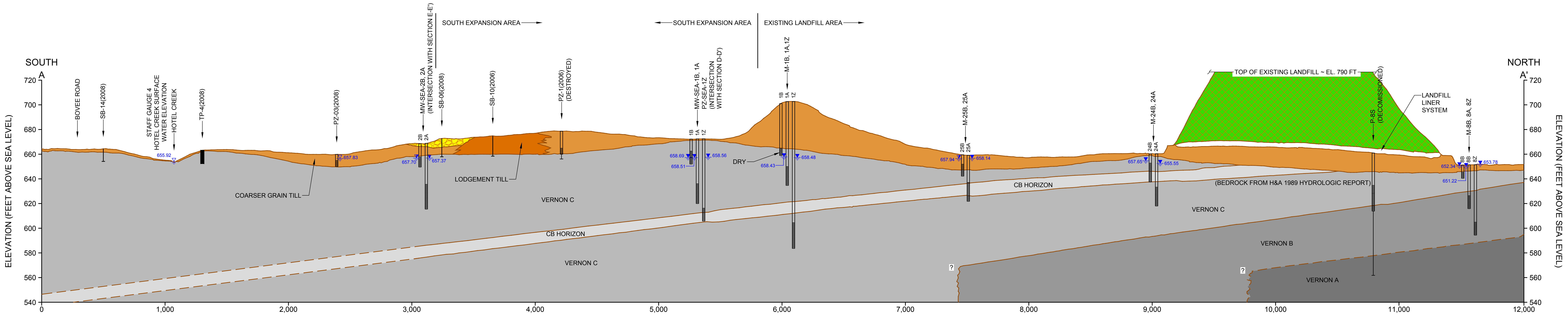
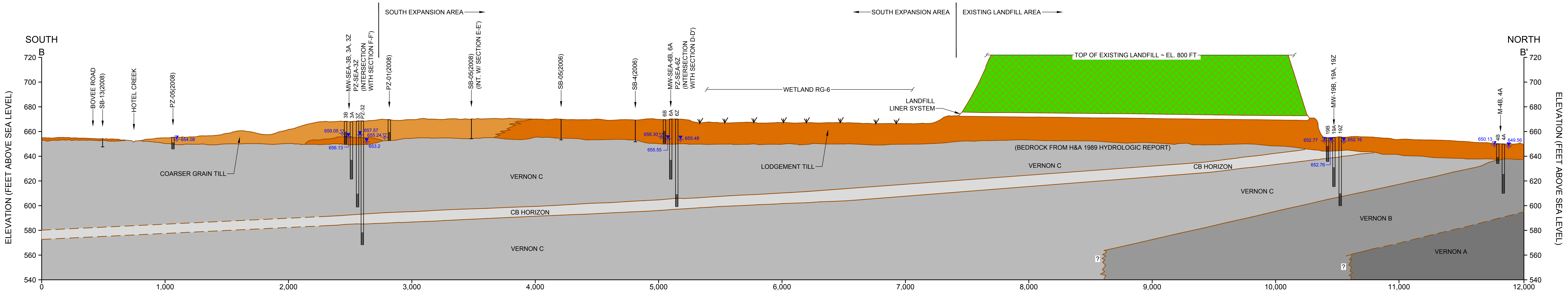
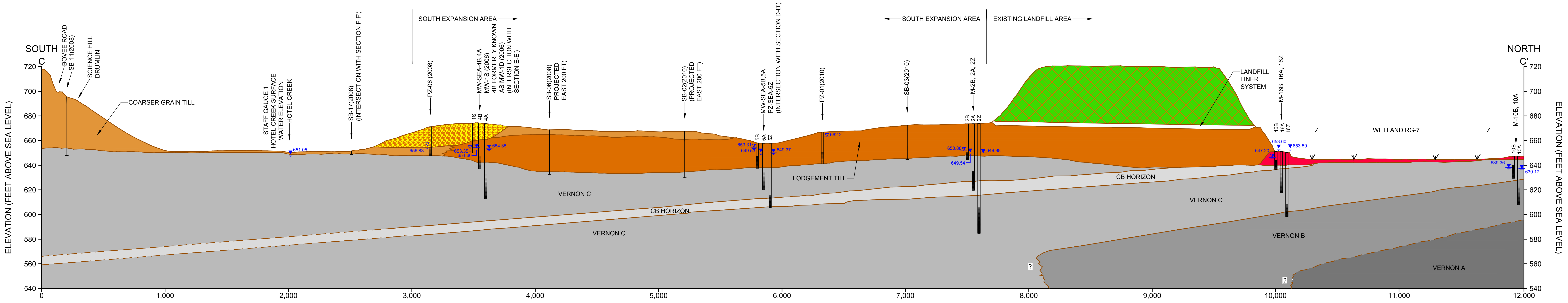
CROSS SECTION LOCATIONS

Project 1328270 | January 2015 | Fig. 10

\\gtb1v-fs01\ I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\Hydrogeologic Investigation\10 - Cross Section Locations.dwg - 2/16/2015







LEGEND:

MW-SEA-3B, 3A, 3Z
PZ-SEA-3Z → MONITORING WELL ID

653.31 ▼ GROUNDWATER ELEVATION (NOVEMBER 14, 2013)

▼ OVERBURDEN/BEDROCK INTERFACE WELL ELEVATION

▽ OVERBURDEN WELL ELEVATION

▼ BEDROCK WELL ELEVATION

WELL SCREEN

SB-09(2008) → SOIL BORING ID

BOTTOM OF BORING

TP-4(2008) → ▮ TEST PIT ID

OVERBURDEN

▨	COBBLES, GRAVEL AND SAND
🟧	COARSER GRAIN DENSE TILL
🟧	LODGEMENT TILL
🟩	WASTE
🟥	LACUSTRINE DEPOSITS

BEDROCK

⬜	VERNON C
⬜	CB HORIZON
⬜	VERNON B
⬛	VERNON A

0 300 600
SCALE: 1" = 300'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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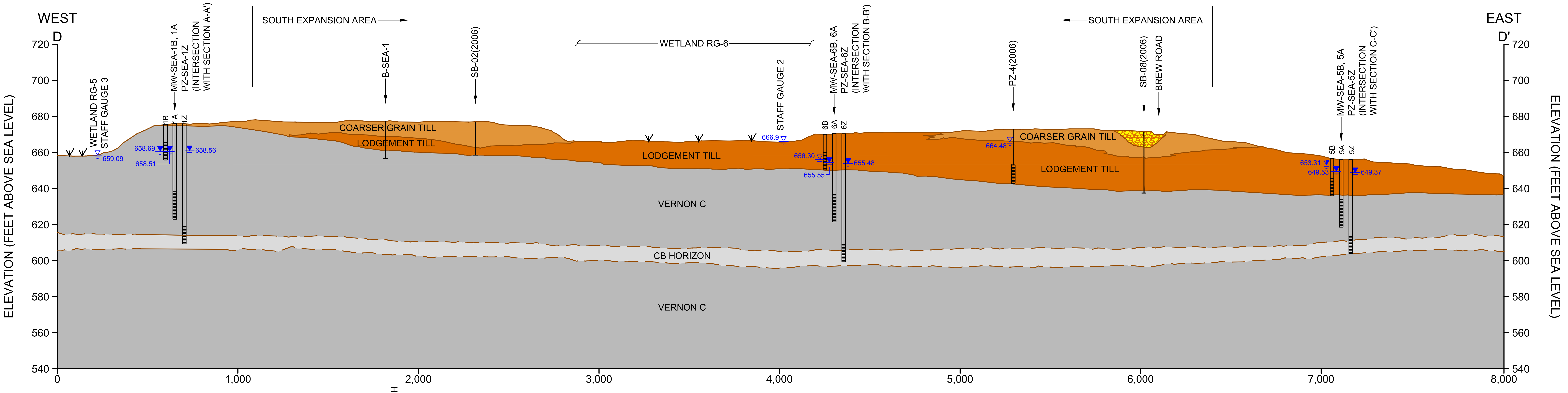
Project 1328270

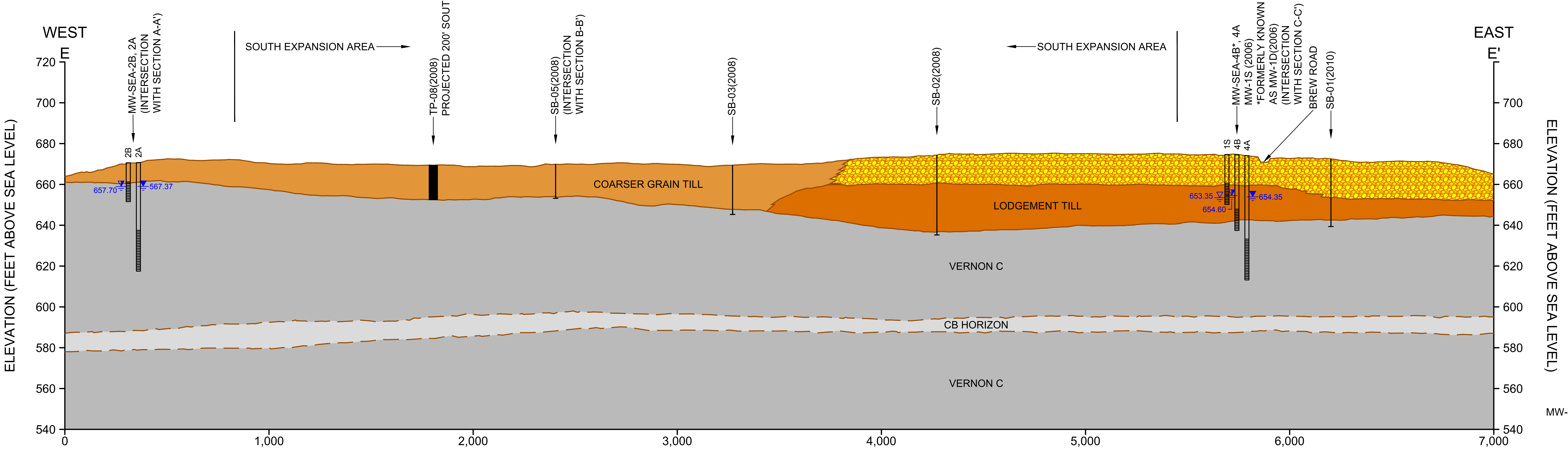
CROSS SECTIONS
A, B, AND C

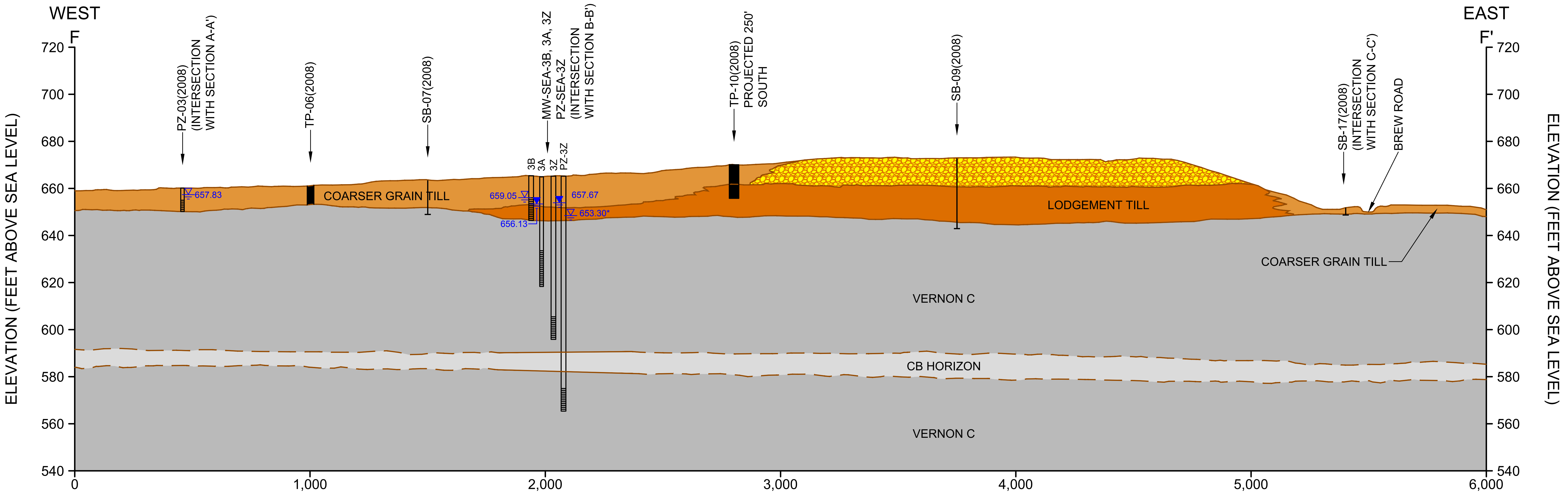
January 2015

Fig. 11

\\gtb1v-fs01\ I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\12 - Cross Sections A, B, C.dwg - 1/15/2015







LEGEND:

MW-SEA-3B, 3A, 3Z
PZ-SEA-3Z → MONITORING WELL ID

653.31 ▼ GROUNDWATER ELEVATION (NOVEMBER 14, 2013)

▼ OVERBURDEN/BEDROCK INTERFACE WELL ELEVATION

* GROUNDWATER ELEVATION FROM OCTOBER 2013 GAUGING EVENT

▽ OVERBURDEN WELL ELEVATION

▼ BEDROCK WELL ELEVATION

▤ WELL SCREEN

SB-09(2008) → SOIL BORING ID

⊥ BOTTOM OF BORING

TP-10(2008) → ▮ TEST PIT ID

OVERBURDEN

🟨 COBBLES, GRAVEL AND SAND

🟧 COARSER GRAIN DENSE TILL

🟧 LODGEMENT TILL

🟩 WASTE

🟥 LACUSTRINE DEPOSITS

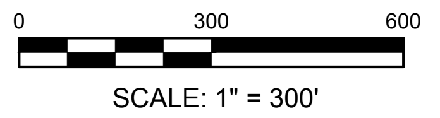
BEDROCK

⬜ VERNON C

⬜ CB HORIZON

⬜ VERNON B

⬛ VERNON A



SCALE: 1" = 300'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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CROSS SECTIONS
D, E, AND F

Project 1328270
January 2015
Fig. 12

\\gtb1v-fs01\ I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\13 - Cross Sections D, E, F.dwg - 1/15/2015

N

Map Scale: 1:12,400

Meters	0	150	300	600	900
Feet	0	500	1000	2000	3000

*Soil-type descriptions are provided in Appendix H.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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Project # 1328270

USDA SOILS MAP

January 2015

Figure 13

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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OVERBURDEN THICKNESS

Project 1328270 | January 2015 | Fig. 14

LEGEND

○ P-85	DECOMMISSIONED DEEP EXPLORATORY WELL (1989)
⊕ M-4A	EXISTING LF MONITORING WELL
SB-3 (2006) ⌖	SOIL BORING SOUTH EXPANSION AREA (2006)
MW-2 (2006) ⊕	MONITORING WELL SOUTH EXPANSION AREA (2006)
TP-1 (2006) ▭	2006 TEST PIT SOUTH EXPANSION AREA (2006)
TP-2 (2008) ▭	2008 TEST PIT
PZ (2006) ⊞	PIEZOMETER SOUTH EXPANSION AREA (2006)
PZ-03 (2008) ⊞	PIEZOMETER SOUTH EXPANSION AREA (2008/2010)
△ SG-4	STAFF GAUGE
○ SB-09	2008 SOIL BORING SOUTH EXPANSION AREA (2008/2010)
⊕ B-SEA-2	SOIL BORING SOUTH EXPANSION AREA (2013)
⊕ MW-SEA-4A	MONITORING WELL SOUTH EXPANSION AREA (2013)
— 5 —	SAND AND GRAVEL ISOPLETH

NOTES:

1. EXTENT OF SAND AND GRAVEL INFERRED FROM EM-31 GEOPHYSICAL SURVEY COMPLETED BY GEOMATRIX (JAN. 2011).

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'

SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

SAND AND GRAVEL THICKNESS

Project 1328270 | January 2015 | Fig. 15

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill Proposed Landfill Expansion Hydrogeologic Investigation	GEI Consultants	BEDROCK TOPOGRAPHY
Town of Riga, New York Monroe County	Project 1328270	January 2015 Fig. 16

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\16 - Bedrock Topography.dwg - 1/15/2015

LEGEND

M-4A	EXISTING LF MONITORING WELL
MW-2 (2006) ⊕	MONITORING WELL SOUTH EXPANSION AREA (2006)
PZ (2006) ⊞	PIEZOMETER SOUTH EXPANSION AREA (2006)
PZ-03 (2008) ⊞	PIEZOMETER SOUTH EXPANSION AREA (2008/2010)
△ SG-4	STAFF GAUGE
MW-SEA-4A	MONITORING WELL SOUTH EXPANSION AREA (2013)
*	PIEZOMETER DESTROYED APPROXIMATE HISTORIC WATER LEVEL CONTOURED
**	WATER LEVEL NOT RECOVERED FROM OCT 2013 SAMPLING EVENT. SEPTEMBER 2013 WELL INVENTORY WATER LEVEL APPROX 660.
—654—	GROUNDWATER CONTOUR
⇨	FLOW DIRECTION

NOTES:

1. GROUNDWATER ELEVATIONS SHOWN FOR WELLS/PIEZOMETERS SCREENED IN THE OBERBURDEN.

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

Project 1328270

WATER TABLE MAP
(NOVEMBER 14, 2013)

January 2015

Fig. 17

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\17 - Water Table Map - 2014-11-14.dwg - 1/15/2015

LEGEND

M-4A	EXISTING LF MONITORING WELL
MW-2 (2006) ⊕	MONITORING WELL SOUTH EXPANSION AREA (2006)
PZ (2006) ⊞	PIEZOMETER SOUTH EXPANSION AREA (2006)
PZ-03 (2008) ⊞	PIEZOMETER SOUTH EXPANSION AREA (2008/2010)
△ SG-4	STAFF GAUGE
MW-SEA-4A	MONITORING WELL SOUTH EXPANSION AREA (2013)
*	PIEZOMETER DESTROYED APPROXIMATE HISTORIC WATER LEVEL CONTOURED
**	WATER LEVEL NOT RECOVERED FROM OCT 2013 SAMPLING EVENT. SEPTEMBER 2013 WELL INVENTORY WATER LEVEL APPROX 660.
—654—	GROUNDWATER CONTOUR
➡	FLOW DIRECTION

NOTES:

1. GROUNDWATER ELEVATIONS SHOWN FOR WELLS/PIEZOMETERS SCREENED IN THE OVERBURDEN.

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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WATER TABLE MAP
(APRIL 3, 2014)

January 2015

Fig. 18

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\18 - Water Table Map - 2014-04-03.dwg - 1/15/2015

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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Project 1328270

B-ZONE
POTENTIOMETRIC SURFACE
(NOVEMBER 14, 2013)

January 2015 Fig. 19

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\19 - B-Zone Potentiometric Surface - 2013-11-14.dwg - 1/15/2015

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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B-ZONE
POTENTIOMETRIC SURFACE
(APRIL 3, 2014)

January 2015

Fig. 20

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\20 - B-Zone Potentiometric Surface - 2014-04-03.dwg - 1/15/2015

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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A-ZONE
POTENTIOMETRIC SURFACE
(NOVEMBER 14, 2013)

January 2015

Fig. 21

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\21 - A-Zone Potentiometric Surface - 2013-11-14.dwg - 1/15/2015

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

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A-ZONE
POTENTIOMETRIC SURFACE
(APRIL 3, 2014)

January 2015

Fig. 22

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\22 - A-Zone Potentiometric Surface - 2014-04-03.dwg - 1/15/2015

SOURCE:
1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

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Z-ZONE
POTENTIOMETRIC SURFACE
(NOVEMBER 14, 2013)

January 2015 Fig. 23

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\23 - Z-Zone Potentiometric Surface - 2013-11-14.dwg - 1/15/2015

SOURCE:
1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

Project 1328270

Z-ZONE
POTENTIOMETRIC SURFACE
(APRIL 3, 2014)

January 2015

Fig. 24

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\24- Z-Zone Potentiometric Surface - 2014-04-03.dwg - 1/15/2015

SOURCE:
1. 2011 BING MAPS ACCESSED VIA ARCGIS ONLINE *(www.arcgis.com)*.
2. NYS GIS CLEARINGHOUSE

0 800 1,600
SCALE: 1" = 800'

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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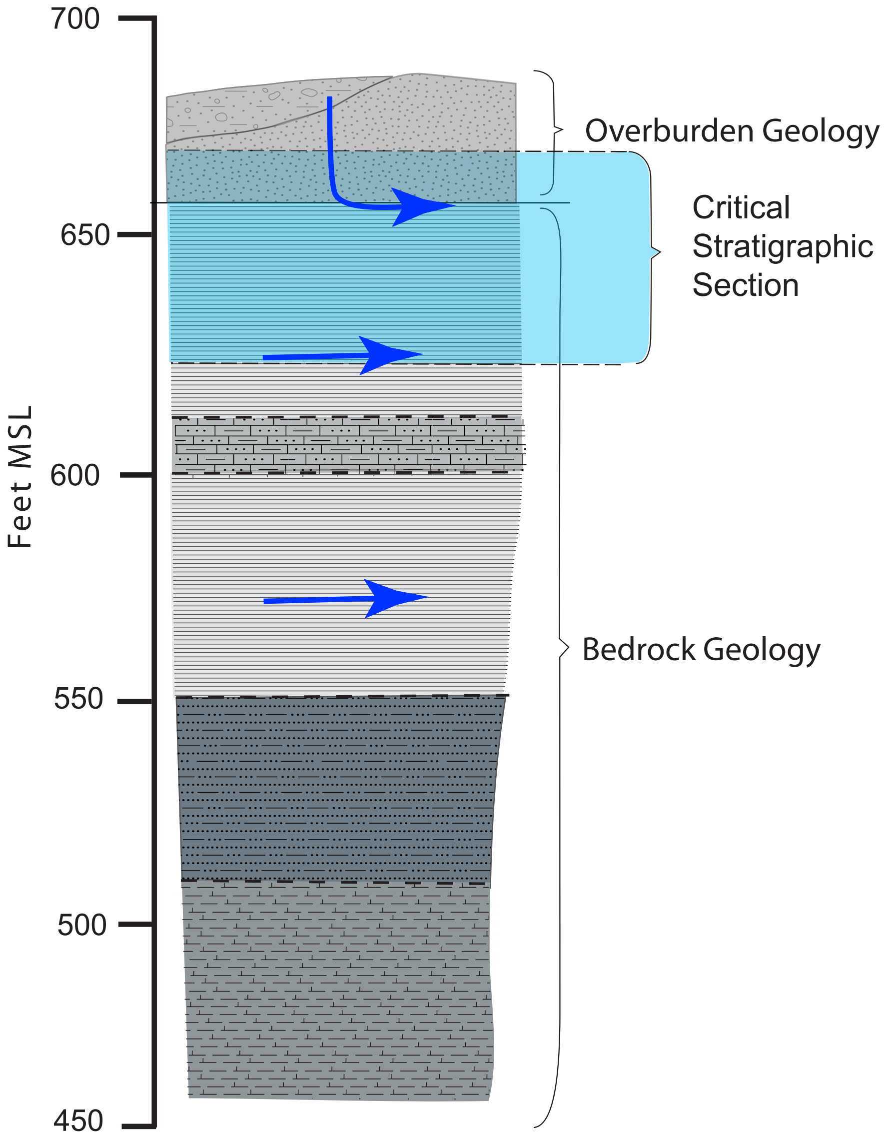
Project 1328270

WETLAND BOUNDARIES
AND SURFACE WATER
SAMPLING LOCATIONS

January 2015

Figure 25

J:\Projects\Waste Managment of New York\Mill Seat Landfill\MillSeat-Landfill Wetland Boundaries and SW.mxd



EXPLANATION

▤ Vernon C

▦ CB Horizon (Vernon C Dolostone)

▩ Vernon B

▦ Vernon A

➔ Groundwater Flow Direction

▨ Lodgement Till

▨ Coarser-Grained Till

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

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Project 1328270

CRITICAL STRATIGRAPHIC SECTION

January 2015

Figure 26

Appendix A

NYSDEC Correspondence (dated July 31, 2013 and August 6, 2013)

GEI Consultants

90B John Muir Drive
Suite 104
Amherst, NY 14228

Ph: (716) 204-7154

Memorandum

To: Mark Domagala (NYSDEC Region 8)

CC: Becky Zayatz (Waste Management)
Chris Prucha (Waste Management)

From: Richard Frappa, P.G.

Regarding: Summary of Draft Site Investigation Plan Discussion for Mill Seat Landfill Lateral Expansion

Date: July 31, 2013

This technical memorandum summarizes discussions held on July 26, 2013 with Mr. Mark Domagala (Region 8 NYSDEC) at the NYSDEC Avon Office regarding the Draft Site Investigation Plan (SIP) submitted to the NYSDEC on June 25, 2013. The agenda for the meeting is attached to this memo. Also in attendance were Becky Zayatz and Chris Prucha of Waste Management.

The purpose of the meeting was to discuss the scope of work presented in the SIP for lateral expansion of the Mill Seat Landfill and update the NYSDEC on issues with the sampling pump in well MW1Z and sampling results for the Stage 4 secondary leachate collection system to be included in the Second Quarter 2013 Environmental Monitoring Report. Meeting topics discussed were those included on the attached agenda.

A key point of the discussion was the critical stratigraphic section (CSS) and the depth of bedrock investigation during implementation of the SIP for the expansion area. Key points and items agreed to during implementation of the SIP are summarized below.

CSS and Drilling Depth in Bedrock

As discussed during the meeting and detailed in the SIP, the CSS at Mill Seat is described to consist of the overburden and upper 30 feet of bedrock. The bedrock portion of the CSS, as described in previous investigations completed for permitting of the existing landfill, was determined from packer tests. Hydraulic conductivities calculated for the intervals of the bedrock tested showed that the upper 30 to 40 feet of upper competent bedrock were greater than 1×10^{-3} cm/s compared to values typically two order of magnitude less in the deeper bedrock. After much discussion about bedrock investigation depths, it was agreed that the site investigation will characterize hydraulic conductivity to establish the vertical extent of the CSS in bedrock. It is assumed, based on testing completed for the existing landfill, that hydraulic conductivity will decrease with depth and the A-zone monitoring well will be set to monitor the most conductive zone in the upper bedrock (within 50 feet of bedrock surface). Prior to bedrock well installation, packer tests will be completed at 10 foot intervals. Testing will continue until lower hydraulic conductivity bedrock is encountered indicating the bottom of the CSS. Criteria for discontinuing to core and packer test will be: 1) one to two packer tests having lower hydraulic conductivity (an approximately two orders of magnitude lower K value than shallower bedrock) or 2) drilling and testing has advanced to a depth of 50 feet. In the case of the former, the A-zone well screen will be placed to monitor the zone having the highest hydraulic conductivity. In the case of the latter, the NYSDEC will be contacted and a decision will be reached in the field regarding the length and placement of the A-zone well screen.

Clarifications to SIP Scope of Work

The following provides clarification to activities described in Section 5.0 of the Draft SIP.

Section 5.1 Literature Search – Site-specific data will not be limited to the resources listed on page 17. Other sources, as appropriate, will be reviewed for site relevance.

Section 5.2 Water Well Survey – As described, the previously conducted off-site private water well survey will be updated. It is recognized that all recipients of mailed questionnaires may not respond and a door to door survey of some homes will need to be completed to achieve the objective of the task.

Section 5.3 Subsurface Investigation Activities –

> Section 5.4.1 Existing Piezometer/Monitoring well Assessment – If wells need to be decommissioned, wells will be overdrilled, removed, and the open hole grouted to surface.
>
> Section 5.4.2 Soil Borings - All borings will be drilled and sampled to refusal after reaching weathered bedrock. If the presence of a glacial erratic causes refusal, the boring will be relocated within a few feet of the proposed location and re-drilled to the depth of refusal and sampled beyond that depth. The boring proposed in Wetland RG-6 may be completed at a later date after appropriate permit requirements are met for wetland disturbance.
>
> Section 5.4.3 Geotechnical Soil Sample Collection and Analysis – It is recognized that additional permeability data are needed of the till. The number of samples collected for permeability testing will be increased to five (5) samples. Bulk samples of till material may be collected and tested for permeability if Shelby tube sample collection fails to retrieve representative samples.
>
> Section 5.4.4 Monitoring Wells – The volume of water lost during drilling into bedrock and injected during packer testing will be recovered by the driller prior to installing the well. It may be necessary to pump additional water from the well after well installation during development if the equivalent volume of drilling/packer testing water loss is not recovered during the drilling program.

Section 5.5 Hydraulic Conductivity Testing – AQTESOLV or similar program will be engaged to facilitate analysis of hydraulic conductivity testing data. Equations to be used to generate estimated hydraulic conductivity values will be from Hvorslev, Bouwer & Rice, or Cooper Papadopoulos.

Section 5.7 Surface Water Study – The assessment of surface water quality on and near the landfill property will include trend analysis of existing surface water quality data.

Existing Landfill Environmental Monitoring Items

During the meeting we described a report from the Test America sampling crew that the pump at monitoring well M1Z failed and became stuck in the well. The well was unable to be sampled during the Second Quarter 2013 monitoring event. A Project Hydrogeologist from GEI visited well location M1Z to assess a remedy for the inoperative pump. It was confirmed that the pump could not be removed manually and plans are being made to attempt retrieval using a drilling rig. The NYSDEC will be notified when this work is scheduled.

We also discussed sampling results of the Secondary Stage 4 leachate collection system that show evidence of leachate impact. Sampling occurred soon after damage occurred to the "run-out" area of the Stage 4 liner system. The "run-out" is the leading edge of the liner system that extends into the construction area for the next cell so that all of the layers of the liner system can be tied together as a continuous system when the adjacent cell is constructed. A temporary geomembrane flap is welded to the primary liner in this "run-out" area to protect the primary and secondary geosynthetic materials. In addition, the primary liner is welded to the secondary liner to prevent surface water from entering between the two membranes and into the secondary leachate collection system. In April 2013, landfill staff were assessing elevated liquid volumes in the Cell 4 secondary leachate collection system. A check of the preliminary analytical results for the second quarter sample indicated the potential for mixing with leachate. Damage to the exposed liner system in the run-out area was suspected and Golder Associates (Golder) was contacted to inspect the area. WMNY also notified Region 8 NYSDEC. Golder identified a small area where the weld of the temporary flap had failed, tearing a slice in the primary liner. It is believed that during a spring storm, elevated leachate levels in the primary sump area reached the location of the damaged liner, allowing leachate to enter the secondary system. Golder inspected the length of the run-out area and all defects were repaired. The NYSDEC observed the inspection and subsequent repairs to the system. Cell 4C is currently under construction and permanent tie-in to the liner system will be completed as part of this project. It was agreed that samples will be collected from the Primary, Secondary and Underdrain system during the Third Quarter sampling event (July 2013) and analyzed for the Part 360 Baseline parameter list.

Meeting Agenda

Mill Seat Landfill – Lateral Expansion
Draft Site Investigation Plan Discussion
NYSDEC Region 8
July 26, 2013

- Overview of Draft Site Investigation Plan (SIP)

- Critical Stratigraphic Section

- Historical Investigations (AMEC Geomatrix October 2010 – Potential Soil Borrow Areas)

- Scope of Work Discussion
  - ✓ Data Gaps
  - ✓ Part 360 and Design Needs

- Drilling in Wetland RG-6 (permitting – ACOE Nationwide Permit; NYSDEC Permit (Article 24) with rare and endangered species assessment

- Schedule

- Existing Landfill Environmental Monitoring Program
  - ✓ Discussion of inoperable sample collection pump in well MW1Z
  - ✓ Stage 4 Secondary Leachate Collection System 2nd Quarter 2013 Sampling

Frappa, Rick

From: Mark Domagala <madomaga@gw.dec.state.ny.us>
Sent: Tuesday, August 06, 2013 2:15 PM
To: Christopher Prucha; Rebecca Zayatz; Frappa, Rick
Cc: Edward Kieda; Scott Foti
Subject: Re: Mill Seat Landfill - SIP Meeting MEMO

Rick,

The Draft Site Investigation Plan, Mill Seat Sanitary Landfill – Lateral Expansion was submitted to the Department on June 26, 2013 and the discussion with you and Waste Management staff was held on July 26, 2013. A follow-up memo dated July 31, 2013 summarized that discussion.

I have a few follow-up comments concerning the scope of work.

There will be a need to investigate the stratigraphic Z-zone (deep bedrock flow zone) for the proposed expansion area. As you know, the Z-Zone has been identified in previous investigations which have been used to develop the facility's Environmental Monitoring Plan (EMP).

As you are aware, the Z-zone is a component of the EMP and is part of the groundwater monitoring scheme for the landfill. Therefore, there should be a sufficient number of deep bedrock wells, both upgradient and down gradient, to determine hydraulic gradient and hydraulic, geologic and groundwater characteristics. The evaluation of the deep bedrock will also provide the data to support or modify the facility's EMP.

Also, all relative data from the site hydrogeologic investigation must be tied together with the existing landfill to show the hydrogeologic conditions across the entire site, not just representing the expansion area.

5.6 Background groundwater quality testing

Characterizing the existing groundwater quality for the 2013 Site Investigation must follow the existing site EMP. Additional parameters and alternative analyses may also be included in the testing.

5.9 Monitoring Well/Piezometer Abandonment

The Site Investigation report is part of the permit application. All Monitoring wells and piezometer must be listed in the EMP. Those subject to proposed abandonment will be addressed in the EMP and will require NYSDEC notification and approval prior to actual abandonment.

Existing Landfill Environmental Monitoring Items

If the attempt to retrieve the stuck downhole equipment in M-1Z are unsuccessful, well replacement will be necessary.

If you have any questions, please contact me at 585 226-5426 or Scott Foti at 585 226-5408

Sincerely
Mark Domagala

>>> "Frappa, Rick" <rfrappa@geiconsultants.com> 7/31/2013 5:17 PM >>>
Mark,
As discussed at our meeting, we prepared this Memo to document the July 26, 2013 meeting and the discussion items affecting the scope of work of the Site Investigation Plan (SIP) as well as some 2nd quarter landfill monitoring results. We will also provide a set of full size drawings of the figures included in the SIP.

We will contact you after a schedule for SIP implementation has been established with Waste Management.
Thanks again for meeting with us,
Rick

Richard Frappa, PG
Senior Consultant
GEI Consultants, Inc. P.C.
90B John Muir Drive, Suite 104
Amherst, New York 14228
Main: (716) 204-7154
Direct: (716) 204-7156
Cell: (716) 984-5958
Email: rfrappa@geiconsultants.com

www.geiconsultants.com

From: Mark Domagala [mailto:madomaga@gw.dec.state.ny.us]
Sent: Thursday, July 25, 2013 3:46 PM
To: Frappa, Rick; Christopher Prucha; Rebecca Zayatz
Subject: Re: Mill Seat Landfill - Meeting

Rick,

Confirming our meeting tomorrow at 10am at Avon.

Mark Domagala

>>> "Frappa, Rick" <rfrappa@geiconsultants.com> 7/25/2013 3:35 PM >>>
Hi Mark
Just confirming our meeting at your office tomorrow at 10am with Waste Management.
Rick

Sent from my iPhone

On Jul 10, 2013, at 9:33 AM, "Mark Domagala" <madomaga@gw.dec.state.ny.us> wrote:

> Yes, that works great.
>
> Thanks

Mark Domagala

>>> "Frappa, Rick" <rfrappa@geiconsultants.com> 7/10/2013 10:27 AM >>>
Mark,
If July 26 works, I'll send a meeting invite.
Thanks
Rick

Richard Frappa, PG
Senior Consultant
GEI Consultants, Inc.
90B John Muir Drive, Suite 104
Amherst, New York 14228
Main: (716) 204-7154
Direct: (716) 204-7156
Cell: (716) 984-5958
Email: rfrappa@geiconsultants.com

<mime-attachment.jpg>

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From: Mark Domagala [mailto:madomaga@gw.dec.state.ny.us]
Sent: Wednesday, July 10, 2013 10:02 AM
To: Frappa, Rick
Cc: Becky Zayatz (rzayatz@wm.com)
Subject: Re: Mill Seat Landfill - Well M1Z inoperative sampling pump

Rick,

I have to apologize for postponing our Friday meeting this week. I have to take some personal leave for family.
We can re-schedule for later this month as that may fit your current schedule. I am pretty much open the last two weeks of July except 7/23 and 7/30. Please let Becky and Chris know that I have to reschedule.

Thanks
Mark Domagala

>>> "Frappa, Rick" <rfrappa@geiconsultants.com> 7/9/2013 4:02 PM >>>
Mark,
As discussed in our call on July 8, 2013, a groundwater sample was not recovered from monitoring well M1Z during the Second Quarter 2013 sampling event at the Mill Seat Landfill. The Test America sampling crew reported that the sampling pump did not yield water following connection of the air compressor discharge line to the pumping system during sampling. A GEI Hydrogeologist inspected the well and attempted to re-position the pump within the stainless steel well screen. Several attempts were made to pull up on the tubing without the aid of mechanical equipment. The pump could not be moved and remained lodged in-place.

Monitoring well M1Z was installed in July 1989 and is located upgradient of the existing landfill. The well is 119 feet deep and monitors deep bedrock groundwater below the Critical Stratigraphic Section (CSS) established for the site.

We would like to discuss an alternative to sampling the well during our meeting on Friday and use those discussions to develop a plan.

Looking forward to seeing you Friday.

Rick

Richard Frappa, PG
Senior Consultant
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Amherst, New York 14228
Main: (716) 204-7154
Direct: (716) 204-7156
Cell: (716) 984-5958
Email: rfrappa@geiconsultants.com

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Appendix B

Soil Boring and Monitoring Well Construction Logs

MILL SEAT LANDFILL SOUTH EXPANSION AREA - SUMMARY OF RQD AND WATER LOSS DATA

PZ-SEA-1Z Core Interval (feet)	RQD% / Water Loss During Core Run (gallons)	MW-SEA-2A Core Interval (feet)	RQD% / Water Loss During Core Run (gallons)	PZ-SEA-3Z Core Interval (feet)	RQD% / Water Loss During Core Run (gallons)	MW-SEA-4A Core Interval (feet)	RQD% / Water Loss During Core Run (gallons)	PZ-SEA-5Z Core Interval (feet)	RQD% / Water Loss During Core Run (gallons)	PZ-SEA-6Z Core Interval (feet)	RQD% / Water Loss During Core Run (gallons)
5-15	0 % / <50	12-22	14 % / 60	28-38	0 % / <50	38-48	10 % / 100	21-31	12 % / 150	20-30	4 % / 200
15-25	0 % / <50	22-32	9% /400	38-48	23 % / <50	48-53	16% / 350	31-41	41 % / 300	30-40	5% / 400
25-35	0 % / 350	32-42	7 % / 750	48-58	14 % / 400	53-58	8 % / 450	41-51	63 % / 300	40-50	17 % / 500
35-45	4% / 850	42-62	44% / 600	58-68	16% / 1000	58-68	54% / 650			50-60	23% / 500
45-55	8% / 800			69-79	53% / 1000					60-70	61% 500
55-65	39% / 650			79-89	45% / 1000						
				89-99	27% / 1000						
Estimated Total Water Loss	2700	Estimated Total Water Loss	1800	Estimated Total Water Loss	~5000	Estimated Total Water Loss	1600	Estimated Total Water Loss	750	Estimated Total Water Loss	2100
Estimated Water Recovered During Air Rotary	5000+	Recovered During Air Rotary	4000+	Recovered During Air Rotary	7000+	Recovered During Air Rotary	3000+	Estimated Water Recovered During Air Rotary	1500+	Estimated Water Recovered During Air Rotary	3000+

Boring Location

NORTHING: ______ **EASTING:** ______ **STATION:** ______ **OFFSET:** ______
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:** ______
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** ______
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

B-SEA-1

PAGE 1 of 1

Drilling Information

DATE START / END: 8/27/2013 - 8/27/2013
TOTAL DEPTH (FT): 20.9
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO:
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/14	13-13-8-11			**Coarse Grained Till (SC-SM)-** very stiff, dark brown silt with trace fine sand and fine gravel, moist.		
			S-2		2 to 4	24/14	2-6-6-10					
			S-3		4 to 6	24/17	2-4-3-3					
	5									as above, moist throughout.		
			S-4		6 to 8	24/13	2-3-7-18	Sample B-SEA-1 collected (4-16') for grainsize and Atterberg limits testing.				
			S-5		8 to 10	24/19	12-20-26-37			**Lodgement Till (SC-SM)-** hard, reddish brown clayey silt with some fine to coarse sand and little fine gravel, moist.		
	10		S-6		10 to 12	24/17	7-30-53-50					
			S-7		12 to 14	24/19	13-39-63-77			**Lodgement Till** , as above.		
			S-8		14 to 15.9	23/18	24-54-68-75/5"					
	15											
			S-9		16 to 16.9	11/10	35-80/4"			Bedrock- **VERNON C HORIZON-** greenish grey, highly weathered shale, dry to moist.		
			S-10		18 to 20	24/8	13-17-4-16					
	20		S-11		20 to 20.9	11/8	2-75/5"			-advance 4 1/4" HSA to 20.0' bgs. Sampler refusal at 20.9' bgs.		
										End of Boring at 20.9 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: ______ EASTING: ______ STATION: ______ OFFSET: ______
HORIZONTAL DATUM: NAD83 NY West Zone STATION CENTERLINE: ______
VERTICAL DATUM: NAVD 88 ESTIMATED GROUND SURFACE ELEV. (FT): ______
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

B-SEA-2

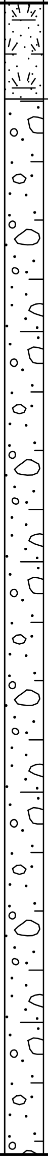
PAGE 1 of 2

Drilling Information

DATE START / END: 8/27/2013 - 8/27/2013
TOTAL DEPTH (FT): 37.2
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO:
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured



Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/13	1-2-3-5		**Topsoil (ML)**- soft, dark brown clayey silt with trace fine sand and rootlets, moist.		
			S-2		2 to 4	24/23	4-12-12-14		**Lodgement Till (SC-SM)**- hard, grey-brown silt and clay with some fine to medium sand and fine gravel, moist throughout.		
	5		S-3		4 to 6	24/23	6-19-19-26	Sample B-SEA-2 collected (0-14') for grainsize and Atterberg limits testing.			
			S-4		6 to 7.5	18/18	12-36-76				
			S-5		8 to 9	12/12	24-75/5"		**Lodgement Till** as above.		
	10		S-6		10 to 11	12/12	25-75/6"				
			S-7		12 to 13	12/12	40-75/6"				
	15		S-9		14 to 14.8	10/11	30-75/5"		**Lodgement Till (SC-SM)**- hard brown silt with some fine to medium sand and some fine gravel, moist.		
			S-10		16 to 18	24/24	27-55-67-75				
			S-10		18 to 20	24/24	28-42-43-51				
	20		S-11		20 to 22	24/24	15-43-55-75		as above, with 0.1' thick fine sand lens (saturated) at 19.7' bgs.		
			S-12		22 to 24	24/24	21-34-27-32				

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location
NORTHING: **EASTING:** **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):**
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

B-SEA-2

PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	25		S-13		24 to 26	24/24	17-37-32-38					
			S-14		26 to 28	24/24	21-36-38-50					
			S-15		28 to 30	24/24	15-28-34-38	Sample B-SEA-2 collected (14-36') for grainsize, Atterberg limits and remolded permeability testing.		**Lodgement Till** as above with 0.3' thick fine to coarse sand lens between 28.7 and 29.0' bgs. Saturated.		
	30		S-16		30 to 32	24/22	12-29-25-44					
			S-17		32 to 34	24/21	23-18-25-33					
	35		S-18		34 to 36	24/16	69-44-65-47			**Well Graded Gravel (GW)** Dense, grey medium to fine gravel, saturated.		
			S-19		36 to 37.2	14/16	36-40-75/2"			**Lodgement Till (CL)-** hard, grey-brown silt with little fine to coarse sand and little fine gravel, moist.		
										Bedrock- **VERNON C HORIZON** weathered grey-green shale, saturated. Auger refusal at 37.2' bgs. End of Boring at 37.2 feet		
	40											
	45											
	50											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,084.85 **EASTING:** 671,919.8 **STATION:** **OFFSET:**

HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**

VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 671.82

LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-1A

PAGE 1 of 2

Drilling Information

DATE START / END: 8/30/2013 - 8/30/2013

TOTAL DEPTH (FT): 51.0

CONTRACTOR: Nothnagle

DRILLER: M. Loranty

LOGGED BY (Person): Glenn Combes

EQUIPMENT: CME-85

BORING METHOD: Hollow Stem Auger/Macrocore

AUGER ID/OD: 4.25 in / N/A

CASING ID/OD: N/A / 6" in

CORE INFO: Type: NX/ Air Rotary Core and Ream

HAMMER TYPE: Automatic

HAMMER WEIGHT (lbs): 140

HAMMER DROP (inch): 30

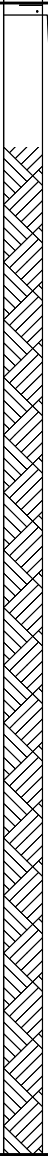
WATER LEVEL DEPTHS (ft):

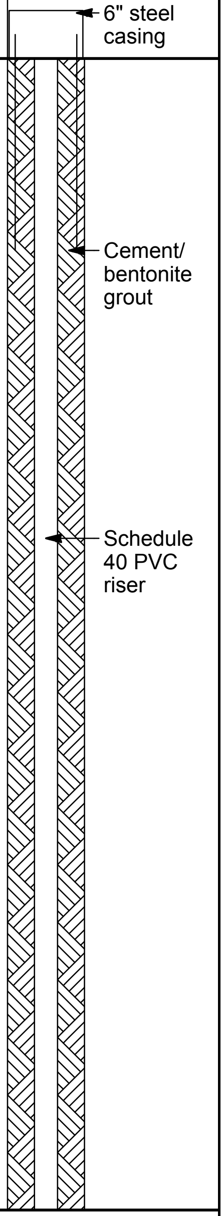
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
										Advance 5 7/8" diameter roller bit via air rotary methods to 65' bgs without sampling. See log of PZ-SEA-1Z for lithology. **Lodgement Till (CL-ML)** Bedrock- **VERNON C HORIZON**		
670												
	5											
665												
	10											
660												
	15											
655												
	20											
650												





Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York

PROJECT NAME: Mill Seat Landfill-SEA

CITY/STATE: Riga, New York

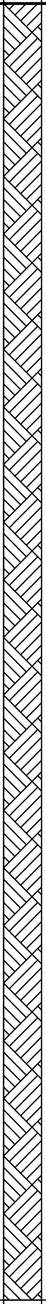
GEI PROJECT NUMBER: 1328270-*-1000

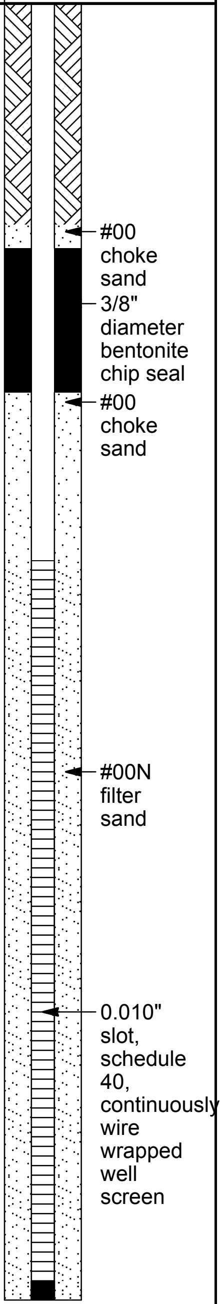
GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location
NORTHING: 1,113,084.85 **EASTING:** 671,919.8 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 671.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING
MW-SEA-1A
PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
	25											
645												
	30											
640												
	35											
635												
	40											
630												
	45											
625												
	50									**VERNON C HORIZON**		
										End of Boring at 51 feet		
620												





CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

Boring Location

BORING

MW-SEA-1B

PAGE 1 of 1

NORTHING: 1,113,079.44 **EASTING:** 671,920.02 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 671.83
LOCATION: Mill Seat Landfill - Southern Expansion Area

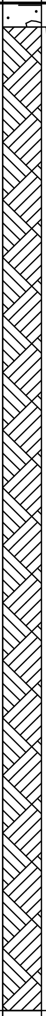
Drilling Information

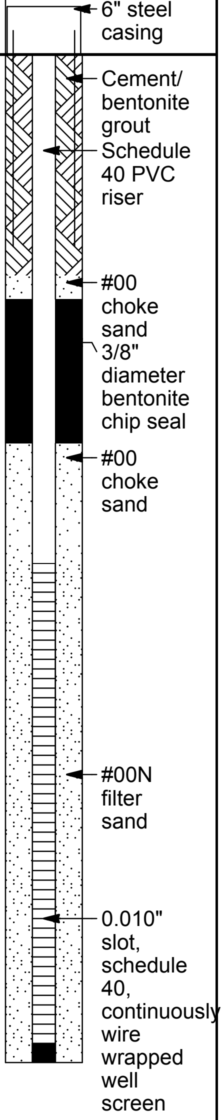
DATE START / END: 8/28/2013 - 8/29/2013
TOTAL DEPTH (FT): 21.0
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	WELL CONSTRUCTION DETAILS
										Advance 5 7/8" diameter roller bit via air rotary methods to 21' bgs without sampling. See log of PZ-SEA-1Z for lithology. **Lodgment Till (CL-ML)** Bedrock- **VERNON C HORIZON**		
670												
	5											
665												
	10											
660												
	15											
655												
	20											
										End of Boring at 21 feet		
650												





Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,091.22 **EASTING:** 671,919.36 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 671.64
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

PZ-SEA-1Z

PAGE 1 of 3

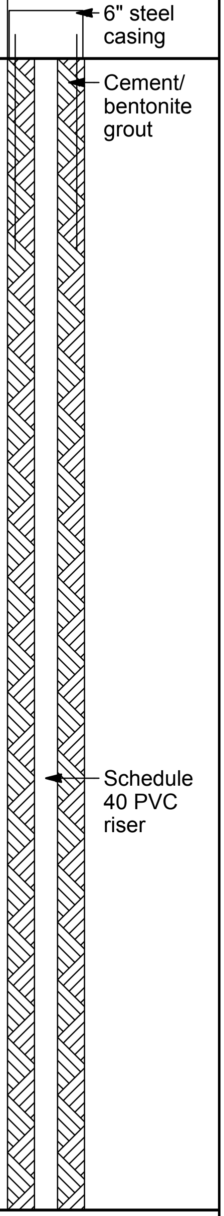
Drilling Information

DATE START / END: 9/17/2013 - 9/17/2013
TOTAL DEPTH (FT): 66.0
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter
OD = Outside Diameter
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
S = Split Spoon
DP = Direct Push Sample
U = Undisturbed Tube Sample
C = Rock Core
V = Field Vane Shear
SC = Sonic Core
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
OVM = Organic Vapor Meter
Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength
F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth
			S-1		0 to 1.25	15/15	4-54-75/0.3			**Lodgement Till (CL-ML)-** Hard brown silt with some fine to coarse sand and little fine to medium gravel, dry to moist.	
670			S-2		1.25 to 1.85	7/1	21-58/0.1				
	5		Run #1		5 to 15	120/78	0			**VERNON C HORIZON** Tan-brown to grey, aphanitic, moderately hard calcareous shale. Intenseley fractured, several mechanical breaks along clay/mud seams, few vertical joints, thinly bedded with occassional undulating bedding, some soft sediment deformation.	
665											
	10										
660											
	15		Run #2		15 to 25	120/78	0				
655											
	20										
650											

WELL CONSTRUCTION DETAILS



CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,091.22 **EASTING:** 671,919.36 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 671.64
LOCATION: Mill Seat Landfill - Southern Expansion Area

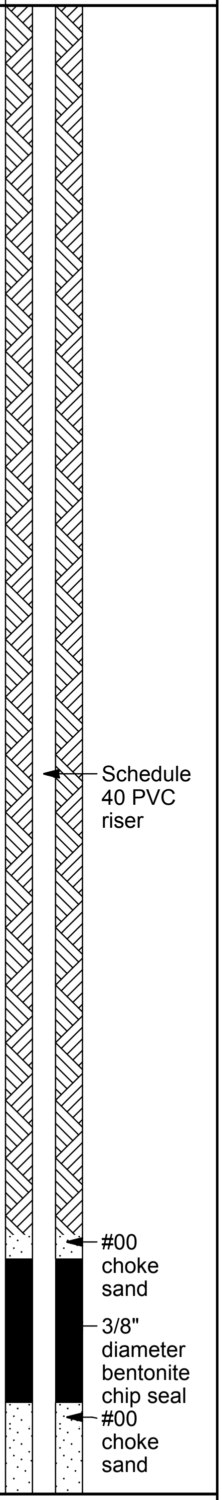
BORING

PZ-SEA-1Z

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
	25		Run #3		25 to 35	120/84	0			
645										
	30									
640										
	35		Run #4		35 to 45	120/108	4		**VERNON C HORIZON**	
635									Red-grey mottled argillaceous dolomite, moderately to intensely fractured, frequent high to low angle fractures with gypsum precipitation and iron staining on fracture surfaces.	
	40									
630										
	45		Run #5		45 to 55	120/82	8		Dark grey to greenish grey, moderately hard, aphanitic, argillaceous shale. Undulating bedding with soft sediment deformation throughout, abundant bedding plane fracutres and mechanical breaks, slightly dolomitic with few small (<1" dia.) vugs between 50-55' bgs.	
	50									
620										

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,091.22 EASTING: 671,919.36 STATION: OFFSET:
HORIZONTAL DATUM: NAD83 NY West Zone STATION CENTERLINE:
VERTICAL DATUM: NAVD 88 ESTIMATED GROUND SURFACE ELEV. (FT): 671.64
LOCATION: Mill Seat Landfill - Southern Expansion Area

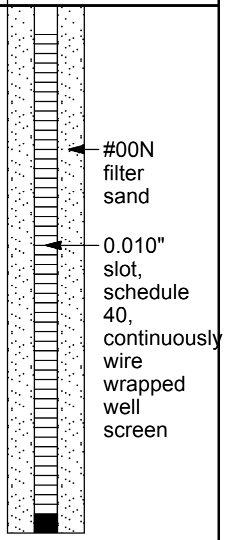
BORING

PZ-SEA-1Z

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth
615			Run #6		55 to 65	120/120	39				
	60									**VERNON CB HORIZON -** grey, argillaceous dolomite with abundant 0.5-2.0" diameter vugs, few mechanical breaks, few vertical joints.	
610										**VERNON C HORIZON -** grey, dolomitic shale, thinly bedded, few bedding plane fractures with gypsum infilling, little soft sediment deformation.	
	65										
605										End of Boring at 66 feet	
	70										
600											
	75										
595											
	80										
590											
	85										

WELL CONSTRUCTION DETAILS



CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

Boring Location

NORTHING: 1,112,009.69 **EASTING:** 672,257.09 **STATION:** **OFFSET:**

HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**

VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 667.29

LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-2A

PAGE 1 of 2

Drilling Information

DATE START / END: 8/30/2013 - 8/30/2013

TOTAL DEPTH (FT): 52.3

CONTRACTOR: Nothnagle

DRILLER: M. Loranty

LOGGED BY (Person): Glenn Combes

EQUIPMENT: CME-85

BORING METHOD: Hollow Stem Auger/Macrocore

AUGER ID/OD: 4.25 in / N/A

CASING ID/OD: N/A / 6" in

CORE INFO: Type: NX/ Air Rotary Core and Ream

HAMMER TYPE: Automatic

HAMMER WEIGHT (lbs): 140

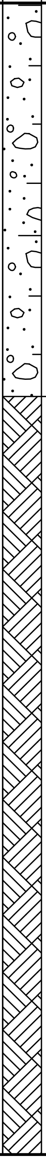
HAMMER DROP (inch): 30

WATER LEVEL DEPTHS (ft): ∇ 6.0

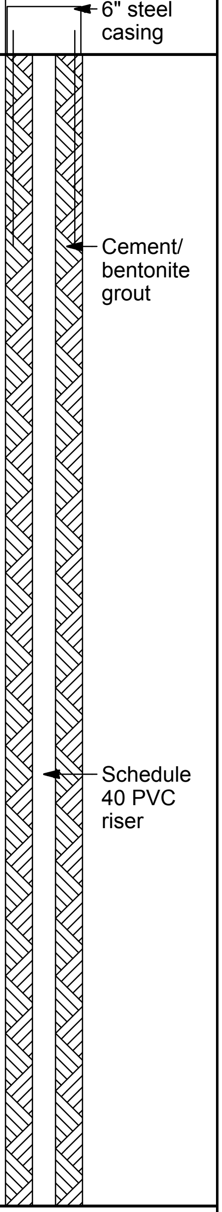
GENERAL NOTES:

ABBREVIATIONS:					
	ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
	OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
	Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
	Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth
			S-1		0 to 2	24/16	2-6-8-10			**Topsoil** - stiff, brown silt/ clayey-silt with little fine to coarse sand and trace fine gravel, moist.	
665			S-2		2 to 3.6	19/10	7-75/0.6			**Lodgement Till (CL-ML)-** very dense brown fine to medium gravel with little fine to coarse sand and trace clayey silt, moist.	
	5		S-3		4 to 6	24/19	11-15-19-18				
			S-4		6 to 8	24/15	8-34-29-28			**Lodgement TIll** as above.	∇
660			S-5		8 to 9.8	22/6	9-3-3-100/0.3			**Vernon C Horizon** -tan-brown to grey aphanitic, moderately hard calcareous shale. Intensely fractured, several mechanical breaks along clay/ mud seams, few vertical joints with iron-stained surfaces, thinly bedded/ undulating bedding.	
	10		S-6		10 to 10.2	2/0	100/0.2				
655			Run #1		12 to 22	120/89	14				
	15									slightly to moderately weathered clay partings throughout.	
650											
	20										
645			Run #2		22 to 32	120/61	9				



WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York

PROJECT NAME: Mill Seat Landfill-SEA

CITY/STATE: Riga, New York

GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location
NORTHING: 1,112,009.69 **EASTING:** 672,257.09 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 667.29
LOCATION: Mill Seat Landfill - Southern Expansion Area

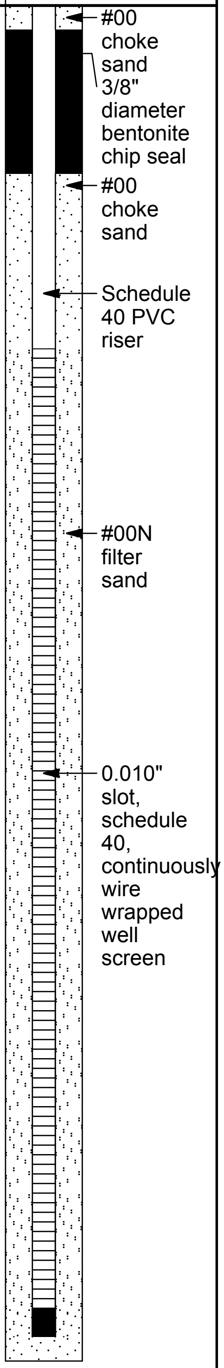
BORING

MW-SEA-2A

PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_2O Depth
	25									
640										
	30									
635			Run #3		32 to 42	120/82	7			
	35									
630										
	40									
625			Run #4		42 to 52	120/114	44		**VERNON C HORIZON** grey-green, massively bedded calcareous shale, moderately fractured with few mechanical breaks, slightly weathered.	
	45								**VERNON C HORIZON** red-gray mottled argillaceous dolomite, intensely fractured, frequent high to low angle fractures, few 0.5-1" diameter vugs with occasional gypsum infilling, hard to very hard throughout.	
620										
	50									
615									End of Boring at 52.25 feet	

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,013.55 **EASTING:** 672,258.76 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 667.29
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-2B

PAGE 1 of 1

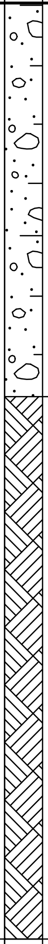
Drilling Information

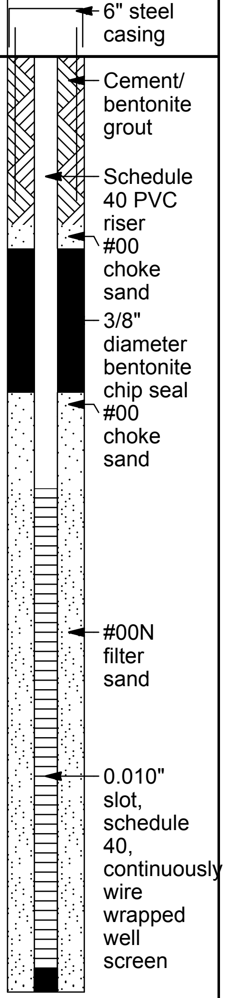
DATE START / END: 9/9/2013 - 9/9/2013
TOTAL DEPTH (FT): 19.5
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): ∇ 6.0
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
										Advance 5 7/8" diameter roller bit via air rotary methods to 19.5' bgs without sampling. See log of MW-SEA-2A for lithology.		
665												
	5											
											∇	
660										**Lodgement Till (CL-ML)**		
										Bedrock- **VERNON C HORIZON**		
	10											
655												
	15											
650												
										End of Boring at 19.5 feet		
	20											
645												





Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,661.81 **EASTING:** 673,174.39 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.48
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-3A

PAGE 1 of 2

Drilling Information

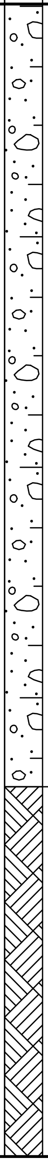
DATE START / END: 9/5/2013 - 9/5/2013
TOTAL DEPTH (FT): 47.0
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

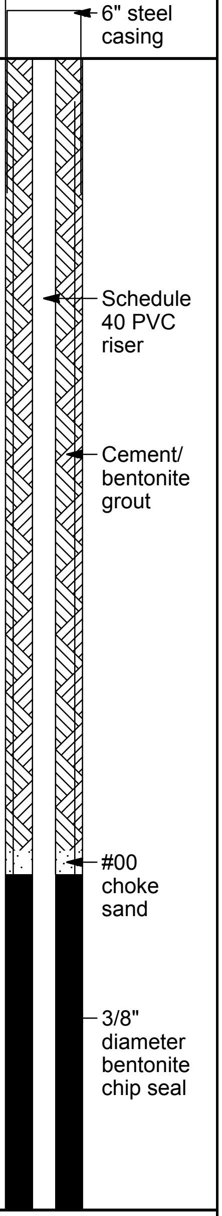
ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
665									Advance 5 7/8" diameter roller bit via air rotary methods to 47.0' bgs without sampling. See log of MW-SEA-3Z for lithology.	
	5									
660										
	10									
655										
	15									
									Lodgement Till (CL-ML)	
650										
									Bedrock- **VERNON C HORIZON**	
	20									
645										

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,661.81 **EASTING:** 673,174.39 **STATION:** ______ **OFFSET:** ______

HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:** ______

VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.48

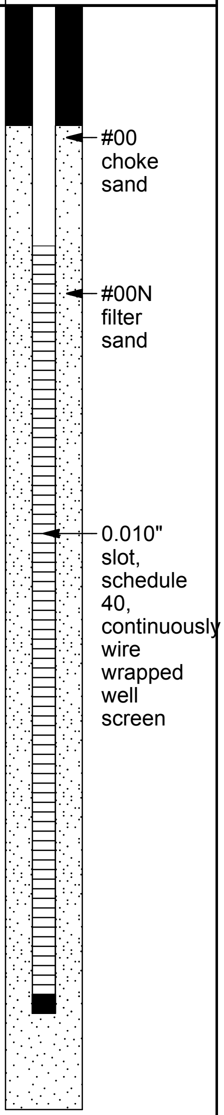
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-3A

PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	WELL CONSTRUCTION DETAILS
	25								▨			
640									▨			
	30								▨			
635									▨			
	35								▨	**VERNON C HORIZON**		
630									▨			
	40								▨			
625									▨			
	45								▨			
620									▨			
										End of Boring at 47 feet		
	50											
615												



CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants
GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,657.39 **EASTING:** 673,164.55 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.13
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-3B

PAGE 1 of 1

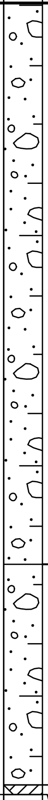
Drilling Information

DATE START / END: 8/26/2013 - 8/26/2013
TOTAL DEPTH (FT): 16.5
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

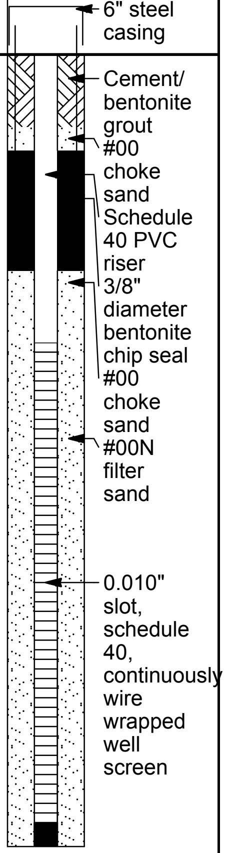
ABBREVIATIONS:
ID = Inside Diameter
OD = Outside Diameter
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
S = Split Spoon
DP = Direct Push Sample
U = Undisturbed Tube Sample
C = Rock Core
V = Field Vane Shear
SC = Sonic Core
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
OVM = Organic Vapor Meter
Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength
F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
665									Advance 4-1/4" dia. HSA to 8' bgs without sampling. See log of well MW-SEA-3Z for lithology.	
	5									
660										
			S-1		8 to 10	24/20	18-22-34-50		**Coarse Grained Till (CL-ML)-** hard, brown to dark brown silt and fine to medium sand with some fine subangular gravel, moist.	
	10		S-2		10 to 12	24/18	22-54-75-50		as above, hard, brown to dark brown silt and fine to medium sand with some fine subangular gravel, moist.	
655										
			S-3		12 to 14	24/22	21-35-36-53		**Lodgement Till (CL-ML)-** very hard, purple-grey silt and fine to medium sand with little fine to medium gravel, moist.	
			S-4		14 to 16	24/23	14-39-46-34			
	15									
650			S-5		16 to 16.4	5/4	60/4"		Bedrock- **VERNON C HORIZON**	
									End of Boring at 16.5 feet	
	20									
645										

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,659.83 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-3Z

PAGE 1 of 3

Drilling Information

DATE START / END: 8/22/2013 - 8/22/2013
TOTAL DEPTH (FT): 68.0
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter
OD = Outside Diameter
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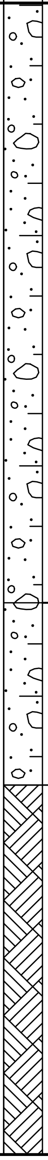
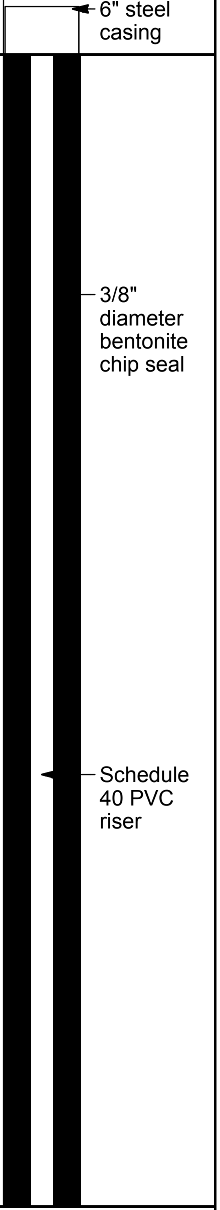
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
S = Split Spoon
DP = Direct Push Sample
U = Undisturbed Tube Sample
C = Rock Core
V = Field Vane Shear
SC = Sonic Core
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
OVM = Organic Vapor Meter
Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength
F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
			S-1		0 to 2	24/19	4-5-7-9		**Coarse Grained Till (CL-ML)-** hard, brown to dark brown silt and fine to medium sand with some fine subangular gravel, moist.	
665			S-2		2 to 4	24/18	5-11-13-22			
	5		S-3		4 to 6	24/24	15-26-25-31			
660			S-4		6 to 8	24/8	18-51-50-43			
			S-5		8 to 8.8	10/1	18-50/0.3			
	10		S-6		10 to 11.2	14/14	35-45-50/0.2			
655			S-7		12 to 14	24/24	20-40-47-50	Sample MW-SEA-3 (12-15') collected for grainsize and Atterberg limits testing. Sample B-SEA-3 (12-15') collected for remolded permeability testing.	**Lodgement Till (CL-ML)-** very hard, purple-grey silt and fine to medium sand with little fine to medium gravel, moist.	
	15		S-8		14 to 16	24/18	11-27-28-58			
650			S-9		16 to 16.6	7/1	76-50/0.2		**VERNON C HORIZON-** grey-green, moderately hard aphanitic shale, very close to massively bedded, little soft sediment deformation. Several breaks along mud/ clay seams.	
			Run #1		18 to 28	120/96	34			
	20									
645										

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,659.83 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

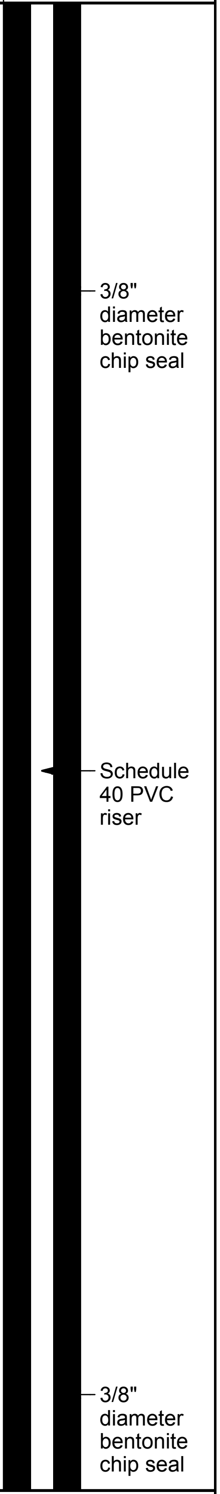
BORING

MW-SEA-3Z

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
	25								**VERNON C HORIZON** as above.	
640										
			Run #2		28 to 38	120/80	0			
	30								moderately dolomitic 29.5-30.0' bgs with several 0.1-2.0" dia. vugs. Intensely fractured	
635										
	35									
630										
			Run #3		38 to 48	120/118	23			
	40									
625										
									massively bedded with few high-angle open fractures between 43 and 45' bgs.	
	45									
620										
			Run #4		48 to 58	120/95	14			
									VERNON C HORIZON Grey-green, massviely bedded calcareous shale, increasing carbonate content. Several low to high angle fractures throughout.	
	50									
615										
									VERNON C HORIZON very hard, red-gray mottled argillaceous dolomite, moderately fractured, frequent vertical to high-angle fractures, few 0.5-1.5" dia vugs	

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

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90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location
NORTHING: 1,111,659.83 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

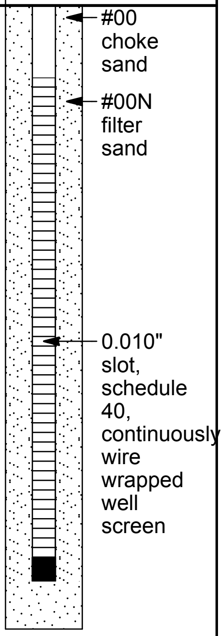
BORING

MW-SEA-3Z

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION						GRAPHIC LOG	Sample Description & Classification	H_2O Depth
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data			
610									▨		
			Run #5		58 to 68	120/73	16		▨		
	60								▨		
									▨	**VERNON C HORIZON** hard, grey-green aphanitic calcareous shale, very close to massively bedded, few thin (1-2" thick) dolomitic zones.	
605									▨		
	65								▨		
600									▨		
										End of Boring at 68 feet	
	70										
595											
	75										
590											
	80										
585											
	85										

WELL CONSTRUCTION DETAILS



CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,657.39 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

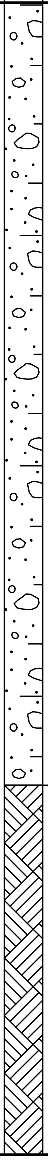
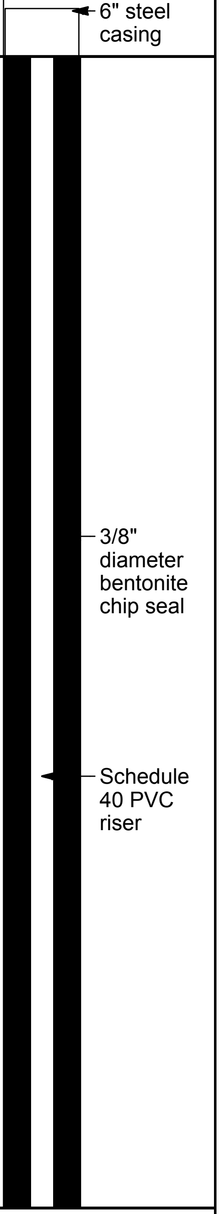
PZ-SEA-3Z

PAGE 1 of 4

Drilling Information

DATE START / END: 8/22/2013 - 8/22/2013
TOTAL DEPTH (FT): 100.0
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter
OD = Outside Diameter
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
S = Split Spoon
DP = Direct Push Sample
U = Undisturbed Tube Sample
C = Rock Core
V = Field Vane Shear
SC = Sonic Core
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
OVM = Organic Vapor Meter
Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength
F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION						GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data				
										Advance 5 7/8" diameter roller bit via air rotary methods to 68.0' bgs without sampling. See log of MW-SEA-3Z for lithology.		
665												
	5											
660												
	10											
655												
	15									**Lodgement Till (CL-ML)**		
650										Bedrock- **VERNON C HORIZON**		
	20											
645												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

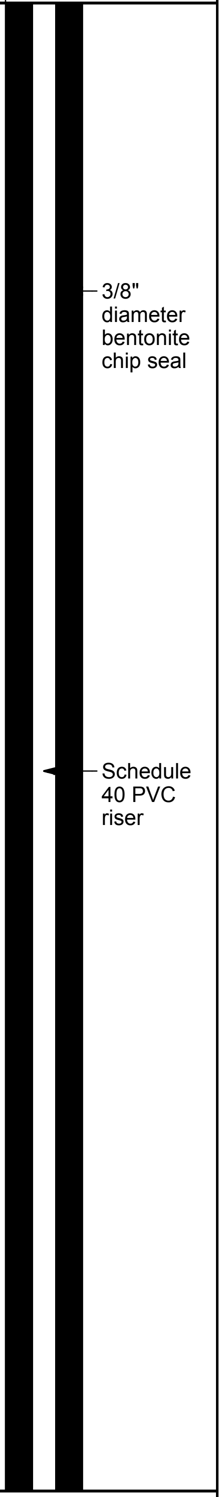
NORTHING: 1,111,657.39 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

PZ-SEA-3Z

PAGE 2 of 4

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
	25											
640												
	30											3/8" diameter bentonite chip seal
635												
	35											
630												
	40											Schedule 40 PVC riser
625												
	45											
620												
	50											
615												



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

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90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,111,657.39 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

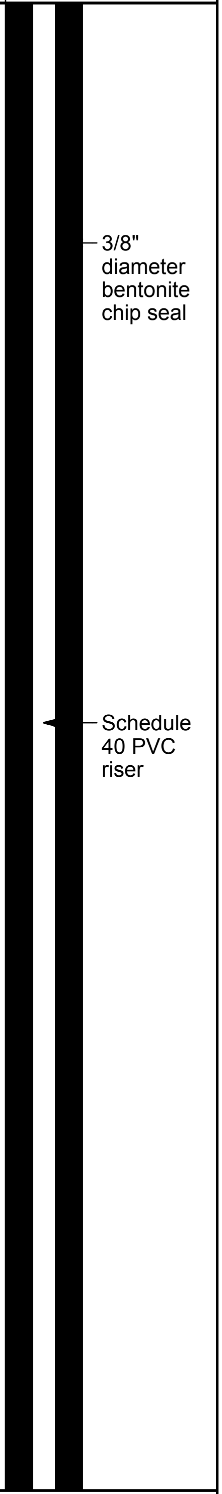
BORING

PZ-SEA-3Z

PAGE 3 of 4

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_2O Depth
610										
	60									
605										
	65									
600										
			Run #1		68 to 79	132/132	53		**VERNON C HORIZON-** dark grey to grey, moderately fractured dolomitic shale. Abundant gypsum-filled low to high angle fractures. Abundant soft sediment deformation throughout.	
	70									
595										
	75									
									VERNON CB HORIZON- hard, grey argillaceous dolomite with abundant 0.1-2.0" diameter vugs. Few mechanical breaks, little fracturing throughout.	
590										
									VERNON C HORIZON- moderately hard, gray, slightly dolomitic, calcareous shale. Thinly bedded, few clay partings, slightly stylolitic, few small 0.5" diameter vugs, moderately to intensely fractured.	
			Run #2		79 to 89	120/120	45			
	80									
585										
	85									

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
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90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

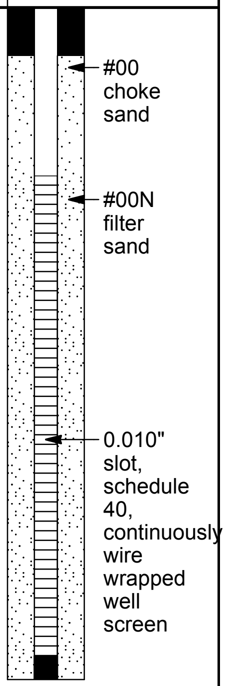
Boring Location
NORTHING: 1,111,657.39 **EASTING:** 673,169.6 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 666.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

PZ-SEA-3Z

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth
580										**VERNON C HORIZON** hard, grey-green calcareous shale, intensely fractured with moderate weathering along partings, frequent gypsum infilling of fractures.	
			Run #3		89 to 99	120/120	27				
	90										
575										**VERNON C HORIZON** moderately fractured, massively bedded zone between 92.4 and 96' bgs. Several mechanical breaks, little weathering, few large gypsum nodules and gypsum infilling of fractures.	
	95										
570											
	100									End of Boring at 100 feet	
565											
	105										
560											
	110										
555											
	115										
550											

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,216.1 **EASTING:** 674,879.53 **STATION:** **OFFSET:**

HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**

VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 675.82

LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-4A

PAGE 1 of 3

Drilling Information

DATE START / END: 8/22/2013 - 8/22/2013

TOTAL DEPTH (FT): 68.0

CONTRACTOR: Nothnagle

DRILLER: S. Loranty

LOGGED BY (Person): Glenn Combes

EQUIPMENT: CME-85

BORING METHOD: Hollow Stem Auger/Macrocore

AUGER ID/OD: 4.25 in / N/A

CASING ID/OD: N/A / 6" in

CORE INFO: Type: NX/ Air Rotary Core and Ream

HAMMER TYPE: Automatic

HAMMER WEIGHT (lbs): 140

HAMMER DROP (inch): 30

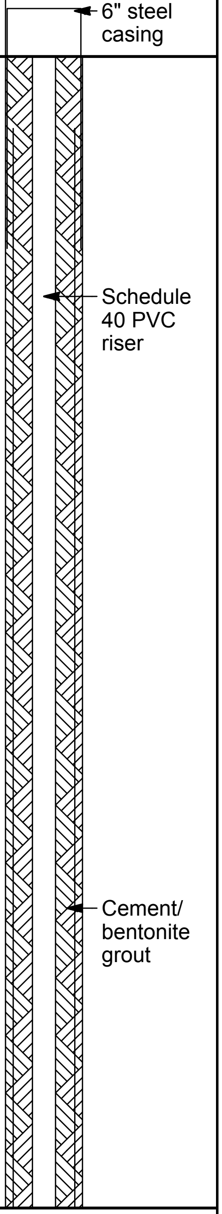
WATER LEVEL DEPTHS (ft):

GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter
OD = Outside Diameter
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
S = Split Spoon
DP = Direct Push Sample
U = Undisturbed Tube Sample
C = Rock Core
V = Field Vane Shear
SC = Sonic Core
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
OVM = Organic Vapor Meter
Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength
F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION						GRAPHIC LOG	Sample Description & Classification	H_20 Depth
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data			
675			S-1		0 to 2	24/18	4-7-9-11			**Lodgement Till (CL-ML)-** hard, light brown to brown fine to medium sand and wilt with trace fine subangular gravel, dry	
			S-2		2 to 4	24/22	7-8-9-7				
	5		S-3		4 to 6	24/12	4-8-11-12			**Sand and Gravel (GWS)-** loose, red-brown fine to medium round to subangular gravel with fine to medium sand, trace silt, dry	
670			S-4		6 to 8	24/13	7-12-10-10				
			S-5		8 to 10	24/6	21-16-9-10				
665	10		S-6		10 to 12	24/12	9-14-13-14			As above with increasing fine to medium sand.	
			S-7		12 to 14	24/12	9-14-15-17				
	15		S-8		14 to 16	24/13	5-7-7-7				
660			S-9		16 to 18	24/18	6-8-15-24			saturated at 16' bgs. **Lodgement Till (CL-ML)-** hard, light reddish-grey silt and fine to medium sand, fine to medium subangular gravel and little clay, moist	
			S-10		18 to 20	24/19	4-9-28-51				
655	20		S-11		20 to 22	24/22	21-20-34-44				
			S-12		22 to 24	24/23	30-40-32-147				

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,216.1 **EASTING:** 674,879.53 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 675.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

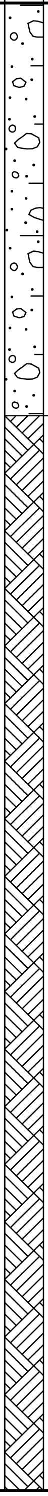
BORING

MW-SEA-4A

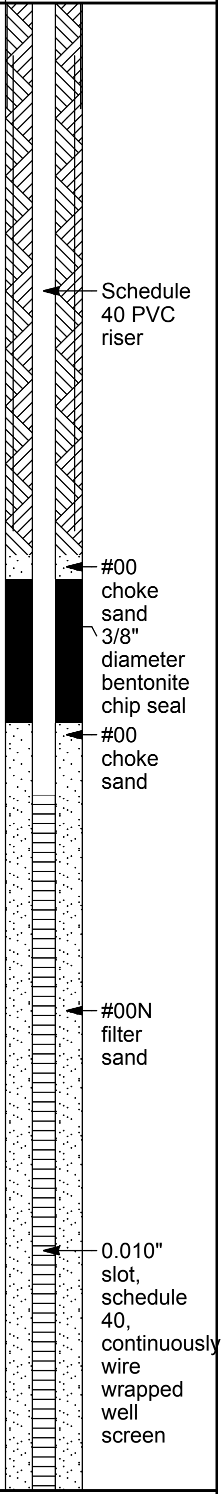
PAGE 2 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_2O Depth
	25		S-13		24 to 26	24/22	26-47-48-50			
650			S-14		26 to 28	24/24	32-33-37-40			
			S-15		28 to 30	24/20	32-35-50-78		**Lodgement Till** as above, with increasing grey, weathered shale bedrock gravel.	
645	30		S-16		30 to 32	24/22	10-39-41-30			
			S-17		32 to 33.2	14/12	29-46-50/.2		**Vernon C Horizon-** moderately hard, grey-green aphanitic calcareous shale. Thin to massively bedded, instensely fractured. Frequent mechanical breaks along mud/clay seams, slightly dolomitic at 41' bgs.	
640	35									
635 630	40 45		Run #1		38 to 48	120/42	10			
625	50		Run #2		48 to 53	60/30	16		hard to very hard, red-gray mottled argillaceous dolomite. Moderately to intensely fractured. Several high angle fractures with few 0.5-2.0" diameter vugs.	
			Run #3		53 to 58	60/42	8			

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,216.1 **EASTING:** 674,879.53 **STATION:** ______ **OFFSET:** ______

HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:** ______

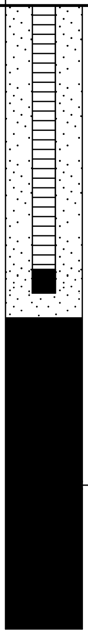
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 675.82

LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-4A

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
620												
			Run #4		58 to 68	120/115	54			hard, grey-green, massively bedded calcareous shale. Slightly dolomitic, moderately fractured with frequent gypsum-filled low to high-angle fractures		
	60											
615												
	65											3/8" diameter bentonite chips bottom of hole.
610												
										End of Boring at 68 feet		
	70											
605												
	75											
600												
	80											
595												
	85											
590												

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants
GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,298.31 **EASTING:** 675,070.92 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 656.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-5A

PAGE 1 of 2

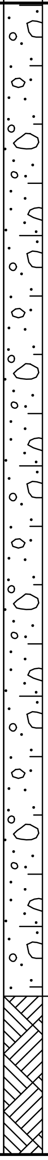
Drilling Information

DATE START / END: 8/28/2013 - 8/28/2013
TOTAL DEPTH (FT): 38.5
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

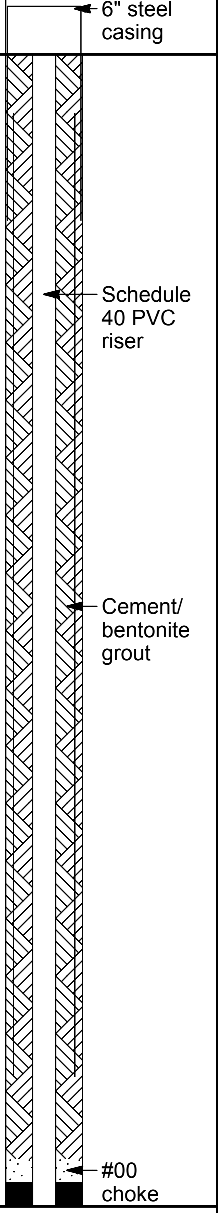
ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth
655			S-1		0 to 2	24/14	1-2-6-7			Advance 5 7/8" diameter roller bit via air rotary methods to 38.5' bgs without sampling. See log of MW-SEA-5Z for lithology.	
			S-2		2 to 4	24/17	4-9-9-13				
	5		S-3		4 to 6	24/19	20-42-40-25	Sample MW-SEA-5 (0-20') collected for grainsize and Atterberg limits testing. Sample B-SEA-5 (0-20') collected for remolded permeability testing.			
650			S-4		6 to 8	24/19	14-30-45-45				
			S-5		8 to 10	24/16	28-38-59-75				
	10		S-6		10 to 12	24/20	15-42-38-33				
645			S-7		12 to 14	24/21	27-30-36-32				
	15		S-8		14 to 16	24/22	17-25-31-41				
640			S-9		16 to 18	24/0	75/.2				
			S-10		18 to 20	24/17	23-64-75/0.5				
	20		S-11 S-12		20 to 20.6	7/8	28-75/0.2 75/0.3			**Lodgement Till (CL-ML)**	
										Bedrock- **VERNON C HORIZON**	
635											



WELL CONSTRUCTION DETAILS



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CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

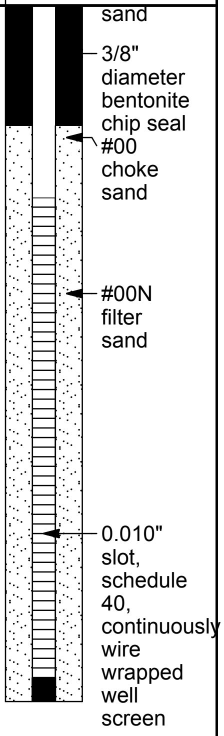
NORTHING: 1,113,298.31 **EASTING:** 675,070.92 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 656.82
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-5A

PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION						GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data				
	25									**VERNON C HORIZON**		
630												
	30											
625												
	35											
620												
										End of Boring at 38.5 feet		
	40											
615												
	45											
610												
	50											
605												



CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

Boring Location

NORTHING: 1,113,287.78 **EASTING:** 675,073.07 **STATION:** ______ **OFFSET:** ______
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:** ______
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 656.99
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-5B

PAGE 1 of 1

Drilling Information

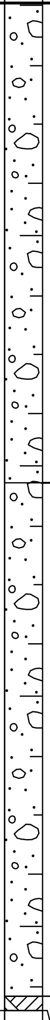
DATE START / END: 8/29/2013 - 8/29/2013
TOTAL DEPTH (FT): 21.0
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

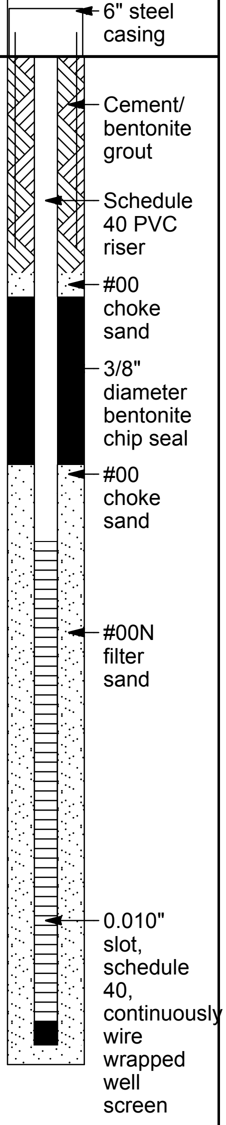
ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
									Advance 4-1/4" diameter HSA to 10.0' bgs without sampling. See log of PZ-SEA-5Z for lithology.	
655										
	5									
650										
	10		S-1		10 to 12	24/23	18-25-34-34		**Lodgement Till (CL-ML)-** hard, gray brown silt with some fine to coarse sand, some fine to medium gravel, moist.	
645			S-2		12 to 14	24/22	16-52-37-45			
			S-3		14 to 16	24/0	62-75/0.4			
	15									
			S-4		16 to 17	12/10	28-750.4			
640			S-5		17 to 18	12/6	67-75/0.6		**Lodgement Till (CL-ML)** as above. Hard, brown to gray silt with some fine to coarse sand, some fine to medium gravel, moist.	
			S-6		18 to 20	24/24	39-55-65-75/0.5			
	20								-sampler refusal at 20'bgs. Advance 4-1/4" HSA to 21'bgs.	
									Bedrock- **VERNON C HORIZON**	
									End of Boring at 21 feet	
635										

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,292.61 **EASTING:** 675,070.06 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 656.94
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

PZ-SEA-5Z

PAGE 1 of 2

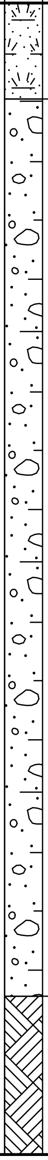
Drilling Information

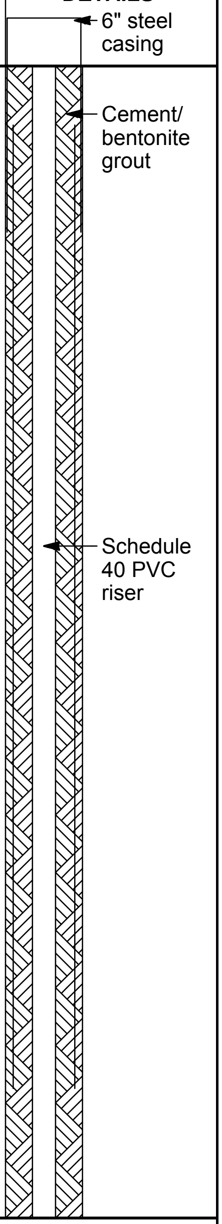
DATE START / END: 9/20/2013 - 9/23/2013
TOTAL DEPTH (FT): 52.5
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
										Topsoil/ reworked Lodgement Till (CL-ML)- soft, dark red to reddish brown silt and clay with little fine sand, trace fine gravel, moist		
655										**Lodgement Till (CL-ML)-** stiff, reddish-brown silt/ clayey silt with some fine to coarse sand and some fine gravel, moist.		
	5											
650												
	10											
645												
	15											
640												
	20											
			Run #1		21 to 31	120/120	12			**VERNON C HORIZON-** hard, gray aphanitic, calcareous shale. Thinly bedded with little soft sediment deformation throughout. Intensely fractured between 21 and 23' bgs.		
635												





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PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,113,292.61 **EASTING:** 675,070.06 **STATION:** ______ **OFFSET:** ______
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:** ______
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 656.94
LOCATION: Mill Seat Landfill - Southern Expansion Area

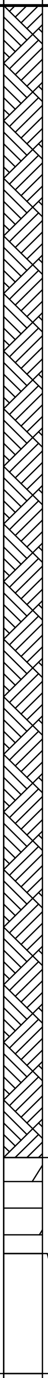
BORING

PZ-SEA-5Z

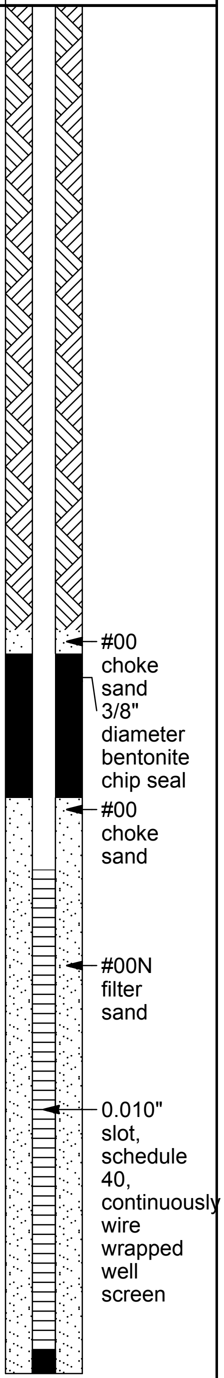
PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_2O Depth
	25								Hard to very hard, red-gray mottled argillaceous dolomite. Moderately to intenseley fractured, several mechanical breaks. Several high angle fractures with gypsum infilling, slightly dolomitic throughout.	
630										
	30									
			Run #2		31 to 41	120/120	41			
625										
	35								Hard, grey-brown to dark gray aphanitic calcareous shale (as above) with few mechanical breaks and abundant gypsum infilling of fractures. Slightly dolomitic throughout.	
620										
	40									
			Run #3		41 to 51	120/120	63			
615										
	45									
610										
									VERNON CB HORIZON Hard, gray argillaceous dolomite with abundant 0.5-2" diameter vugs, few mechanical breaks, few vertical joints.	
	50									
									VERNON C HORIZON- hard, grey-brown to dark gray aphanitic shale with few mechanicla breaks and gypsum infilling of fractures. Slightly dolomitic throughout.	
605										
									End of Boring at 52.5 feet	

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



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PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,878.46 **EASTING:** 673,616.58 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 669.62
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-6A

PAGE 1 of 2

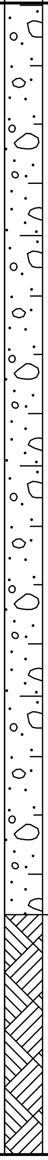
Drilling Information

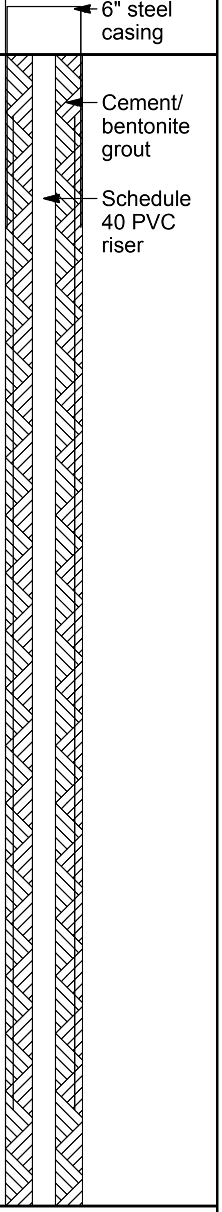
DATE START / END: 8/29/2013 - 9/12/2013
TOTAL DEPTH (FT): 48.0
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION						GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data				
										Advance 5 7/8" diameter roller bit via air rotary methods to 48' bgs without sampling. See log of MW-SEA-6Z for lithology.		
665	5											
660	10											
655	15											
										Lodgement Till (CL-ML)		
650	20									Bedrock- **VERNON C HORIZON**		





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CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

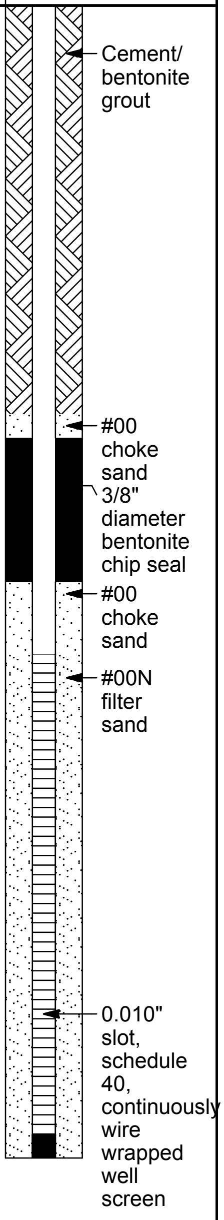
GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location
NORTHING: 1,112,878.46 **EASTING:** 673,616.58 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 669.62
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING
MW-SEA-6A
PAGE 2 of 2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	WELL CONSTRUCTION DETAILS
645	25											
										VERNON C HORIZON		
640	30											
635	35											
630	40											
625	45											
										End of Boring at 48 feet		
620	50											
615												



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,879.22 **EASTING:** 673,621.42 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 669.73
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

MW-SEA-6B

PAGE 1 of 1

Drilling Information

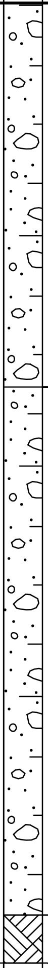
DATE START / END: 8/30/2013 - 8/30/2013
TOTAL DEPTH (FT): 20.0
CONTRACTOR: Nothnagle
DRILLER: M. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

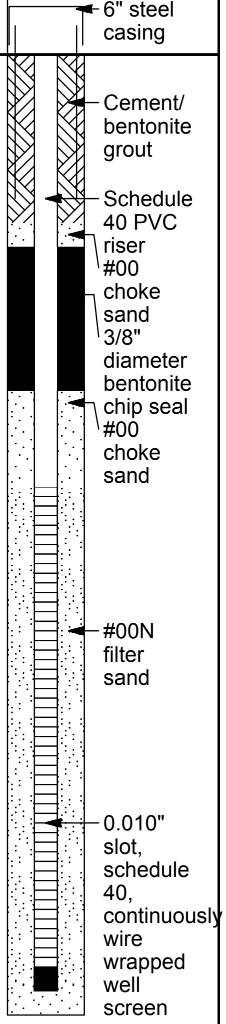
ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_20 Depth
									Advanced 4-1/4" diameter HSA to 8.0' bgs without sampling. See log of PZ-SEA-6Z for lithology.	
665	5									
			S-1		8 to 10	24/0	39-43-33-27		**Lodgement Till (CL-ML)-** Hard brown silt with some fine to coarse sand, little fine to medium gravel, moist.	
660	10		S-2		10 to 12	24/24	20-13-19-23			
			S-3		12 to 14	24/24	11-26-33-31			
655	15		S-4		14 to 16	24/0	51-36-38-50			
			S-5		16 to 18	24/24	8-18-17-23		**Lodgement Till (CL-ML)-** as above. hard brown to grey, silt with little fine to coarse sand, trace fine to medium gravel, moist.	
			S-6		18 to 20	24/24	16-19-6-63			
650	20								Bedrock- **VERNON C HORIZON** End of Boring at 20 feet	

GRAPHIC LOG



WELL CONSTRUCTION DETAILS



GEOTECHNICAL BORING LOG 02 MILL SEAT LANDFILL.GPJ GEI TEMPLATE 11-7-13.GDT 5/16/14

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,882.73 **EASTING:** 673,624.55 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 669.70
LOCATION: Mill Seat Landfill - Southern Expansion Area

BORING

PZ-SEA-6Z

PAGE 1 of 3

Drilling Information

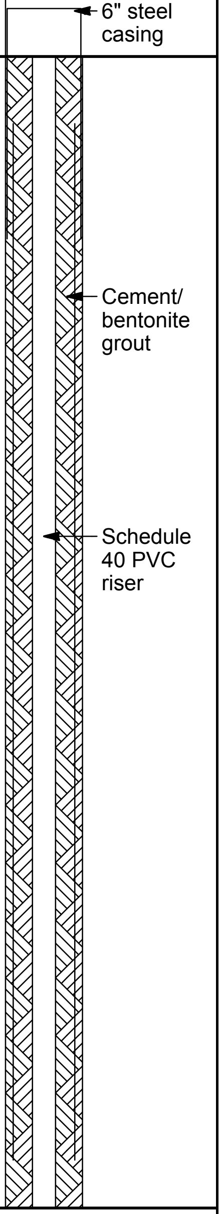
DATE START / END: 9/3/2013 - 9/8/2013
TOTAL DEPTH (FT): 70.5
CONTRACTOR: Nothnagle
DRILLER: S. Loranty
LOGGED BY (Person): Glenn Combes
EQUIPMENT: CME-85
BORING METHOD: Hollow Stem Auger/Macrocore
AUGER ID/OD: 4.25 in / N/A
CASING ID/OD: N/A / 6" in
CORE INFO: Type: NX/ Air Rotary Core and Ream
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undisturbed Tube Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
Pen. = Penetration Length	S = Split Spoon	V = Field Vane Shear	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Rec. = Recovery Length	DP = Direct Push Sample	SC = Sonic Core	OVM = Organic Vapor Meter	NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth
			S-1		0 to 2	24/17	2-3-8-7			**Lodgement Till (CL-ML)-** Stiff dark brown silt with little fine sand, little fine to medium gravel, moist.	
			S-2		2 to 4	24/22	1-4-6-9				
665	5		S-3		4 to 6	24/23	4-9-9-12	Sample MW-SEA-6 (0-19') collected for grainsize and Atterberg limits testing.			
			S-4		6 to 8	24/22	9-11-14-17				
			S-5		8 to 10	24/22	6-19-22-20				
660	10		S-6		10 to 12	24/4	8-14-28-42				
			S-7		12 to 14	24/24	10-23-30-35				
655	15		S-8		14 to 16	24/24	10-25-29-32			**Lodgement Till (CL-ML)-** as above. Hard brown to brown-gray silt with some fine to coarse sand; little fine to medium gravel; moist	
			S-9		16 to 18	24/0	31-61-57-56				
			S-10		18 to 19.5	18/12	19-17-75/4"				
650	20		S-11		19.5 to 19.8	4/0	70/4"			**VERNON C HORIZON** hard, dark grey to medium gray, calcareous shale. Intensely fractured and weathered, with abundant sub-horizontal to high angle fractures. Several mechanical breaks along clay partings and bedding planes. Exhibits soft sediment deformation throughout	
			Run #1		20.5 to 30.5	120/108	4				

WELL CONSTRUCTION DETAILS



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CLIENT: Waste Management of New York
PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

GEI Consultants

GEI Consultants, Inc. PC
90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,882.73 **EASTING:** 673,624.55 **STATION:** **OFFSET:**
HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:**
VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 669.70
LOCATION: Mill Seat Landfill - Southern Expansion Area

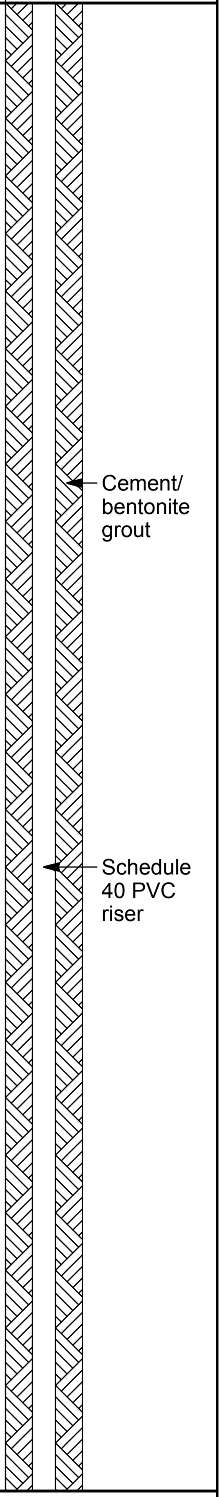
BORING

PZ-SEA-6Z

PAGE 2 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	H_2O Depth
645	25									
640	30									
			Run #2		30.5 to 40.5	120/66	5			
635	35									
630	40									
			Run #3		40.5 to 50	114/114	18		hard to very hard, red-gray mottled argillaceous dolomite. Soft sediment deformation throughout. Moderately to intensely fractured, several mechanical breaks. Several high angle fractures, slightly dolomitic throughout.	
625	45									
620	50								**VERNON C HORIZON** as above. hard, gray calcareous shale. Thinly bedded with abundant gypsum-filled low angle and bedding plane fractures. Few mechanical breaks, slightly weathered throughout.	
			Run #4		50 to 60	120/120	23			
615										

WELL CONSTRUCTION DETAILS



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CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

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90B John Muir Drive Suite 104
Amherst, NY 14228
(716) 204-7154

Boring Location

NORTHING: 1,112,882.73 **EASTING:** 673,624.55 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD83 NY West Zone **STATION CENTERLINE:** _____

VERTICAL DATUM: NAVD 88 **ESTIMATED GROUND SURFACE ELEV. (FT):** 669.70

LOCATION: Mill Seat Landfill - Southern Expansion Area

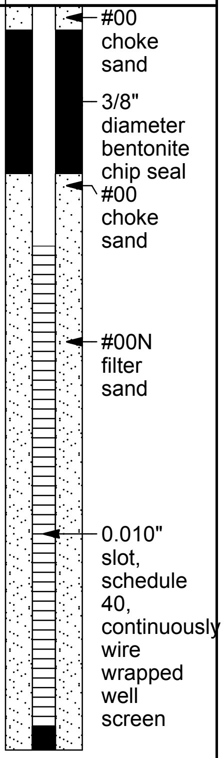
BORING

PZ-SEA-6Z

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field Test Data	Sample Description & Classification	$H_2$0 Depth
610	60		Run #5		60 to 70	120/120	61			
605	65								**VERNON CB HORIZON**- Hard, grey argillaceous dolomite with abundant 0.25-1.0" diameter vugs, few mechanical breaks, slightly weathered. **VERNON C HORIZON** - hard, grey calcareous shale. Thinly bedded with soft sediment deformation between 67 and 68.2' bgs. Few mechanical breaks along bedding plane partings with slight weathering.	
600	70								End of Boring at 70.5 feet	
595	75									
590	80									
585	85									

WELL CONSTRUCTION DETAILS



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PROJECT NAME: Mill Seat Landfill-SEA
CITY/STATE: Riga, New York
GEI PROJECT NUMBER: 1328270-*-1000

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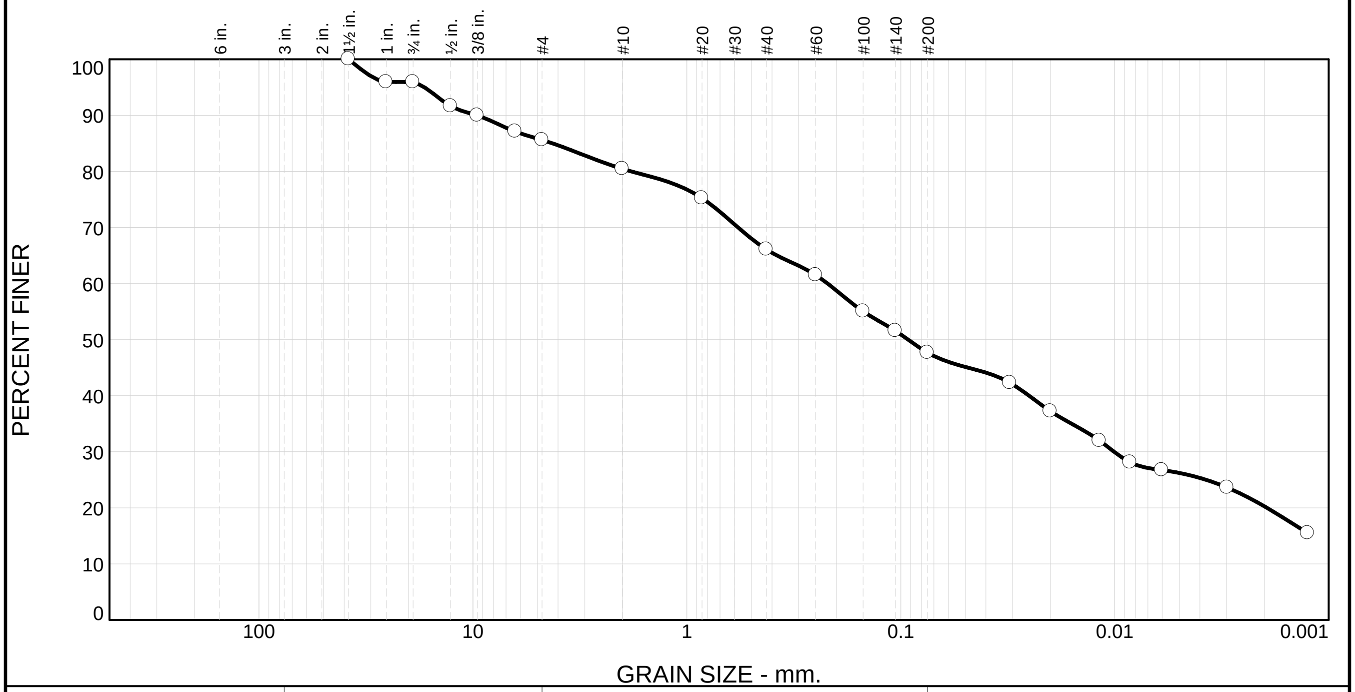
Appendix C

Soil Physical Testing Summary- 3rd Rock LLC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.1	10.3	5.2	14.3	18.4	21.5	26.2

TEST RESULTS (ASTM D 422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	95.9		
.75	95.9		
.5	91.6		
.375	90.0		
.25	87.1		
#4	85.6		
#10	80.4		
#20	75.2		
#40	66.1		
#60	61.5		
#100	55.0		
#140	51.6		
#200	47.7		
0.0309 mm.	42.3		
0.0200 mm.	37.2		
0.0118 mm.	32.0		
0.0085 mm.	28.1		
0.0060 mm.	26.7		
0.0030 mm.	23.6		
0.0013 mm.	15.5		

* (no specification provided)

Material Description

ID#13-578
Silty, clayey sand

Atterberg Limits (ASTM D 4318)

PL= 13 **LL=** 18 **PI=** 5

Classification

USCS (D 2487)= SC-SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 9.5868	D_{85}= 4.2481	D_{60}= 0.2198
D_{50}= 0.0925	D_{30}= 0.0101	D_{15}=
D_{10}=	C_u=	C_c=

Remarks

Date Received: 10/23/13 **Date Tested:** 10/30/13
Tested By: JS
Checked By: JMA
Title: LM

Source of Sample: Millseat Landfill, 2013 **Depth:** 4-16' **Date Sampled:**
Sample Number: B-SEA-1

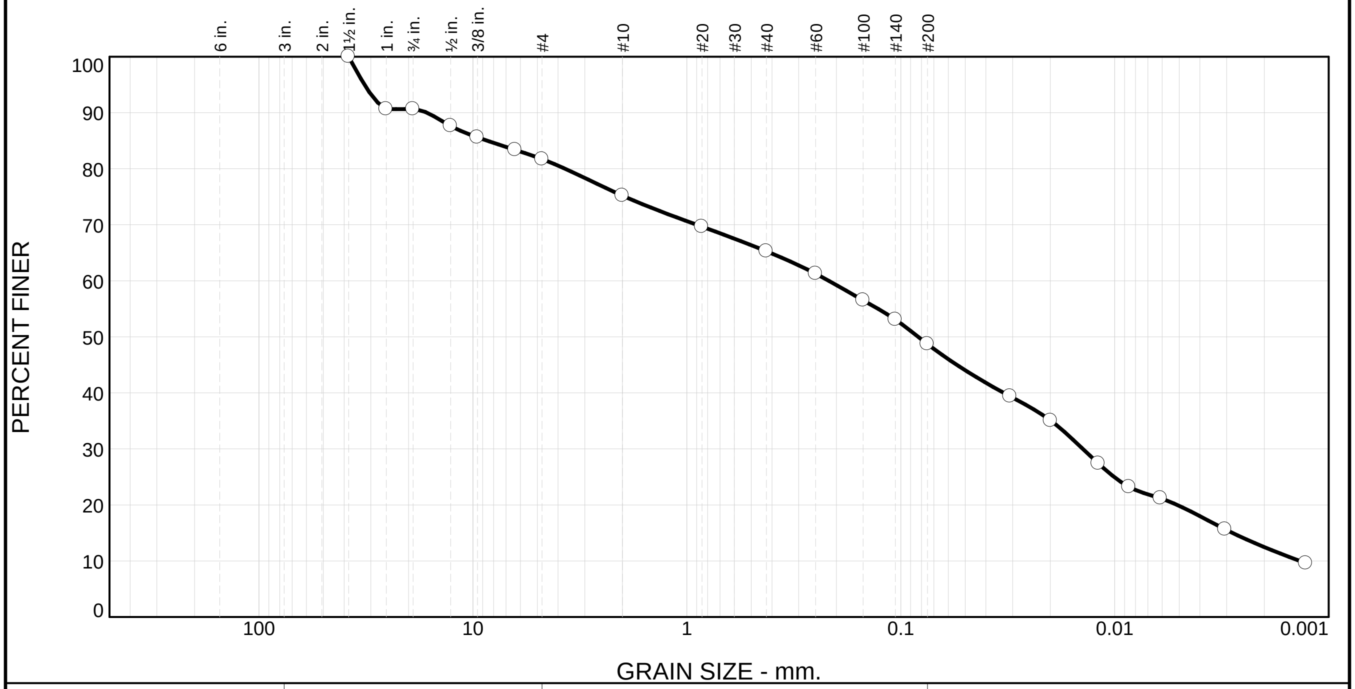
3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill

Project No: 12-038 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.4	8.9	6.5	9.9	16.6	28.9	19.8

TEST RESULTS (ASTM D 422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	90.6		
.75	90.6		
.5	87.6		
.375	85.6		
.25	83.4		
#4	81.7		
#10	75.2		
#20	69.7		
#40	65.3		
#60	61.3		
#100	56.5		
#140	53.1		
#200	48.7		
0.0308 mm.	39.4		
0.0199 mm.	35.0		
0.0119 mm.	27.4		
0.0086 mm.	23.2		
0.0061 mm.	21.2		
0.0031 mm.	15.7		
0.0013 mm.	9.6		

* (no specification provided)

Material Description

ID#13-579
Silty, clayey sand with gravel

Atterberg Limits (ASTM D 4318)

PL= 16 **LL=** 22 **PI=** 6

Classification

USCS (D 2487)= SC-SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 16.4052 D_{85}= 8.5727 D_{60}= 0.2169
D_{50}= 0.0829 D_{30}= 0.0141 D_{15}= 0.0028
D_{10}= 0.0014 C_u= 158.91 C_c= 0.67

Remarks

Date Received: 10/23/13 **Date Tested:** 10/30/13
Tested By: JS
Checked By: JMA
Title: LM

Source of Sample: Millseat Landfill, 2013 **Depth:** 0-14' **Date Sampled:**
Sample Number: B-SEA-2

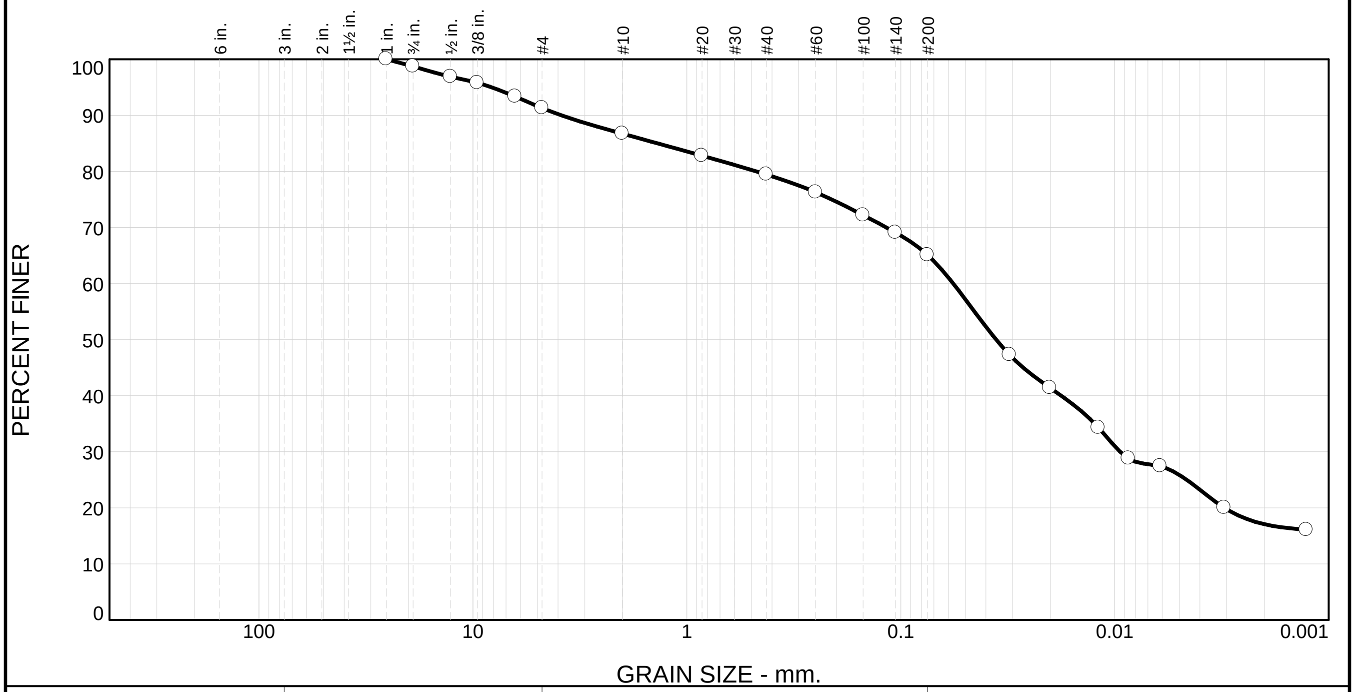
3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill

Project No: 12-038 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.3	7.4	4.6	7.3	14.3	39.2	25.9

TEST RESULTS (ASTM D 422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	98.7		
.5	96.9		
.375	95.8		
.25	93.4		
#4	91.3		
#10	86.7		
#20	82.8		
#40	79.4		
#60	76.3		
#100	72.2		
#140	69.1		
#200	65.1		
0.0310 mm.	47.3		
0.0201 mm.	41.4		
0.0119 mm.	34.3		
0.0086 mm.	28.8		
0.0061 mm.	27.4		
0.0031 mm.	20.0		
0.0013 mm.	16.1		

* (no specification provided)

Material Description

ID#13-580
Sandy lean clay

Atterberg Limits (ASTM D 4318)

PL= 12 **LL=** 20 **PI=** 8

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4(2)

Coefficients

D_{90}= 3.8574	D_{85}= 1.3724	D_{60}= 0.0569
D_{50}= 0.0358	D_{30}= 0.0094	D_{15}=
D_{10}=	C_u=	C_c=

Remarks

Date Received: 10/23/13 **Date Tested:** 10/28/13
Tested By: JS
Checked By: JMA
Title: LM

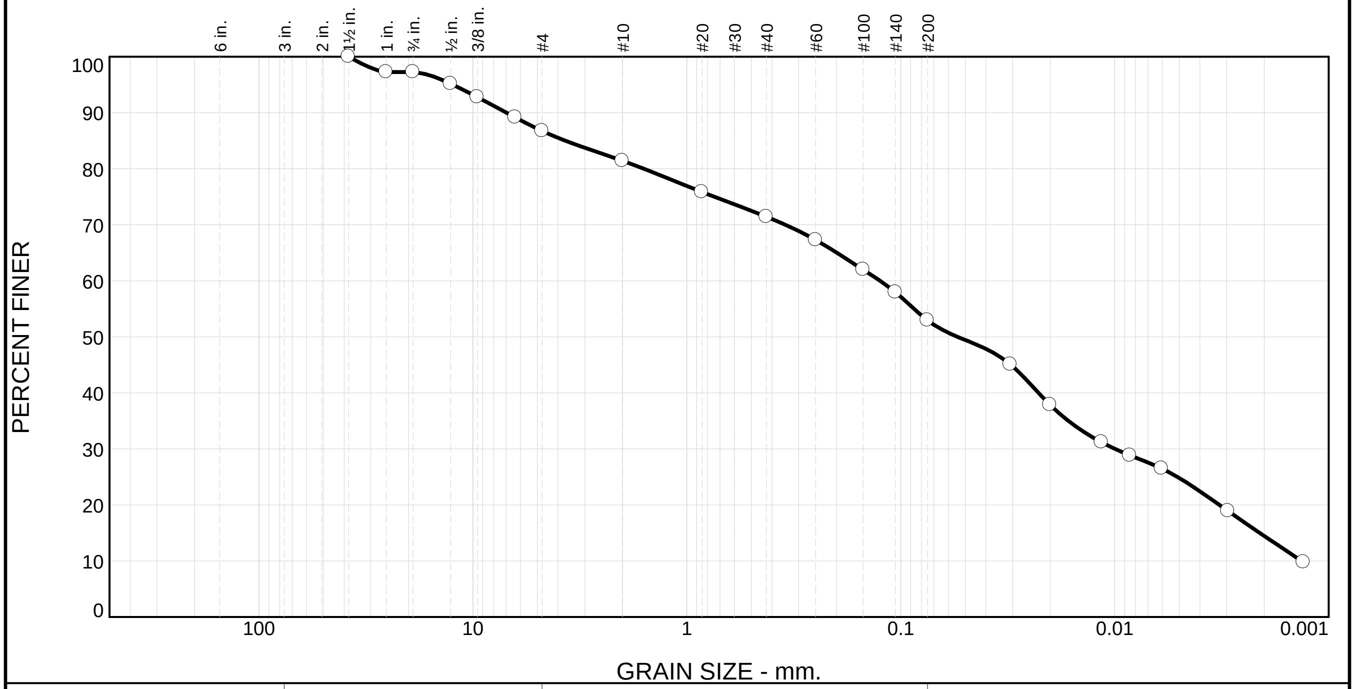
Source of Sample: Millseat Landfill, 2013 **Depth:** 14-36' **Date Sampled:**
Sample Number: B-SEA-2

3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill
Project No: 12-038 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.7	10.6	5.3	10.0	18.4	28.2	24.8

TEST RESULTS (ASTM D 422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	97.3		
.75	97.3		
.5	95.2		
.375	92.8		
.25	89.2		
#4	86.7		
#10	81.4		
#20	75.9		
#40	71.4		
#60	67.3		
#100	62.0		
#140	58.0		
#200	53.0		
0.0308 mm.	45.1		
0.0201 mm.	37.9		
0.0115 mm.	31.2		
0.0085 mm.	28.8		
0.0060 mm.	26.5		
0.0030 mm.	18.9		
0.0013 mm.	9.8		

* (no specification provided)

Material Description

ID#13-581
Sandy silty clay

Atterberg Limits (ASTM D 4318)

PL= 11 **LL=** 18 **PI=** 7

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 6.9642 D_{85}= 3.6982 D_{60}= 0.1250
D_{50}= 0.0543 D_{30}= 0.0100 D_{15}= 0.0021
D_{10}= 0.0013 C_u= 93.49 C_c= 0.60

Remarks

Date Received: 10/23/13 **Date Tested:** 10/30/13
Tested By: JS
Checked By: JMA
Title: LM

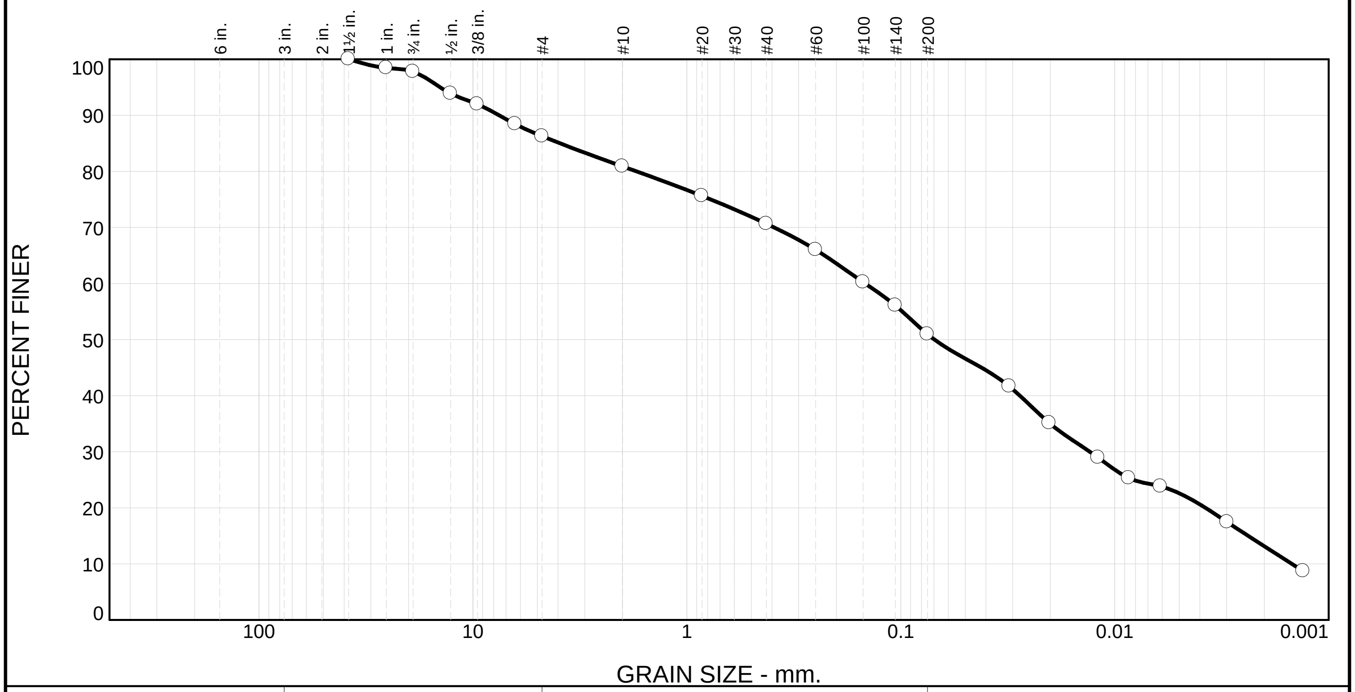
Source of Sample: Millseat Landfill, 2013 **Depth:** 12-15' **Date Sampled:**
Sample Number: B-SEA-3

3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill
Project No: 12-038 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.2	11.5	5.4	10.2	19.7	28.4	22.6

TEST RESULTS (ASTM D 422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	98.4		
.75	97.8		
.5	93.9		
.375	92.0		
.25	88.4		
#4	86.3		
#10	80.9		
#20	75.6		
#40	70.7		
#60	66.0		
#100	60.2		
#140	56.1		
#200	51.0		
0.0311 mm.	41.7		
0.0202 mm.	35.1		
0.0120 mm.	29.0		
0.0086 mm.	25.3		
0.0061 mm.	23.8		
0.0030 mm.	17.5		
0.0013 mm.	8.7		

* (no specification provided)

Material Description

ID#13-582
Sandy silty clay

Atterberg Limits (ASTM D 4318)

PL= 13 **LL=** 18 **PI=** 5

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 7.5430	D_{85}= 3.9146	D_{60}= 0.1468
D_{50}= 0.0696	D_{30}= 0.0131	D_{15}= 0.0024
D_{10}= 0.0015	C_u= 98.90	C_c= 0.78

Remarks

Date Received: 10/23/13 **Date Tested:** 10/28/13
Tested By: JS
Checked By: JMA
Title: LM

Source of Sample: Millseat Landfill, 2013 **Depth:** 0-20' **Date Sampled:**
Sample Number: B-SEA-5

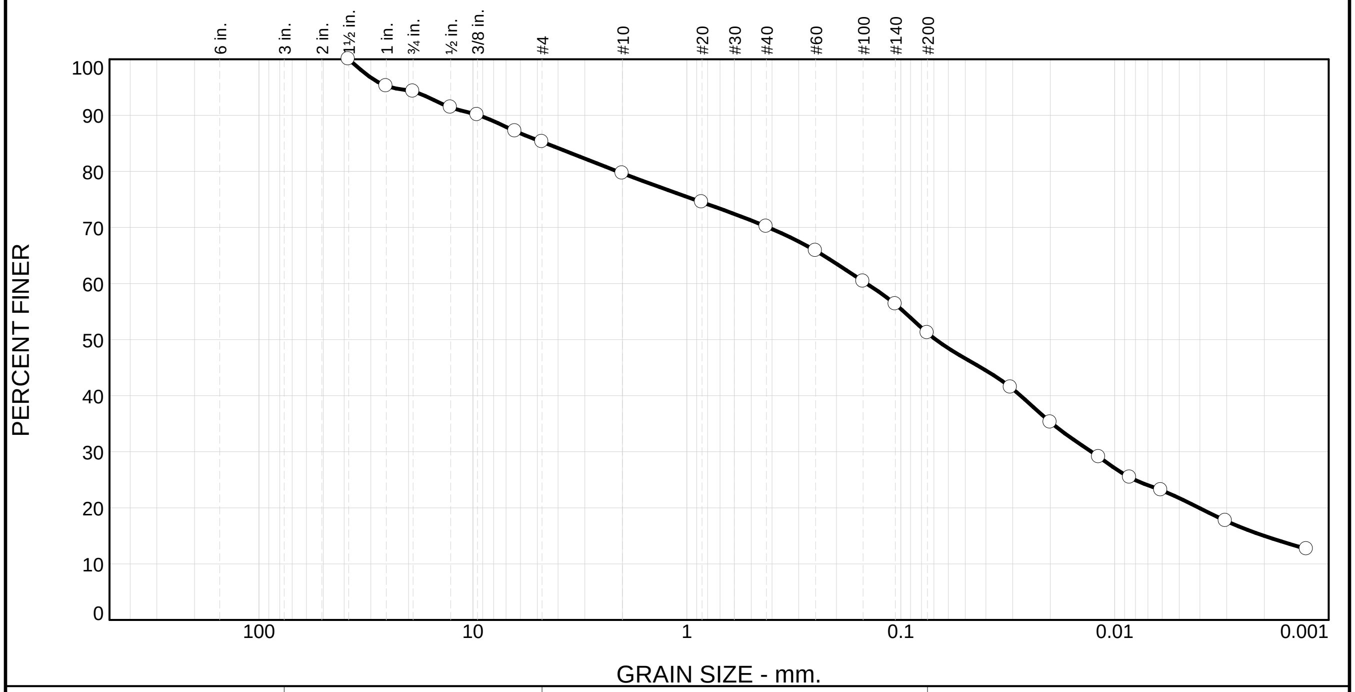
3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill

Project No: 12-038 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.7	9.0	5.6	9.5	19.0	29.5	21.7

TEST RESULTS (ASTM D 422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	95.2		
.75	94.3		
.5	91.4		
.375	90.1		
.25	87.2		
#4	85.3		
#10	79.7		
#20	74.5		
#40	70.2		
#60	65.8		
#100	60.4		
#140	56.3		
#200	51.2		
0.0307 mm.	41.5		
0.0200 mm.	35.3		
0.0118 mm.	29.0		
0.0085 mm.	25.4		
0.0061 mm.	23.2		
0.0030 mm.	17.7		
0.0013 mm.	12.7		

* (no specification provided)

Material Description

ID#13-583
Sandy silty clay

Atterberg Limits (ASTM D 4318)

PL= 14 **LL=** 20 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 9.3914	D_{85}= 4.5639	D_{60}= 0.1448
D_{50}= 0.0686	D_{30}= 0.0129	D_{15}= 0.0020
D_{10}=	C_u=	C_c=

Remarks

Date Received: 12/23/13 **Date Tested:** 10/30/13
Tested By: JS
Checked By: JMA
Title: LM

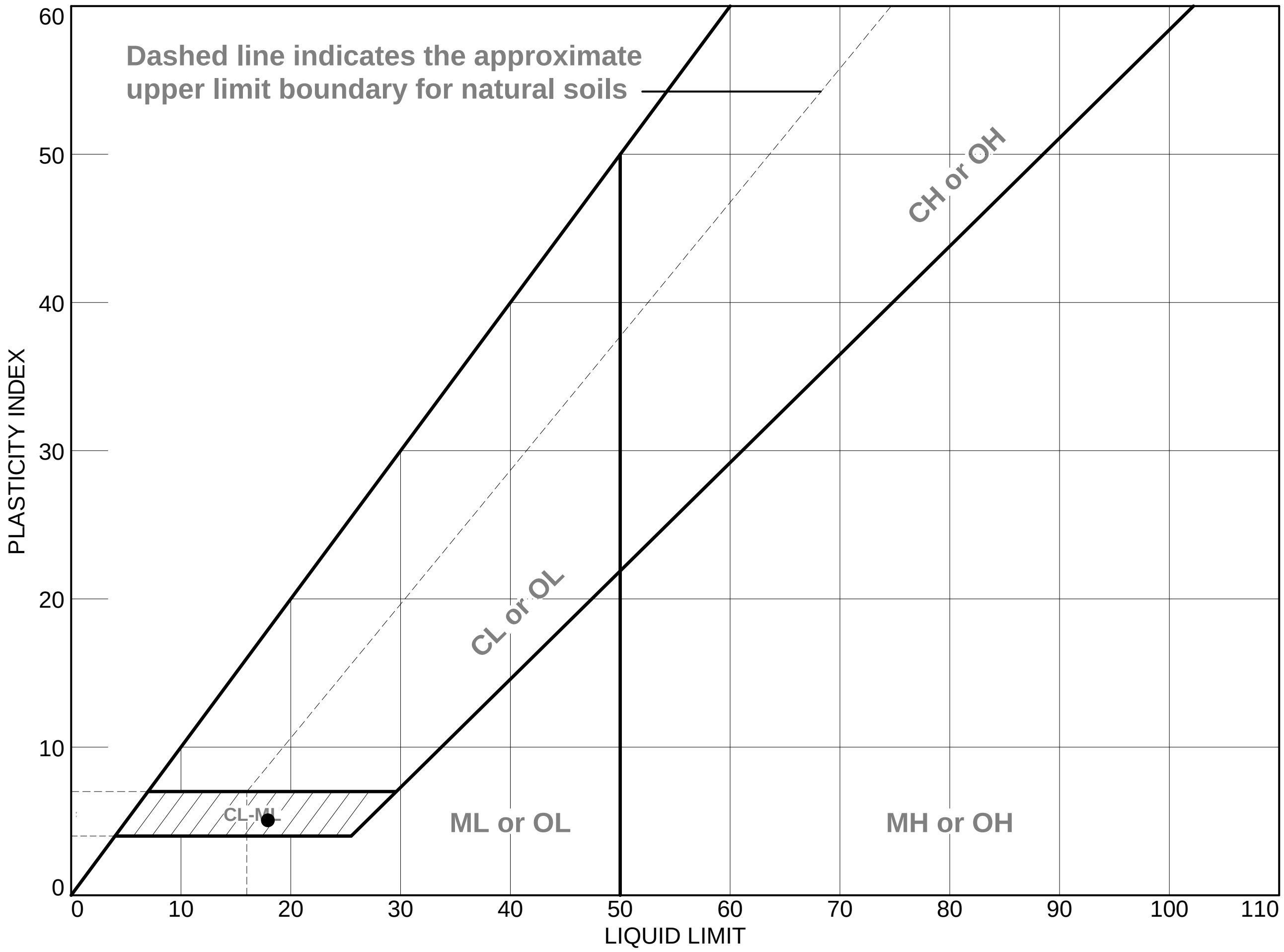
Source of Sample: Millseat Landfill, 2013 **Depth:** 0-19' **Date Sampled:**
Sample Number: B-SEA-6

3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill
Project No: 12-038 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



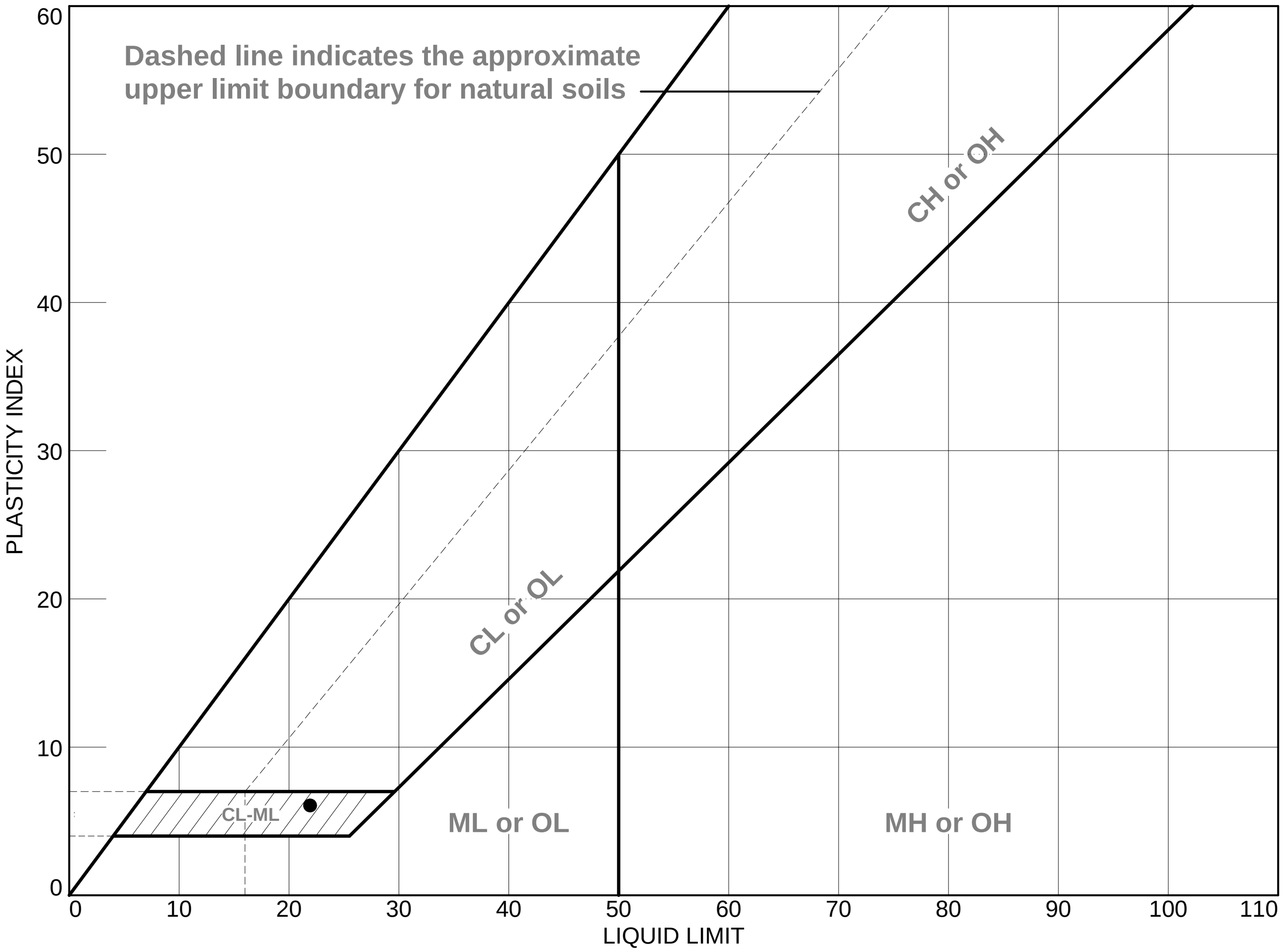
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Millseat Landfill, 2013	B-SEA-1	4-16'		13	18	5	SC-SM

3rd Rock, LLC **East Aurora, NY**	**Client:** GEI Consultants, Inc. **Project:** Millseat Landfill **Project No.:** 12-038 **Figure**

Tested By: JS 10/31/13 **Checked By:** JMA

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Millseat Landfill, 2013	B-SEA-2	0-14'		16	22	6	SC-SM

3rd Rock, LLC

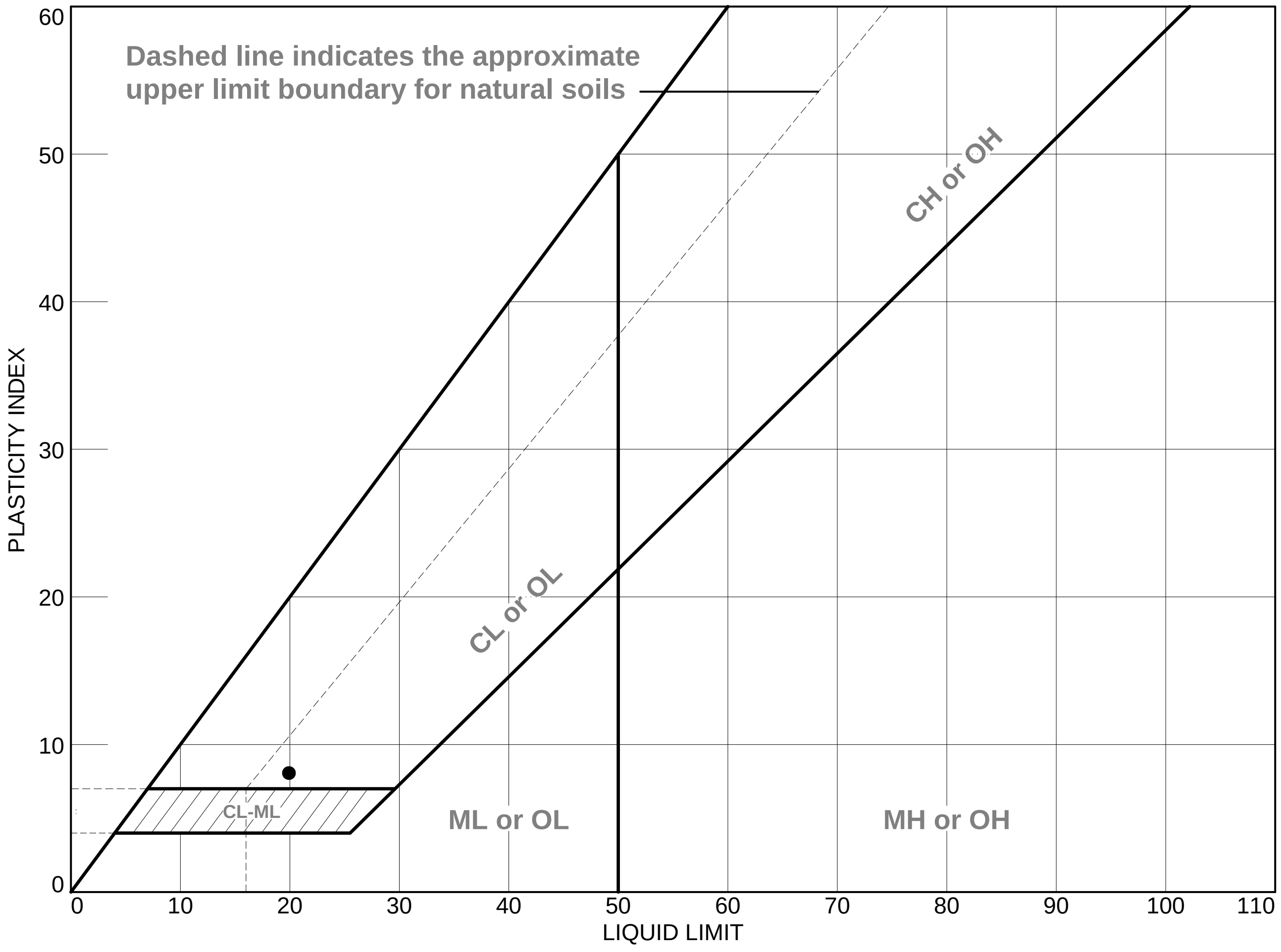
East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill

Project No.: 12-038 **Figure**

Tested By: JS 10/31/13 **Checked By:** JMA

LIQUID AND PLASTIC LIMITS TEST REPORT

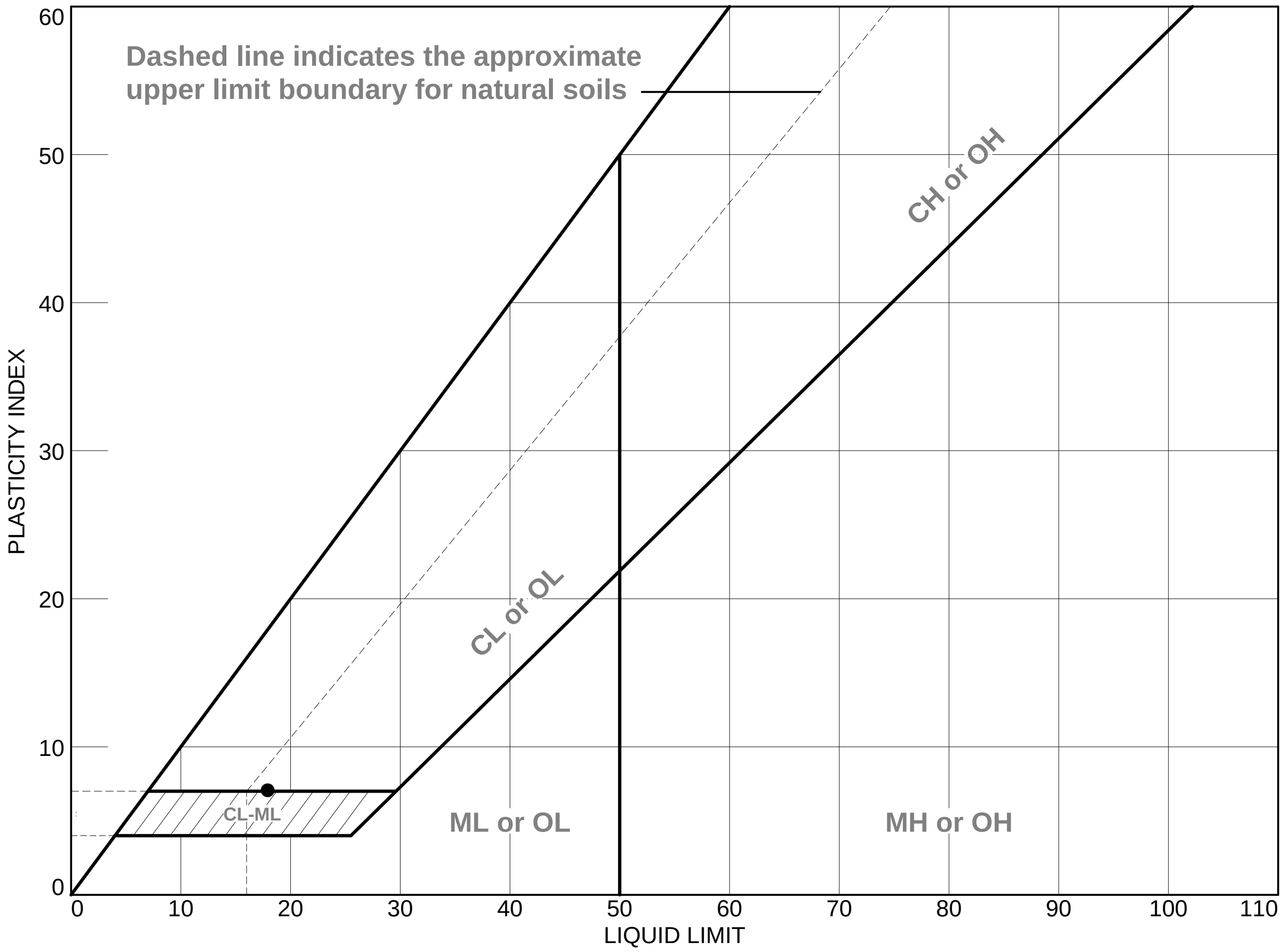


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Millseat Landfill, 2013	B-SEA-2	14-36'		12	20	8	CL

3rd Rock, LLC **East Aurora, NY**	**Client:** GEI Consultants, Inc. **Project:** Millseat Landfill **Project No.:** 12-038 **Figure**

Tested By: JS 10/31/13 **Checked By:** JMA

LIQUID AND PLASTIC LIMITS TEST REPORT



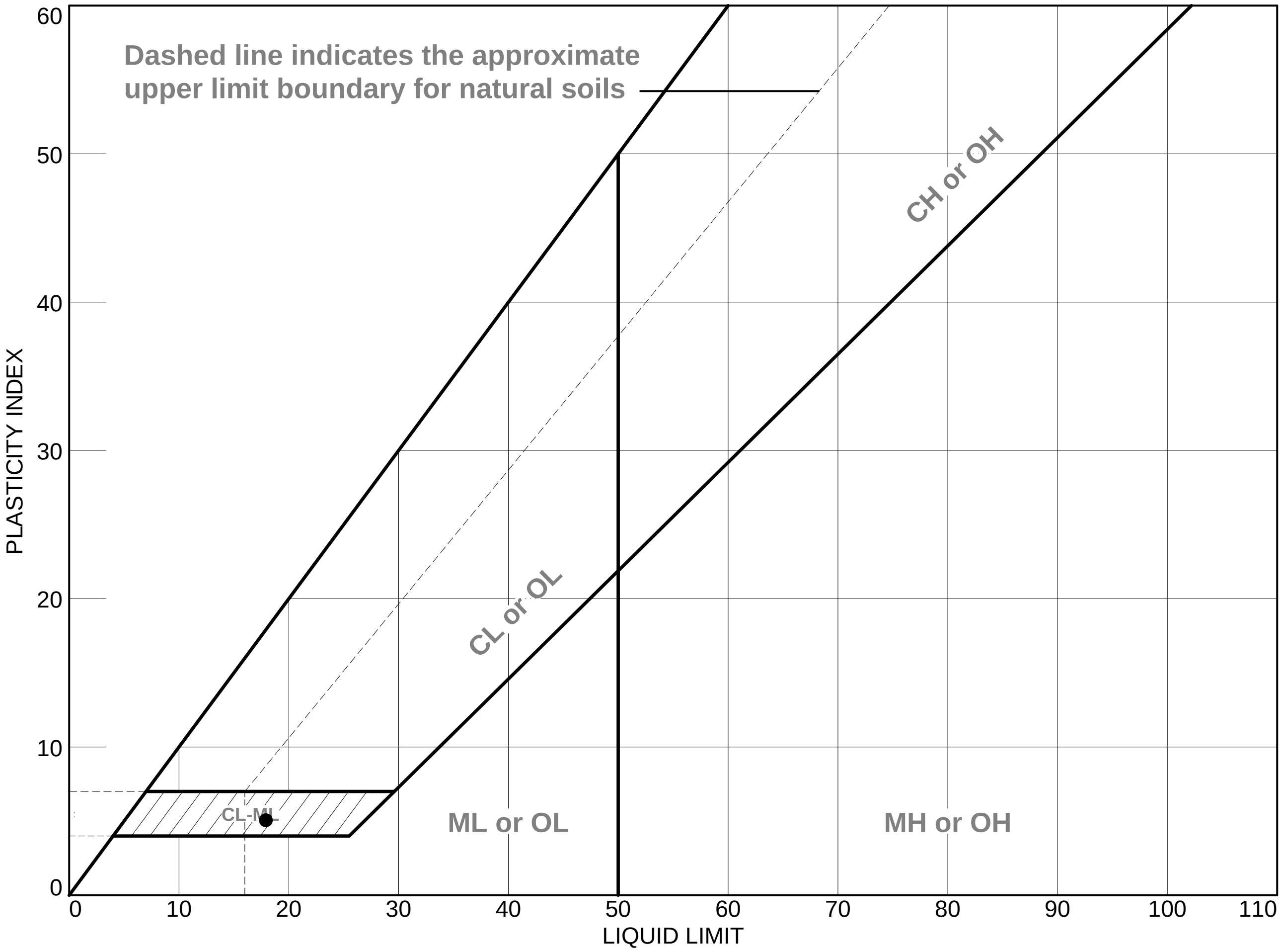
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Millseat Landfill, 2013	B-SEA-3	12-15'		11	18	7	CL-ML

3rd Rock, LLC **East Aurora, NY**	**Client:** GEI Consultants, Inc. **Project:** Millseat Landfill **Project No.:** 12-038 **Figure**

Tested By: JS 11/1/13 **Checked By:** JMA

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Millseat Landfill, 2013	B-SEA-5	0-20'		13	18	5	CL-ML

3rd Rock, LLC

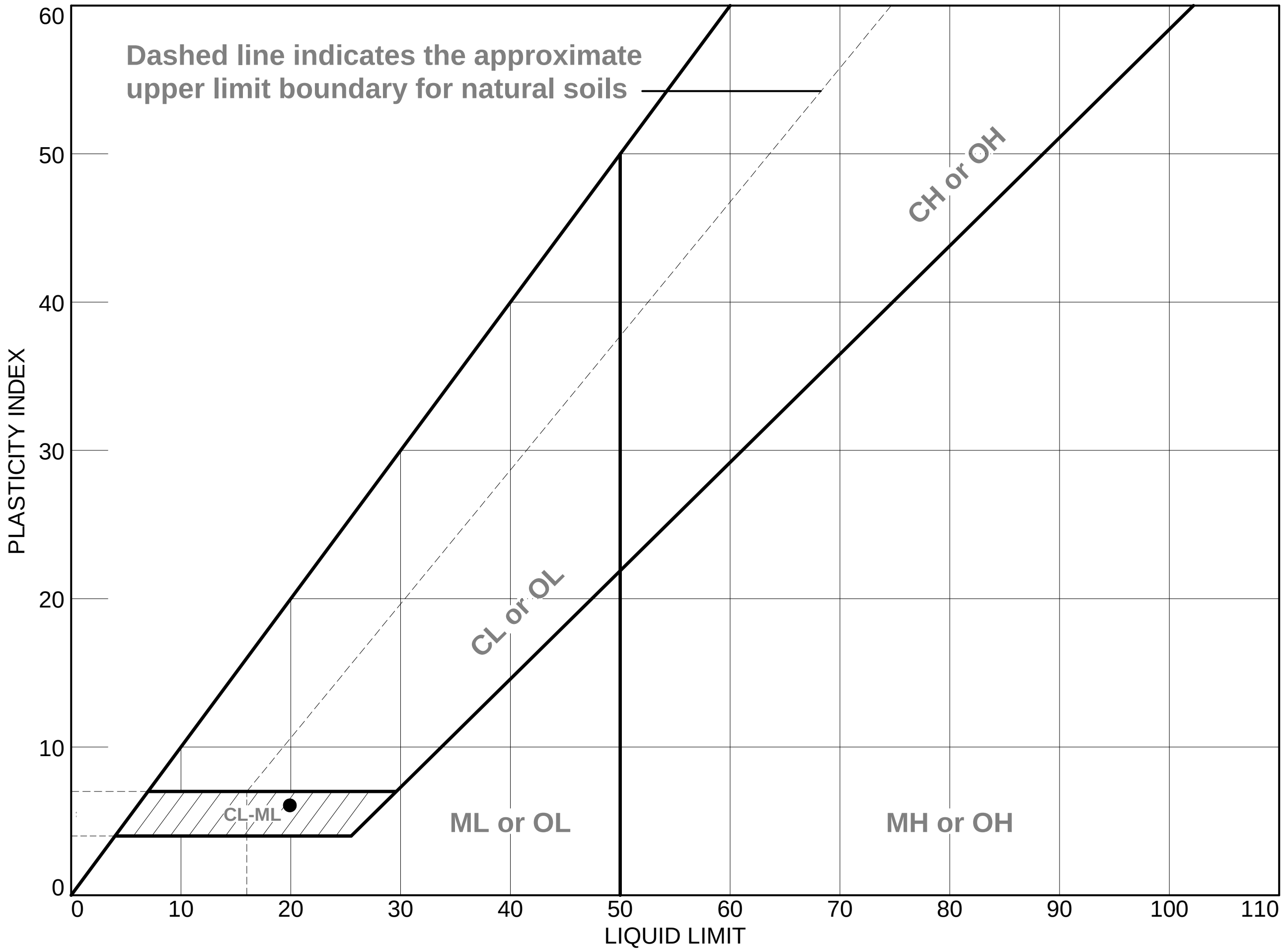
East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill

Project No.: 12-038 **Figure**

Tested By: JS 10/31/13 **Checked By:** JMA

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Millseat Landfill, 2013	B-SEA-6	0-19'		14	20	6	CL-ML

3rd Rock, LLC

East Aurora, NY

Client: GEI Consultants, Inc.
Project: Millseat Landfill

Project No.: 12-038 **Figure**

Tested By: JS 10/31/13 **Checked By:** JMA

FINAL PERMEABILITY REPORT

Project Name:	GEI Millseat Landfill	**Date:**	11/08/13	
Project No.:	13-037	**Tested By:**	JS	
Sample No.:	B-SEA-2, 14-36'	**Check By:**	JMA	
Sample I.D.:	13-580	**Date of Test:**	10/29/13	
Laboratory Method:	ASTM D5084, Method C	**Date Test Complete:**		11/07/13
Remarks:	*Specimen remolded to approximate in place density*	**CELL NO.:**		3

INITIAL SAMPLE DATA:

Height, in.:	3.011	Wet Density, pcf:	148.0
Diameter, in.:	2.805	Dry Density, pcf:	137.3
Moisture Content,%:	7.80	Compaction, %:	NA

FINAL SAMPLE DATA:

Height, in.:	3.005	Wet Density, pcf:	151.7
Diameter, in.:	2.794	Dry Density, pcf:	139.9
Moisture Content,%:	8.40		

SATURATION AND CONSOLIDATION DATA:

Consolidation Pressure: 85 psi

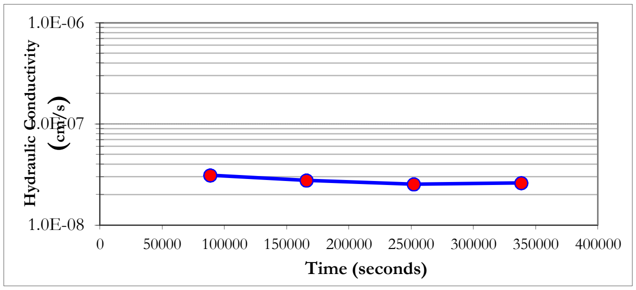
Backpressure: 80 psi

Saturation (B parameter): 95%

AVERAGE PERMEABILITY RESULT (average of last 4 readings, K, cm/s):

Trial #	Testing Pressures (psi)			Q (ml/sec)	Final K (cm/s)
	1	2	3		
1	85.1	80	79.7	4.35E-06	3.1E-08
2	85.1	80	79.7	3.75E-06	2.8E-08
3	85.1	80	79.7	3.36E-06	2.5E-08
4	85.1	80	79.7	3.36E-06	2.6E-08

Average K	2.7E-08
Average K , ft/day	7.8E-05



FINAL PERMEABILITY REPORT

Project Name:	GEI Millseat Landfill	**Date:**	11/08/13
Project No.:	13-037	**Tested By:**	JS
Sample No.:	B-SEA-3, 12-15'	**Check By:**	JMA
Sample I.D.:	13-581	**Date of Test:**	10/30/13
Laboratory Method:	ASTM D5084, Method C	**Date Test Complete:**	11/08/13
Remarks:	*Specimen remolded to approximate in place density*	**CELL NO.:**	5B

INITIAL SAMPLE DATA:

Height, in.:	3.105	Wet Density, pcf:	145.5
Diameter, in.:	2.796	Dry Density, pcf:	135.1
Moisture Content,%:	7.70	Compaction, %:	NA

FINAL SAMPLE DATA:

Height, in.:	3.074	Wet Density, pcf:	148.7
Diameter, in.:	2.798	Dry Density, pcf:	136.1
Moisture Content,%:	9.30		

SATURATION AND CONSOLIDATION DATA:

Consolidation Pressure: 85 psi

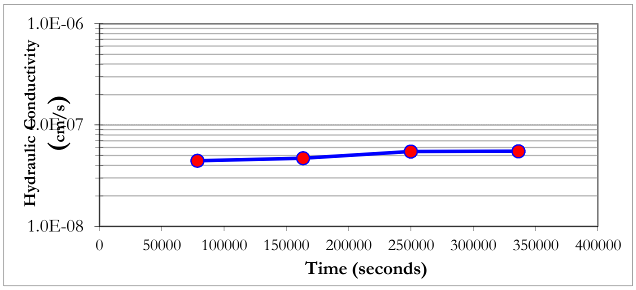
Backpressure: 80 psi

Saturation (B parameter): 99%

AVERAGE PERMEABILITY RESULT (average of last 4 readings, K, cm/s):

Trial #	Testing Pressures (psi)			Q (ml/sec)	Final K (cm/s)
	1	2	3		
1	85.1	80	79.7	5.73E-06	4.5E-08
2	85.1	80	79.7	5.78E-06	4.7E-08
3	85.1	80	79.7	6.37E-06	5.5E-08
4	85.1	80	79.7	6.07E-06	5.5E-08

Average K	5.0E-08
Average K , ft/day	1.4E-04



3rd rock

FINAL PERMEABILITY REPORT

Project Name:	GEI Millseat Landfill		**Date:**	11/05/13
Project No.:	13-037		**Tested By:**	JS
Sample No.:	B-SEA-5, 0-20'		**Check By:**	JMA
Sample I.D.:	13-582		**Date of Test:**	10/28/13
Laboratory Method:	ASTM D5084, Method C		**Date Test Complete:**	11/05/13
Comments:	Specimen remolded to approximate in place density		**CELL NO.:**	5A

INITIAL SAMPLE DATA:

Height, in.:	3.047	Wet Density, pcf:	145.2
Diameter, in.:	2.804	Dry Density, pcf:	135.8
Moisture Content,%:	6.90	Target Density,pcf:	In place

FINAL SAMPLE DATA:

Height, in.:	3.021	Wet Density, pcf:	149.7
Diameter, in.:	2.808	Dry Density, pcf:	136.6
Moisture Content,%:	9.60		

SATURATION AND CONSOLIDATION DATA:

Consolidation Pressure: 85 psi

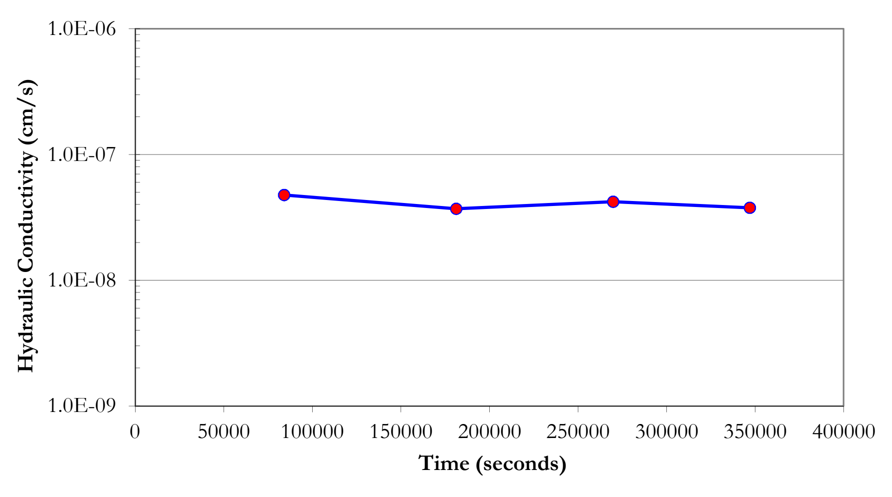
Backpressure: 80 psi

Saturation (B parameter): 100%

AVERAGE PERMEABILITY RESULT (average of last 4 readings, K, cm/s):

Trial #	Testing Pressures (psi)			Q (ml/sec)	Final K (cm/s)
	1	2	3		
1	85.1	80	79.7	5.24E-06	4.8E-08
2	85.1	80	79.7	4.07E-06	3.7E-08
3	85.1	80	79.7	4.63E-06	4.2E-08
4	85.1	80	79.7	4.15E-06	3.8E-08

Average K	4.1E-08
Average K , ft/day	1.2E-04



Appendix D

Bedrock Core Photographs

Bedrock Core Photographic Log

Project :	Mill Seat Landfill- Southern Expansion Area	**Page:**	1 of 6
Client :	Waste Management of New York	**GEI Proj. No.**	1328270
Subcontractor:	Nothnagle Drilling, Inc.		

Bedrock Core Photographic Log

Project : Mill Seat Landfill- Southern Expansion Area
Client : Waste Management of New York
Subcontractor: Nothnagle Drilling, Inc.

Page: 2 of 6
GEI Proj. No. 1328270

Bedrock Core Photographic Log

Project :	Mill Seat Landfill- Southern Expansion Area	**Page:**	3 of 6
Client :	Waste Management of New York	**GEI Proj. No.**	1328270
Subcontractor:	Nothnagle Drilling, Inc.		

Bedrock Core Photographic Log

Project : Mill Seat Landfill- Southern Expansion Area
Page: 4 of 6
Client : Waste Management of New York
GEI Proj. No. 1328270
Subcontractor: Nothnagle Drilling, Inc.

Bedrock Core Photographic Log

Project : Mill Seat Landfill- Southern Expansion Area
Page: 5 of 6
Client : Waste Management of New York
GEI Proj. No. 1328270
Subcontractor: Nothnagle Drilling, Inc.

Bedrock Core Photographic Log

Project :	Mill Seat Landfill- Southern Expansion Area	**Page:**	6 of 6
Client :	Waste Management of New York	**GEI Proj. No.**	1328270
Subcontractor:	Nothnagle Drilling, Inc.		

Appendix E

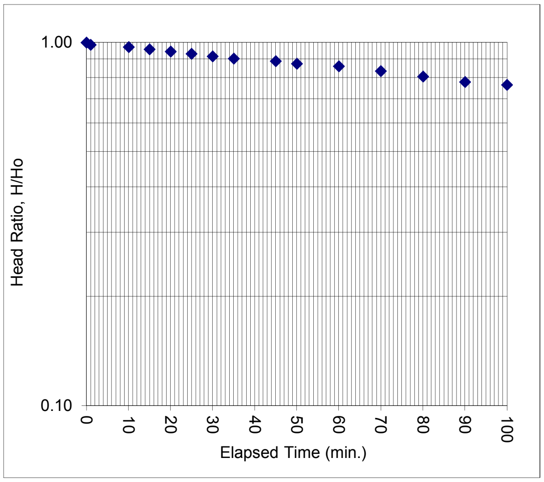
Slug Test Hydraulic Conductivity Calculations

VARIABLE HEAD PERMEABILITY TEST

PZ-01-2010

PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	PZ-01-2010
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	668.44

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **8.50**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet
(below ground surface): **16.0**

db Depth to bottom of screen interval, feet
(below ground surface): **27.0**

L Length, feet: **11.00**

Hs Static Water Level
(feet above troll or well bot): **8.54**

DTW feet below top of riser --

m Estimate: **1**

(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	7.32	1.22	1			
1.00	7.34	1.20	0.986	1.5E-05	0.02	7.9E-06
10.00	7.36	1.19	0.972	1.7E-06	0.00	8.7E-07
15.00	7.37	1.17	0.958	3.1E-06	0.00	1.6E-06
20.00	7.39	1.15	0.944	3.2E-06	0.00	1.6E-06
25.00	7.41	1.14	0.930	3.2E-06	0.00	1.6E-06
30.00	7.42	1.12	0.916	3.3E-06	0.00	1.7E-06
35.00	7.44	1.10	0.902	3.3E-06	0.00	1.7E-06
45.00	7.46	1.08	0.889	1.7E-06	0.00	8.6E-07
50.00	7.48	1.07	0.875	3.4E-06	0.00	1.7E-06
60.00	7.49	1.05	0.861	1.7E-06	0.00	8.8E-07
70.00	7.53	1.02	0.834	3.5E-06	0.00	1.8E-06
80.00	7.56	0.98	0.806	3.7E-06	0.01	1.9E-06
90.00	7.59	0.95	0.778	3.8E-06	0.01	1.9E-06
100.00	7.61	0.93	0.764	2.0E-06	0.00	1.0E-06
110.00	7.64	0.90	0.736	4.0E-06	0.01	2.0E-06
120.00	7.66	0.88	0.722	2.1E-06	0.00	1.1E-06
130.00	7.70	0.85	0.694	4.3E-06	0.01	2.2E-06
140.00	7.71	0.83	0.680	2.2E-06	0.00	1.1E-06
150.00	7.75	0.80	0.652	4.5E-06	0.01	2.3E-06

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.02	1.22			
	20.00	1.15	3.1E-06	0.004	1.6E-06
Lower Portion	25.00	1.14			
	80.00	0.983	2.8E-06	0.004	1.4E-06

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

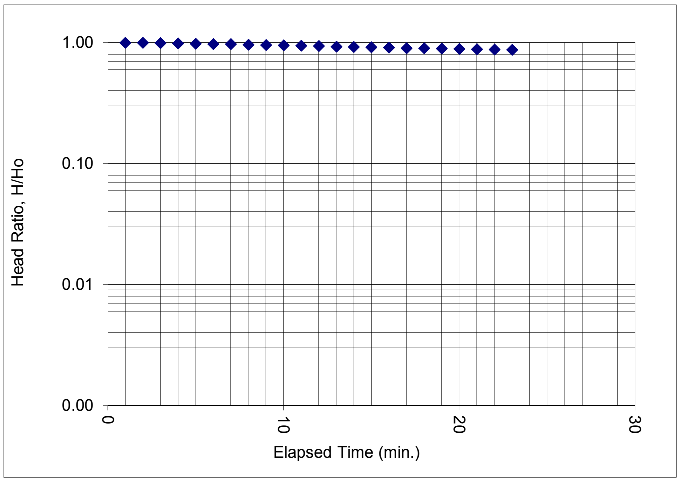
VARIABLE HEAD PERMEABILITY TEST

PZ-3 (2006)

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/02/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	PZ-3 (2006)
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER ELEV.:	679.30

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**1.00**
D Effective diameter, inches:	**2.50**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**19.6**
db Depth to bottom of screen interval, feet (below ground surface):	**31.6**
L Length, feet:	**12.00**
Hs Static Water Level (feet above troll or well bot):	**11.97**
DTW feet below top of riser	**12.82**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock

TEST: slug in

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	15.59	3.62	1			
0.07	15.58	3.61	0.995	3.2E-05	0.05	1.6E-05
0.22	15.56	3.59	0.991	1.1E-05	0.02	5.5E-06
0.37	15.54	3.57	0.986	1.1E-05	0.02	5.5E-06
0.60	15.53	3.56	0.981	7.0E-06	0.01	3.6E-06
1.10	15.51	3.54	0.977	3.3E-06	0.00	1.7E-06
1.30	15.49	3.52	0.972	7.8E-06	0.01	4.0E-06
1.60	15.46	3.49	0.963	1.1E-05	0.02	5.6E-06
2.00	15.44	3.47	0.958	4.2E-06	0.01	2.1E-06
3.00	15.41	3.44	0.949	3.4E-06	0.00	1.7E-06
5.00	15.39	3.42	0.944	8.5E-07	0.00	4.3E-07
7.00	15.37	3.40	0.939	8.6E-07	0.00	4.3E-07
10.00	15.34	3.37	0.930	1.1E-06	0.00	5.8E-07
12.00	15.31	3.34	0.921	1.7E-06	0.00	8.8E-07
15.00	15.29	3.32	0.916	5.8E-07	0.00	3.0E-07
17.00	15.27	3.30	0.911	8.8E-07	0.00	4.5E-07
19.00	15.24	3.27	0.902	1.8E-06	0.00	9.0E-07
21.00	15.24	3.27	0.902	--	--	--
23.00	15.20	3.23	0.892	1.8E-06	0.00	9.1E-07
25.20	15.19	3.22	0.888	8.2E-07	0.00	4.2E-07
28.20	15.17	3.20	0.883	6.1E-07	0.00	3.1E-07
30.20	15.15	3.18	0.879	8.6E-07	0.00	4.4E-07
38.53	15.14	3.17	0.874	2.2E-07	0.00	1.1E-07
--	--	--	--	--	--	--
--	--	--	--	--	--	--
--	--	--	--	--	--	--

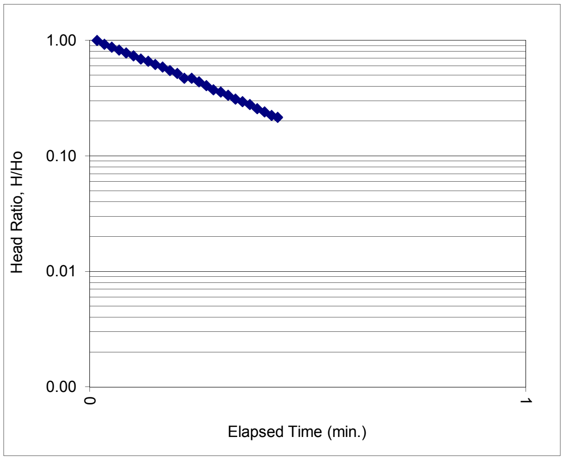
Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.07	3.61			
	1.30	3.57	2.6E-06	0.004	1.3E-06
Lower Portion	3.00	3.54			
	12.00	3.488	5.4E-07	0.001	2.8E-07

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST				PZ-SEA-1Z	
PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	PZ-SEA-1Z
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	672.81

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface): **55.0**

db Depth to bottom of screen interval, feet (below ground surface): **67.0**

L Length, feet: **12.00**

Hs Static Water Level (feet above troll or well bot): **12.6**

DTW feet below top of riser **15.98**

m Estimate: **1**

(Ratio Kh/Kv)

LITHOLOGY: Fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	10.46	2.14	1			
0.03	10.61	1.99	0.929	5.0E-03	7.16	2.5E-03
0.05	10.73	1.87	0.873	4.2E-03	6.00	2.1E-03
0.07	10.83	1.77	0.826	3.8E-03	5.45	1.9E-03
0.08	10.93	1.67	0.779	4.0E-03	5.72	2.0E-03
0.10	11.02	1.58	0.739	3.5E-03	5.09	1.8E-03
0.12	11.12	1.48	0.691	4.5E-03	6.48	2.3E-03
0.13	11.19	1.41	0.660	3.1E-03	4.50	1.6E-03
0.15	11.27	1.33	0.620	4.2E-03	6.03	2.1E-03
0.17	11.34	1.26	0.589	3.5E-03	5.11	1.8E-03
0.18	11.42	1.18	0.549	4.7E-03	6.79	2.4E-03
0.20	11.49	1.11	0.517	4.0E-03	5.80	2.0E-03
0.22	11.59	1.01	0.470	6.5E-03	9.30	3.3E-03
0.23	11.59	1.01	0.470	--	--	--
0.25	11.66	0.94	0.438	4.7E-03	6.80	2.4E-03
0.27	11.73	0.87	0.407	5.1E-03	7.31	2.6E-03
0.28	11.80	0.80	0.375	5.5E-03	7.91	2.8E-03
0.30	11.83	0.77	0.359	2.9E-03	4.21	1.5E-03
0.32	11.88	0.72	0.336	4.5E-03	6.54	2.3E-03
0.33	11.93	0.67	0.312	5.0E-03	7.16	2.5E-03
0.35	11.97	0.63	0.296	3.5E-03	5.08	1.8E-03
0.37	12.00	0.60	0.280	3.7E-03	5.36	1.9E-03
0.38	12.05	0.55	0.256	6.0E-03	8.64	3.0E-03
0.40	12.09	0.51	0.240	4.3E-03	6.22	2.2E-03
0.42	12.12	0.48	0.225	4.6E-03	6.65	2.3E-03
0.43	12.14	0.46	0.217	3.0E-03	4.38	1.5E-03

Represent slope using 2 points.

		Rel. Head (ft)	K(ft/min)	K (ft/day)	K (cm/s)
Upper Portion	0.03	1.99			
	0.07	1.77	4.0E-03	5.73	2.0E-03
Lower Portion	0.10	1.58			
	0.13	1.414	3.8E-03	5.49	1.9E-03

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

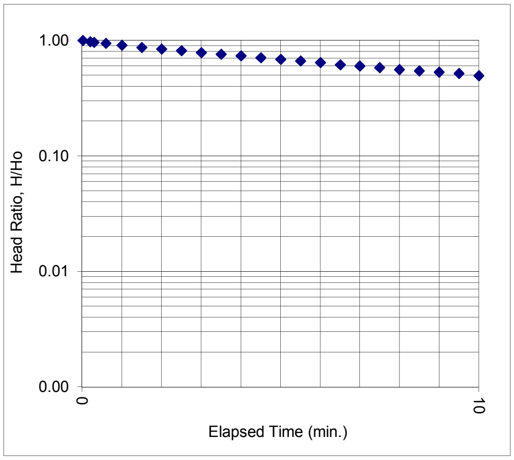
VARIABLE HEAD PERMEABILITY TEST

PZ-SEA-3Z

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/01/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	PZ-SEA-3Z
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER ELEV.:	668.37

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface): **7.5**

db Depth to bottom of screen interval, feet (below ground surface): **19.5**

L Length, feet: **12.00**

Hs Static Water Level (feet above troll or well bot): **19.10**

DTW feet below top of riser **15.32**

m Estimate: **1**

(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	16.71	2.39	1			
0.20	16.76	2.34	0.979	1.3E-04	0.19	6.7E-05
0.30	16.80	2.30	0.964	1.7E-04	0.24	8.4E-05
0.60	16.85	2.25	0.943	8.2E-05	0.12	4.2E-05
1.00	16.93	2.17	0.908	1.1E-04	0.16	5.5E-05
1.50	17.02	2.08	0.872	9.0E-05	0.13	4.6E-05
2.00	17.09	2.02	0.844	7.5E-05	0.11	3.8E-05
2.50	17.15	1.95	0.815	7.7E-05	0.11	3.9E-05
3.00	17.22	1.88	0.787	7.9E-05	0.11	4.0E-05
3.50	17.29	1.81	0.759	8.3E-05	0.12	4.2E-05
4.00	17.34	1.76	0.737	6.4E-05	0.09	3.3E-05
4.50	17.41	1.69	0.709	8.9E-05	0.13	4.5E-05
5.00	17.46	1.64	0.688	6.9E-05	0.10	3.5E-05
5.50	17.51	1.59	0.667	7.0E-05	0.10	3.5E-05
6.00	17.56	1.54	0.645	7.3E-05	0.11	3.7E-05
6.50	17.63	1.47	0.617	1.0E-04	0.15	5.2E-05
7.00	17.66	1.44	0.603	5.3E-05	0.08	2.7E-05
7.50	17.71	1.39	0.581	8.1E-05	0.12	4.1E-05
8.00	17.76	1.34	0.560	8.4E-05	0.12	4.3E-05
8.50	17.80	1.30	0.546	5.8E-05	0.08	2.9E-05
9.00	17.83	1.27	0.531	6.0E-05	0.09	3.0E-05
9.50	17.86	1.24	0.518	5.9E-05	0.09	3.0E-05
10.00	17.92	1.19	0.496	9.5E-05	0.14	4.8E-05
11.00	17.98	1.12	0.468	6.7E-05	0.10	3.4E-05
12.00	18.05	1.05	0.439	7.1E-05	0.10	3.6E-05
13.00	18.10	1.00	0.418	5.6E-05	0.08	2.9E-05

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.20	2.34			
	0.60	2.25	1.0E-04	0.15	5.2E-05
Lower Portion	4.00	1.76			
	6.00	1.541	7.5E-05	0.11	3.8E-05

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

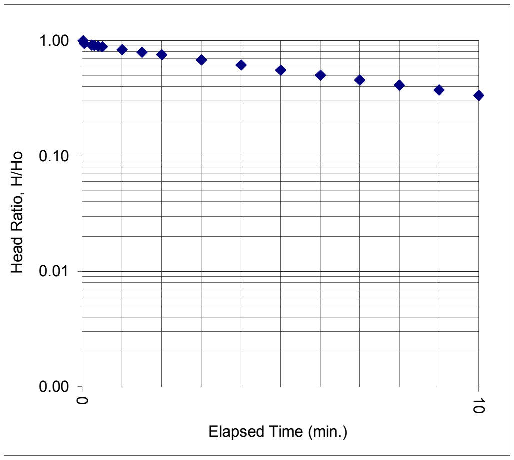
VARIABLE HEAD PERMEABILITY TEST

PZ-SEA-5Z

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/01/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	PZ-SEA-5Z
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER ELEV.:	659.04

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**42.4**
db Depth to bottom of screen interval, feet (below ground surface):	**54.4**
L Length, feet:	**12.00**
Hs Static Water Level (feet above troll or well bot):	**8.10**
DTW feet below top of riser	**10.65**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	3.661	4.44	1			
0.05	3.898	4.20	0.947	1.9E-03	2.67	9.4E-04
0.23	4.034	4.07	0.916	2.0E-04	0.29	1.0E-04
0.30	4.068	4.03	0.908	1.4E-04	0.20	7.2E-05
0.40	4.119	3.98	0.897	1.4E-04	0.21	7.3E-05
0.50	4.153	3.95	0.889	9.7E-05	0.14	4.9E-05
1.00	4.373	3.73	0.840	1.3E-04	0.19	6.6E-05
1.50	4.559	3.54	0.798	1.2E-04	0.17	5.9E-05
2.00	4.746	3.35	0.756	1.2E-04	0.18	6.2E-05
3.00	5.068	3.03	0.683	1.1E-04	0.16	5.8E-05
4.00	5.356	2.74	0.618	1.1E-04	0.16	5.7E-05
5.00	5.627	2.47	0.557	1.2E-04	0.17	5.9E-05
6.00	5.864	2.24	0.504	1.1E-04	0.16	5.8E-05
7.00	6.068	2.03	0.458	1.1E-04	0.16	5.5E-05
8.00	6.271	1.83	0.412	1.2E-04	0.17	6.0E-05
9.00	6.441	1.66	0.374	1.1E-04	0.16	5.6E-05
10.00	6.61	1.49	0.336	1.2E-04	0.17	6.1E-05
11.00	6.746	1.35	0.305	1.1E-04	0.16	5.5E-05
12.00	6.881	1.22	0.275	1.2E-04	0.17	6.0E-05
13.00	6.983	1.12	0.252	9.8E-05	0.14	5.0E-05
14.00	7.085	1.02	0.229	1.1E-04	0.16	5.5E-05
15.00	7.186	0.91	0.206	1.2E-04	0.17	6.0E-05
16.00	7.271	0.83	0.187	1.1E-04	0.16	5.6E-05
18.00	7.407	0.69	0.156	1.0E-04	0.15	5.1E-05
20.00	7.508	0.59	0.133	8.9E-05	0.13	4.5E-05
22.00	7.593	0.51	0.114	8.7E-05	0.13	4.4E-05

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.05	4.20			
	0.30	4.03	1.9E-04	0.27	9.4E-05
Lower Portion	1.50	3.54			
	3.00	3.032	1.2E-04	0.17	5.9E-05

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

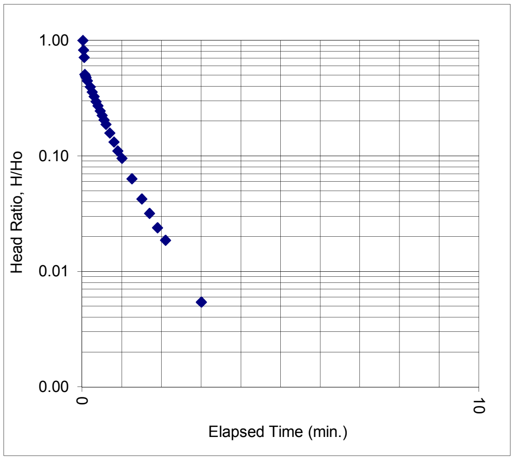
VARIABLE HEAD PERMEABILITY TEST

PZ-SEA-6Z

PROJECT: Mill Seat LF Expansion
LOCATION: Bergen, NY
CLIENT: Waste Management
PERFORMED: M. Cummings DATE: 10/01/13
CALCULATED: M. Cummings DATE: 10/03/13
CHECKED: R. Frappa DATE: 10/07/13

PAGE: 1 of 1
BORING : PZ-SEA-6Z
PROJ NO.: 1328270
TEST NO.: 1
TOP RISER
ELEV.: 671.27

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet
(below ground surface): **59.9**

db Depth to bottom of screen interval, feet
(below ground surface): **71.9**

L Length, feet: **12.00**

Hs Static Water Level
(feet above troll or well bot): **17.12**

DTW feet below top of riser **17.11**

m Estimate: **1**
(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	10.695	6.43	1			
0.03	11.797	5.32	0.828	1.3E-02	18.31	6.5E-03
0.05	12.525	4.60	0.715	9.9E-03	14.31	5.0E-03
0.07	13.847	3.27	0.509	2.3E-02	33.01	1.2E-02
0.08	13.949	3.17	0.494	2.1E-03	3.08	1.1E-03
0.10	14.051	3.07	0.478	2.2E-03	3.18	1.1E-03
0.13	14.237	2.88	0.449	2.1E-03	3.04	1.1E-03
0.20	14.576	2.54	0.396	2.1E-03	3.04	1.1E-03
0.25	14.814	2.31	0.359	2.2E-03	3.19	1.1E-03
0.30	15.017	2.10	0.327	2.1E-03	2.99	1.1E-03
0.35	15.22	1.90	0.296	2.3E-03	3.29	1.2E-03
0.40	15.373	1.75	0.272	1.9E-03	2.72	9.6E-04
0.45	15.542	1.58	0.246	2.3E-03	3.30	1.2E-03
0.50	15.678	1.44	0.224	2.0E-03	2.92	1.0E-03
0.55	15.797	1.32	0.206	1.9E-03	2.79	9.9E-04
0.60	15.915	1.21	0.188	2.1E-03	3.03	1.1E-03
0.70	16.102	1.02	0.158	1.9E-03	2.73	9.6E-04
0.80	16.271	0.85	0.132	2.0E-03	2.94	1.0E-03
0.90	16.407	0.71	0.111	2.0E-03	2.83	1.0E-03
1.00	16.508	0.61	0.095	1.7E-03	2.48	8.7E-04
1.25	16.712	0.41	0.064	1.8E-03	2.63	9.3E-04
1.50	16.847	0.27	0.042	1.8E-03	2.61	9.2E-04
1.70	16.915	0.21	0.032	1.6E-03	2.32	8.2E-04
1.90	16.966	0.15	0.024	1.6E-03	2.32	8.2E-04
2.10	17	0.12	0.019	1.4E-03	2.02	7.1E-04
3.00	17.085	0.04	0.005	1.5E-03	2.22	7.8E-04

Represent slope using 2 points.

		Rel. Head (ft)	K(ft/min)	K (ft/day)	K (cm/s)
Upper Portion	0.07	3.27			
	0.13	2.88	2.1E-03	3.09	1.1E-03
Lower Portion	0.30	2.10			
	0.50	1.442	2.1E-03	3.06	1.1E-03

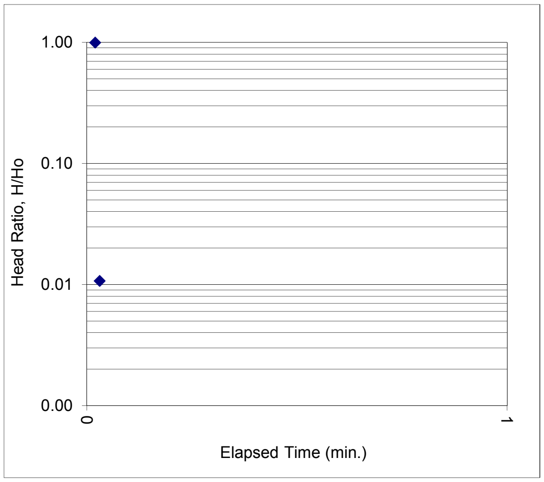
Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST

MW-SEA-1A

PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-1A
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	673.06

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface): **10.1**

db Depth to bottom of screen interval, feet (below ground surface): **22.1**

L Length, feet: **12.00**

Hs Static Water Level (feet above troll or well bot): **14.56**

DTW feet below top of riser **16.28**

m Estimate: **1**

(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock

TEST: slug in

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	15.49	0.93	1			
0.03	14.57	0.01	0.011	5.1E-01	734.92	2.6E-01
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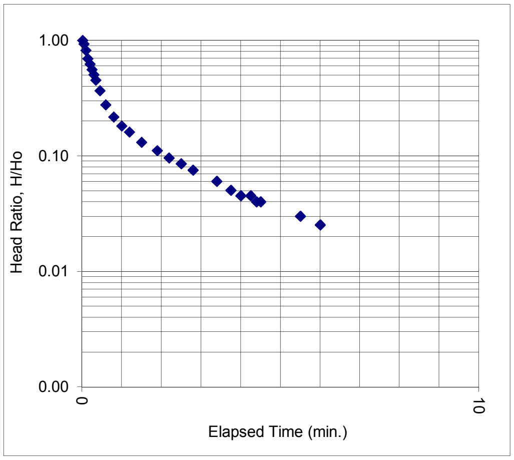
Represent slope using 2 points.

		Rel. Head (ft)	K(ft/min)	K (ft/day)	K (cm/s)
Upper Portion	0.02	0.93			
	0.03	0.01	5.1E-01	734.92	2.6E-01
Lower Portion	0.00	0.00			
	0.00	0.000			

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST				MW-SEA-1B	
PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-1B
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	673.22

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	2.00
D Effective diameter, inches:	5.88

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	10.1
db Depth to bottom of screen interval, feet (below ground surface):	22.1
L Length, feet:	12.00
Hs Static Water Level (feet above troll or well bot):	5.93
DTW feet below top of riser	16.19
m Estimate: (Ratio Kh/Kv)	1

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	2.58	3.36	1			
0.05	2.80	3.14	0.934	2.3E-03	3.31	1.2E-03
0.10	3.17	2.76	0.823	2.8E-03	4.10	1.4E-03
0.15	3.59	2.34	0.697	3.8E-03	5.40	1.9E-03
0.20	3.83	2.10	0.626	2.4E-03	3.48	1.2E-03
0.25	4.05	1.88	0.560	2.5E-03	3.59	1.3E-03
0.30	4.24	1.70	0.505	2.3E-03	3.38	1.2E-03
0.35	4.41	1.53	0.454	2.4E-03	3.43	1.2E-03
0.45	4.70	1.24	0.369	2.4E-03	3.39	1.2E-03
0.60	5.00	0.93	0.278	2.1E-03	3.06	1.1E-03
0.80	5.20	0.73	0.217	1.4E-03	1.99	7.0E-04
1.00	5.32	0.61	0.182	1.0E-03	1.44	5.1E-04
1.20	5.39	0.54	0.162	6.7E-04	0.96	3.4E-04
1.50	5.49	0.44	0.131	7.8E-04	1.13	4.0E-04
1.90	5.56	0.37	0.111	4.7E-04	0.67	2.4E-04
2.20	5.61	0.32	0.096	5.5E-04	0.79	2.8E-04
2.50	5.64	0.29	0.086	4.2E-04	0.60	2.1E-04
2.80	5.68	0.25	0.076	4.7E-04	0.68	2.4E-04
3.40	5.73	0.20	0.060	4.2E-04	0.61	2.1E-04
3.75	5.76	0.17	0.050	5.9E-04	0.85	3.0E-04
4.00	5.78	0.15	0.045	4.8E-04	0.69	2.4E-04
4.25	5.78	0.15	0.045	--	--	--
4.40	5.80	0.14	0.040	8.9E-04	1.28	4.5E-04
4.50	5.80	0.14	0.040	--	--	--
5.50	5.83	0.10	0.030	3.3E-04	0.47	1.7E-04
6.00	5.85	0.09	0.025	3.9E-04	0.56	2.0E-04

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.05	3.14			
	0.15	2.34	3.3E-03	4.75	1.7E-03
Lower Portion	0.25	1.88			
	0.35	1.525	2.4E-03	3.40	1.2E-03

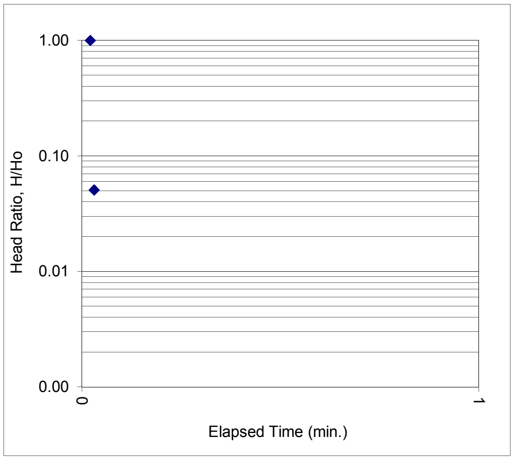
Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST

MW-SEA-2A

PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-2A
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	668.62

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**27.5**
db Depth to bottom of screen interval, feet (below ground surface):	**52.5**
L Length, feet:	**25.00**
Hs Static Water Level (feet above troll or well bot):	**12.97**
DTW feet below top of riser	**12.82**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	7.25	5.72	1			
0.03	12.68	0.29	0.051	1.9E-01	275.84	9.7E-02

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.02	5.72			
	0.03	0.29	1.9E-01	275.84	9.7E-02
Lower Portion	0.00	0.00			
	0.00	0.000			

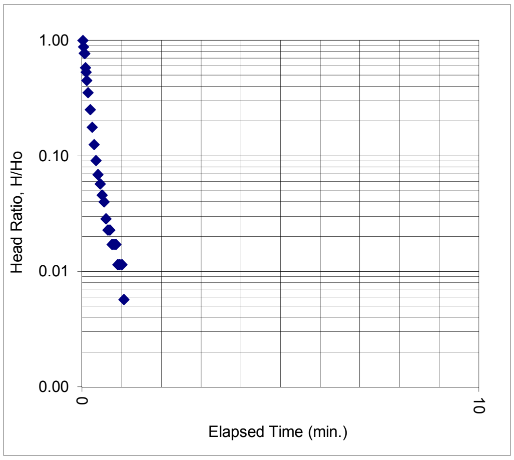
Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST

MW-SEA-2B

PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-2B
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	669.09

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**9.2**
db Depth to bottom of screen interval, feet (below ground surface):	**21.2**
L Length, feet:	**12.00**
Hs Static Water Level (feet above troll or well bot):	**8.05**
DTW feet below top of riser	**13.17**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	5.09	2.97	1			
0.03	5.44	2.61	0.880	8.6E-03	12.44	4.4E-03
0.05	5.75	2.31	0.777	8.4E-03	12.09	4.3E-03
0.07	5.76	2.29	0.771	5.0E-04	0.72	2.5E-04
0.08	6.32	1.73	0.583	1.9E-02	27.25	9.6E-03
0.10	6.48	1.58	0.531	6.3E-03	9.01	3.2E-03
0.12	6.71	1.34	0.451	1.1E-02	15.85	5.6E-03
0.15	7.00	1.05	0.354	8.2E-03	11.78	4.2E-03
0.20	7.31	0.75	0.252	7.7E-03	11.12	3.9E-03
0.25	7.53	0.53	0.177	7.9E-03	11.33	4.0E-03
0.30	7.68	0.37	0.126	7.7E-03	11.15	3.9E-03
0.35	7.78	0.27	0.091	7.2E-03	10.36	3.7E-03
0.40	7.85	0.20	0.069	6.4E-03	9.21	3.2E-03
0.45	7.88	0.17	0.057	4.1E-03	5.91	2.1E-03
0.50	7.92	0.14	0.046	5.0E-03	7.24	2.6E-03
0.55	7.93	0.12	0.040	3.0E-03	4.33	1.5E-03
0.60	7.97	0.09	0.029	7.6E-03	10.91	3.8E-03
0.65	7.98	0.07	0.023	5.0E-03	7.24	2.6E-03
0.70	7.98	0.07	0.023	--	--	--
0.75	8.00	0.05	0.017	6.5E-03	9.33	3.3E-03
0.80	8.00	0.05	0.017	--	--	--
0.85	8.00	0.05	0.017	--	--	--
0.90	8.02	0.03	0.011	9.1E-03	13.15	4.6E-03
0.95	8.02	0.03	0.011	--	--	--
1.00	8.02	0.03	0.011	--	--	--
1.05	8.03	0.02	0.006	1.6E-02	22.48	7.9E-03

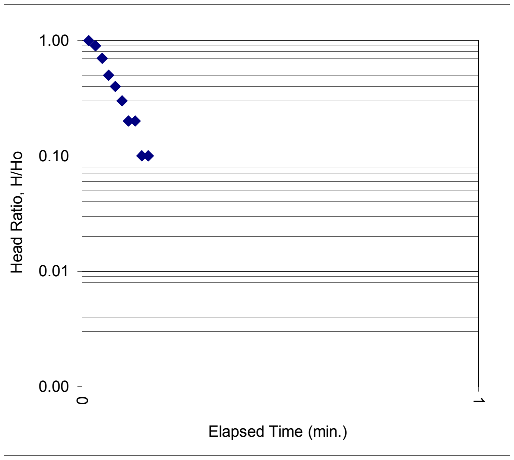
Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.03	2.61			
	0.07	2.29	4.4E-03	6.40	2.3E-03
Lower Portion	0.15	1.05			
	0.25	0.526	7.8E-03	11.22	4.0E-03

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST				MW-SEA-3A	
PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-3A
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	669.01

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**30.7**
db Depth to bottom of screen interval, feet (below ground surface):	**47.7**
L Length, feet:	**17.00**
Hs Static Water Level (feet above troll or well bot):	**17.00**
DTW feet below top of riser	**14.35**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	16.83	0.17	1			
0.03	16.85	0.15	0.905	5.2E-03	7.44	2.6E-03
0.05	16.88	0.12	0.704	1.3E-02	18.80	6.6E-03
0.07	16.92	0.09	0.503	1.7E-02	25.17	8.9E-03
0.08	16.93	0.07	0.402	1.2E-02	16.70	5.9E-03
0.10	16.95	0.05	0.302	1.5E-02	21.52	7.6E-03
0.12	16.97	0.03	0.201	2.1E-02	30.34	1.1E-02
0.13	16.97	0.03	0.201	--	--	--
0.15	16.98	0.02	0.101	3.6E-02	51.86	1.8E-02
0.17	16.98	0.02	0.101	--	--	--

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.03	0.15			
	0.07	0.09	1.5E-02	21.99	7.8E-03
Lower Portion	0.07	0.09			
	0.17	0.017	1.4E-02	20.07	7.1E-03

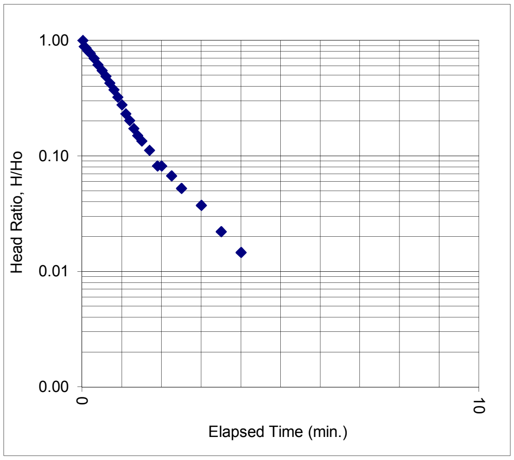
Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST

MW-SEA-3B

PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-3B
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	668.64

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**7.5**
db Depth to bottom of screen interval, feet (below ground surface):	**19.5**
L Length, feet:	**12.00**
Hs Static Water Level (feet above troll or well bot):	**8.66**
DTW feet below top of riser	**10.8**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	6.407	2.25	1			
0.05	6.661	2.00	0.887	4.0E-03	5.82	2.1E-03
0.1	6.729	1.93	0.857	7.8E-04	1.12	4.0E-04
0.15	6.831	1.83	0.812	1.2E-03	1.76	6.2E-04
0.2	6.915	1.75	0.775	1.1E-03	1.52	5.4E-04
0.3	7.085	1.58	0.699	1.2E-03	1.66	5.9E-04
0.4	7.271	1.39	0.617	1.4E-03	2.04	7.2E-04
0.5	7.424	1.24	0.549	1.3E-03	1.89	6.7E-04
0.6	7.559	1.10	0.489	1.3E-03	1.88	6.6E-04
0.7	7.695	0.97	0.428	1.5E-03	2.14	7.5E-04
0.8	7.814	0.85	0.375	1.5E-03	2.13	7.5E-04
0.9	7.932	0.73	0.323	1.7E-03	2.44	8.6E-04
1	8.034	0.63	0.278	1.7E-03	2.45	8.6E-04
1.1	8.136	0.52	0.233	2.0E-03	2.88	1.0E-03
1.2	8.203	0.46	0.203	1.5E-03	2.22	7.8E-04
1.3	8.271	0.39	0.173	1.8E-03	2.61	9.2E-04
1.4	8.322	0.34	0.150	1.6E-03	2.28	8.0E-04
1.5	8.356	0.30	0.135	1.2E-03	1.72	6.1E-04
1.7	8.407	0.25	0.112	1.0E-03	1.49	5.3E-04
1.9	8.475	0.19	0.082	1.8E-03	2.54	9.0E-04
2	8.475	0.19	0.082	--	--	--
2.25	8.508	0.15	0.067	8.8E-04	1.27	4.5E-04
2.5	8.542	0.12	0.052	1.1E-03	1.64	5.8E-04
3	8.576	0.08	0.037	7.7E-04	1.10	3.9E-04
3.5	8.61	0.05	0.022	1.2E-03	1.68	5.9E-04
4	8.627	0.03	0.015	9.4E-04	1.35	4.8E-04

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.05	2.00			
	0.15	1.83	1.0E-03	1.44	5.1E-04
Lower Portion	0.50	1.24			
	0.70	0.965	1.4E-03	2.01	7.1E-04

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

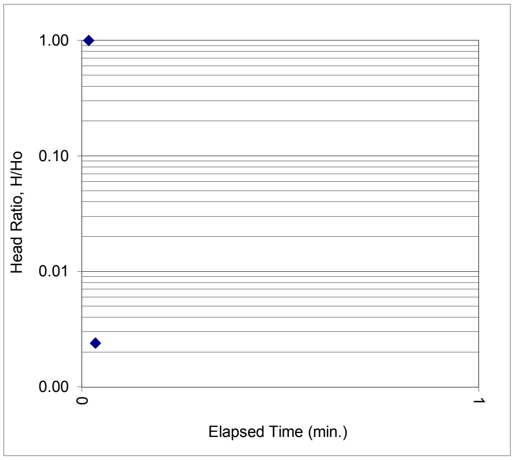
VARIABLE HEAD PERMEABILITY TEST

MW-SEA-3Z

PROJECT: Mill Seat LF Expansion
LOCATION: Bergen, NY
CLIENT: Waste Management
PERFORMED: M. Cummings DATE: 10/01/13
CALCULATED: M. Cummings DATE: 10/03/13
CHECKED: R. Frappa DATE: 10/07/13

PAGE: 1 of 1
BORING : MW-SEA-3Z
PROJ NO.: 1328270
TEST NO.: 1
TOP RISER ELEV.: 668.37

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface): **58.1**

db Depth to bottom of screen interval, feet (below ground surface): **70.1**

L Length, feet: **12.00**

Hs Static Water Level (feet above troll or well bot): **18.30**

DTW feet below top of riser **13.73**

m Estimate: **1**

(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	14.14	4.16	1			
0.03	18.29	0.01	0.002	4.1E-01	586.70	2.1E-01

Represent slope using 2 points.

		Rel. Head (ft)	K(ft/min)	K (ft/day)	K (cm/s)
Upper Portion	0.02	4.16			
	0.03	0.01	4.1E-01	586.70	2.1E-01
Lower Portion	0.00	0.00			
	0.00	0.000			

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

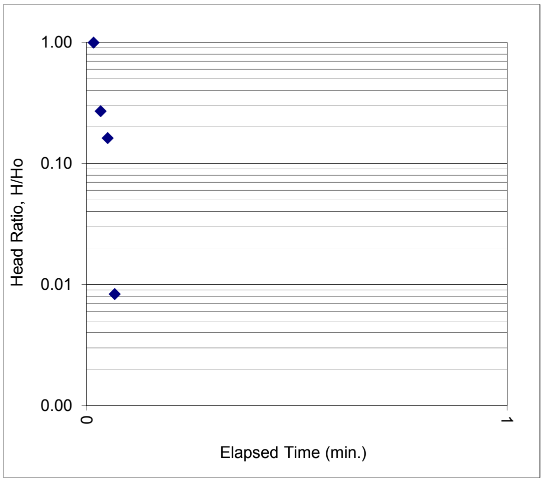
VARIABLE HEAD PERMEABILITY TEST

MW-SEA-4A

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/01/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	MW-SEA-4A
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER	
ELEV.:	677.35

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet
(below ground surface): **40.1**

db Depth to bottom of screen interval, feet
(below ground surface): **62.1**

L Length, feet: **22.00**

Hs Static Water Level
(feet above troll or well bot): **11.36**

DTW feet below top of riser **24.21**

m Estimate: **1**
(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock
TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	7.78	3.58	1			
0.03	10.39	0.97	0.271	5.6E-02	80.09	2.8E-02
0.05	10.78	0.58	0.162	2.2E-02	31.54	1.1E-02
0.07	11.39	0.03	0.008	1.3E-01	181.65	6.4E-02

Represent slope using 2 points.

		Rel. Head (ft)	K(ft/min)	K (ft/day)	K (cm/s)
Upper Portion	0.02	3.58			
	0.03	0.97	5.6E-02	80.09	2.8E-02
Lower Portion	0.05	0.58			
	0.07	0.030	1.3E-01	181.65	6.4E-02

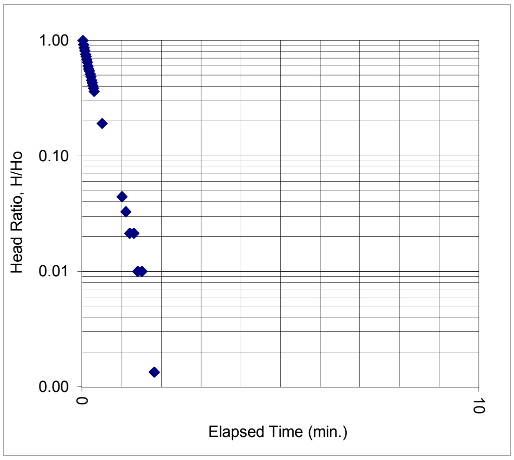
Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

VARIABLE HEAD PERMEABILITY TEST

MW-SEA-4B

PROJECT:	Mill Seat LF Expansion			PAGE:	1 of 1
LOCATION:	Bergen, NY			BORING :	MW-SEA-4B
CLIENT:	Waste Management			PROJ NO.:	1328270
PERFORMED:	M. Cummings	DATE:	10/01/13	TEST NO.:	1
CALCULATED:	M. Cummings	DATE:	10/03/13	TOP RISER	
CHECKED:	R. Frappa	DATE:	10/07/13	ELEV.:	677.82

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**8.50**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**26.0**
db Depth to bottom of screen interval, feet (below ground surface):	**38.0**
L Length, feet:	**12.00**
Hs Static Water Level (feet above troll or well bot):	**13.10**
DTW feet below top of riser	--
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	11.6	1.49	1			
0.03	11.7	1.37	0.920	5.1E-03	7.33	2.6E-03
0.05	11.8	1.29	0.863	3.9E-03	5.64	2.0E-03
0.07	11.9	1.22	0.818	3.3E-03	4.71	1.7E-03
0.08	12.0	1.13	0.761	4.4E-03	6.37	2.2E-03
0.10	12.0	1.08	0.727	2.8E-03	4.05	1.4E-03
0.12	12.1	1.02	0.681	4.0E-03	5.71	2.0E-03
0.13	12.1	0.96	0.647	3.2E-03	4.54	1.6E-03
0.15	12.2	0.90	0.602	4.4E-03	6.34	2.2E-03
0.17	12.3	0.85	0.568	3.6E-03	5.16	1.8E-03
0.18	12.3	0.81	0.545	2.5E-03	3.61	1.3E-03
0.20	12.3	0.76	0.511	4.0E-03	5.71	2.0E-03
0.22	12.4	0.73	0.488	2.8E-03	4.03	1.4E-03
0.23	12.4	0.68	0.454	4.4E-03	6.41	2.3E-03
0.25	12.5	0.64	0.431	3.2E-03	4.54	1.6E-03
0.27	12.5	0.61	0.408	3.3E-03	4.79	1.7E-03
0.28	12.5	0.57	0.386	3.4E-03	4.91	1.7E-03
0.30	12.6	0.54	0.363	3.7E-03	5.37	1.9E-03
0.50	12.8	0.29	0.192	3.2E-03	4.68	1.7E-03
1.00	13.0	0.07	0.044	3.0E-03	4.30	1.5E-03
1.10	13.1	0.05	0.033	3.0E-03	4.37	1.5E-03
1.20	13.1	0.03	0.021	4.3E-03	6.25	2.2E-03
1.30	13.1	0.03	0.021	--	--	--
1.40	13.1	0.01	0.010	7.7E-03	11.12	3.9E-03
1.50	13.1	0.01	0.010	--	--	--
1.82	13.1	0.00	0.001	6.5E-03	9.34	3.3E-03

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.03	1.37			
	0.07	1.22	3.6E-03	5.17	1.8E-03
Lower Portion	0.13	0.96			
	0.17	0.846	4.0E-03	5.75	2.0E-03

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

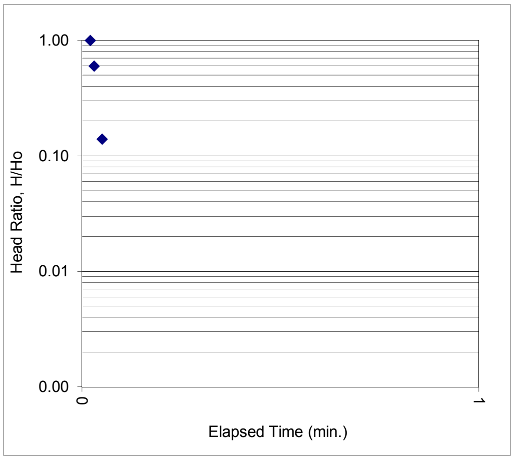
VARIABLE HEAD PERMEABILITY TEST

MW-SEA-5A

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/01/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	MW-SEA-5A
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER ELEV.:	659.29

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	2.00
D Effective diameter, inches:	5.88

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	24.0
db Depth to bottom of screen interval, feet (below ground surface):	41.0
L Length, feet:	17.00
Hs Static Water Level (feet above troll or well bot):	14.46
DTW feet below top of riser	10.55
m Estimate: (Ratio Kh/Kv)	1

LITHOLOGY: fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	10.97	3.49	1			
0.03	12.37	2.09	0.599	4.4E-02	63.94	2.3E-02
0.05	14.949	0.49	0.140	6.3E-02	90.57	3.2E-02
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Represent slope using 2 points.

		Rel. Head (ft)	K(ft/min)	K (ft/day)	K (cm/s)
Upper Portion	0.02	3.49			
	0.05	0.49	5.7E-02	81.69	2.9E-02
Lower Portion	0.00	0.00			
	0.00	0.000			

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

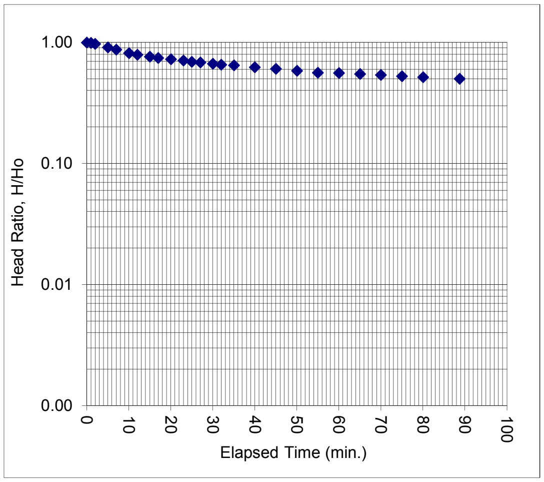
VARIABLE HEAD PERMEABILITY TEST

MW-SEA-5B

PROJECT: Mill Seat LF Expansion
LOCATION: Bergen, NY
CLIENT: Waste Management
PERFORMED: M. Cummings DATE: 10/01/13
CALCULATED: M. Cummings DATE: 10/03/13
CHECKED: R. Frappa DATE: 10/07/13

PAGE: 1 of 1
BORING : MW-SEA-5B
PROJ NO.: 1328270
TEST NO.: 1
TOP RISER
ELEV.: 659.44

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet
(below ground surface): **11.5**

db Depth to bottom of screen interval, feet
(below ground surface): **23.5**

L Length, feet: **12.00**

Hs Static Water Level
(feet above troll or well bot): **10.28**

DTW feet below top of riser **9.55**

m Estimate: **1**
(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock
TEST: slug in

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	13.54	3.26	1			
1.00	13.51	3.23	0.990	1.2E-05	0.02	6.1E-06
2.00	13.46	3.18	0.974	1.8E-05	0.03	8.9E-06
5.00	13.25	2.97	0.912	2.5E-05	0.04	1.3E-05
7.00	13.12	2.84	0.870	2.6E-05	0.04	1.3E-05
10.00	12.95	2.67	0.818	2.3E-05	0.03	1.2E-05
12.00	12.86	2.58	0.792	1.8E-05	0.03	9.3E-06
15.00	12.76	2.48	0.761	1.5E-05	0.02	7.6E-06
17.00	12.71	2.43	0.746	1.2E-05	0.02	5.9E-06
20.00	12.64	2.36	0.725	1.1E-05	0.02	5.4E-06
23.00	12.59	2.31	0.709	8.2E-06	0.01	4.2E-06
25.00	12.54	2.26	0.693	1.3E-05	0.02	6.4E-06
27.00	12.51	2.23	0.683	8.5E-06	0.01	4.3E-06
30.00	12.46	2.18	0.668	8.5E-06	0.01	4.3E-06
32.00	12.42	2.14	0.657	8.9E-06	0.01	4.5E-06
35.00	12.39	2.11	0.647	6.0E-06	0.01	3.0E-06
40.00	12.32	2.04	0.626	7.4E-06	0.01	3.7E-06
45.00	12.25	1.97	0.605	7.6E-06	0.01	3.9E-06
50.00	12.19	1.91	0.584	7.9E-06	0.01	4.0E-06
55.00	12.12	1.84	0.564	8.1E-06	0.01	4.1E-06
60.00	12.10	1.82	0.559	2.1E-06	0.00	1.1E-06
65.00	12.07	1.79	0.548	4.2E-06	0.01	2.2E-06
70.00	12.03	1.75	0.538	4.3E-06	0.01	2.2E-06
75.00	12.00	1.72	0.527	4.4E-06	0.01	2.2E-06
80.00	11.97	1.69	0.517	4.5E-06	0.01	2.3E-06
88.70	11.92	1.64	0.501	4.0E-06	0.01	2.0E-06

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	1.00	3.23			
	10.00	2.97	1.0E-05	0.015	5.2E-06
Lower Portion	20.00	2.67			
	30.00	2.483	8.1E-06	0.012	4.1E-06

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

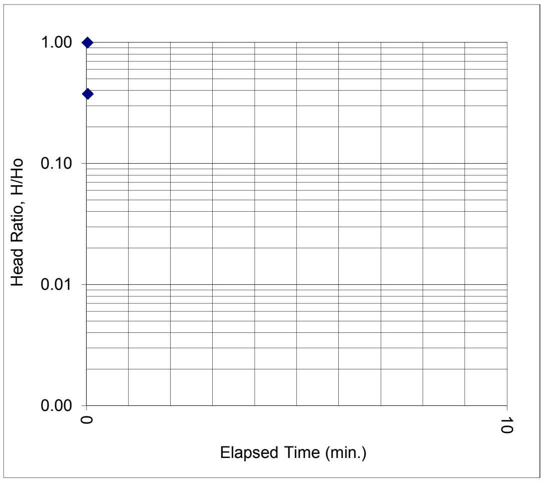
VARIABLE HEAD PERMEABILITY TEST

MW-SEA-6A

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/02/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	MW-SEA-6A
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER ELEV.:	672.27

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches: **2.00**

D Effective diameter, inches: **5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface): **33.7**

db Depth to bottom of screen interval, feet (below ground surface): **50.7**

L Length, feet: **17.00**

Hs Static Water Level (feet above troll or well bot): **16.27**

DTW feet below top of riser **18.1**

m Estimate: **1**

(Ratio Kh/Kv)

LITHOLOGY: fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	13.85	2.42	1			
0.03	15.36	0.91	0.376	8.5E-02	121.96	4.3E-02

Represent slope using 2 points.

		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.02	2.42			
	0.03	0.91	8.5E-02	121.96	4.3E-02
Lower Portion	0.00	0.00			
	0.00	0.000			

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

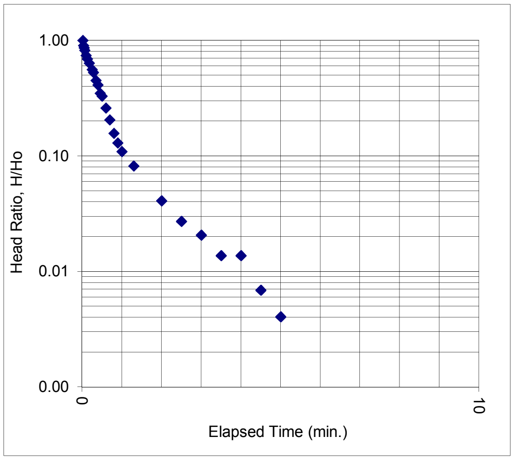
VARIABLE HEAD PERMEABILITY TEST

MW-SEA-6B

PROJECT:	Mill Seat LF Expansion		
LOCATION:	Bergen, NY		
CLIENT:	Waste Management		
PERFORMED:	M. Cummings	DATE:	10/02/13
CALCULATED:	M. Cummings	DATE:	10/03/13
CHECKED:	R. Frappa	DATE:	10/07/13

PAGE:	1 of 1
BORING :	MW-SEA-6B
PROJ NO.:	1328270
TEST NO.:	1
TOP RISER ELEV.:	672.22

Hvorslev Case G (1951)



WELL DETAILS

d Casing diameter, inches:	**2.00**
D Effective diameter, inches:	**5.88**

TEST INTERVAL DETAILS

dt Depth to top of screen interval, feet (below ground surface):	**10.3**
db Depth to bottom of screen interval, feet (below ground surface):	**22.3**
L Length, feet:	**12.00**
Hs Static Water Level (feet above troll or well bot):	**4.22**
DTW feet below top of riser	**17.61**
m Estimate: (Ratio Kh/Kv)	**1**

LITHOLOGY: fractured bedrock

TEST: slug out

t ELAPSED TIME (min)	MEASURED HEAD (feet above troll or well bot.)	Drawdown H Relative Head (feet above/ below static)	H/Ho HEAD RATIO	K (feet/min)	K (feet/day)	K (cm/sec)
0.02	1.746	2.47	1			
0.03	1.983	2.24	0.904	6.8E-03	9.80	3.5E-03
0.05	2.085	2.14	0.863	3.2E-03	4.54	1.6E-03
0.07	2.186	2.03	0.822	3.3E-03	4.71	1.7E-03
0.10	2.39	1.83	0.740	3.6E-03	5.14	1.8E-03
0.13	2.508	1.71	0.692	2.3E-03	3.24	1.1E-03
0.18	2.644	1.58	0.637	1.9E-03	2.68	9.5E-04
0.25	2.831	1.39	0.561	2.1E-03	3.07	1.1E-03
0.28	2.915	1.31	0.527	2.1E-03	3.03	1.1E-03
0.35	3.102	1.12	0.452	2.6E-03	3.76	1.3E-03
0.40	3.203	1.02	0.411	2.1E-03	3.07	1.1E-03
0.45	3.356	0.86	0.349	3.7E-03	5.29	1.9E-03
0.50	3.407	0.81	0.329	1.4E-03	1.97	7.0E-04
0.60	3.576	0.64	0.260	2.6E-03	3.78	1.3E-03
0.70	3.712	0.51	0.205	2.7E-03	3.85	1.4E-03
0.80	3.831	0.39	0.157	3.0E-03	4.33	1.5E-03
0.90	3.898	0.32	0.130	2.1E-03	3.06	1.1E-03
1.00	3.949	0.27	0.110	1.9E-03	2.80	9.9E-04
1.30	4.017	0.20	0.082	1.1E-03	1.56	5.5E-04
2.00	4.119	0.10	0.041	1.1E-03	1.62	5.7E-04
2.50	4.153	0.07	0.027	9.2E-04	1.33	4.7E-04
3.00	4.169	0.05	0.021	6.1E-04	0.88	3.1E-04
3.50	4.186	0.03	0.014	9.1E-04	1.31	4.6E-04
4.00	4.186	0.03	0.014	--	--	--
4.50	4.203	0.02	0.007	1.6E-03	2.25	7.9E-04
5.00	4.21	0.01	0.004	1.2E-03	1.72	6.1E-04

Represent slope using 2 points.

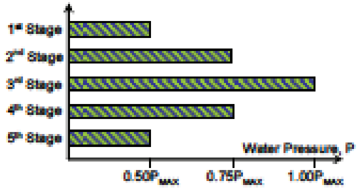
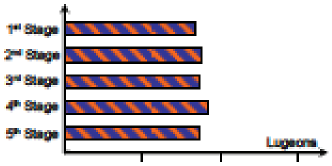
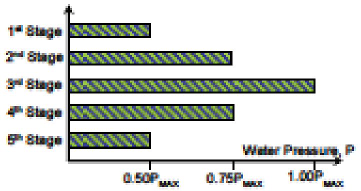
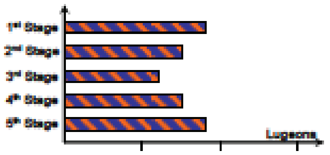
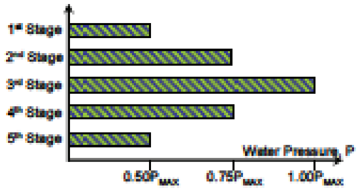
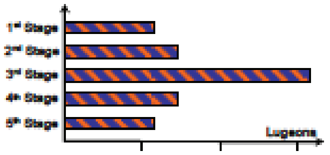
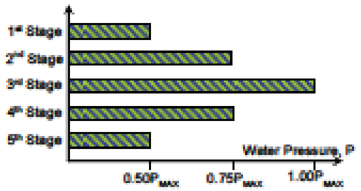
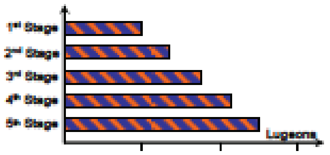
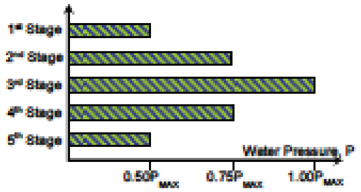
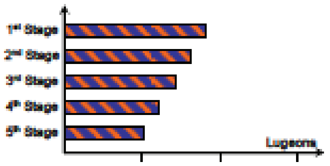
		Rel. Head (ft)	**K(ft/min)**	**K (ft/day)**	**K (cm/s)**
Upper Portion	0.03	2.24			
	0.18	1.58	2.6E-03	3.79	1.3E-03
Lower Portion	0.35	1.12			
	0.60	0.644	2.5E-03	3.58	1.3E-03

Reference: Hvorslev, M.J., Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, U.S. Army Corps of Engineers, April 1951.

Appendix F

Packer Testing Calculations

Packer Testing
Lugeon Pattern

BEHAVIOR	PRESSURE STAGES	LUGEON PATTERN	DESCRIPTION	REPRESENTATIVE LUGEON VALUE
LAMINAR			All Lugeon values about equal regardless of the water pressure	Average of Lugeon values for all stages
TURBULENT			Lugeon values decrease as the water pressures increase. The minimum Lugeon value is observed at the stage with the maximum water pressure	Lugeon value corresponding to the highest water pressure (3rd stage)
DILATION			Lugeon values vary proportionally to the water pressures. The maximum Lugeon value is observed at the stage with the maximum water pressure	Lowest Lugeon value recorded, corresponding either to low or medium water pressures (1st, 2nd, 4th, 5th stage)
WASH-OUT			Lugeon values increase as the test proceeds. Discontinuities' infillings are progressively washed-out by the water	Highest Lugeon value recorded (5th stage)
VOID FILLING			Lugeon values decrease as the test proceeds. Either non-persistent discontinuities are progressively being filled or swelling is taking place	Final Lugeon value (5th stage)

Lugeon pattern progression and determiniation of representative Lugeon value (Houlsby, 1976).

WATER PRESSURE TEST IN BEDROCK

SEA-1Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	2
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	G. Combes	Date:	9/18/2013	Surface	
Calculated By:	M. Cummings	Date:	9/19/2013	Elevation:	671.6
Checked By:	R. Frappa	Date:	9/19/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone:	
Packer pressure:	100 psi	(below ground surface)	45 ft
Gauge height:		Depth to bottom of test zone:	
(above ground surface)	2.8 ft	(below ground surface)	55 ft
Estimated depth to water table:		Length, L:	10 ft
(below ground surface)	14.6 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	38.0	12.7	1.7	1.5E-03	3.0E-03	117
30	3.0	36.0	12.0	1.6	8.1E-04	1.6E-03	61
45	3.0	70.0	23.3	3.1	1.3E-03	2.6E-03	100
30	3.0	55.0	18.3	2.5	1.4E-03	2.8E-03	106
15	3.0	40.0	13.3	1.8	1.7E-03	3.3E-03	125

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon, $L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$ per Weaver and Bruce, Dam Foundation Grouting, 2007

GEI Consultants

WATER PRESSURE TEST IN BEDROCK	SEA-1Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	1
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	G. Combes	Date:	9/18/2013	Surface	
Calculated By:	M. Cummings	Date:	9/19/2013	Elevation:	671.6
Checked By:	R. Frappa	Date:	9/19/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone:	
Packer pressure:	100 psi	(below ground surface)	55 ft
Gauge height:		Depth to bottom of test zone:	
(above ground surface)	2.8 ft	(below ground surface)	65 ft
Estimated depth to water table:		Length, L:	10 ft
(below ground surface)	14.6 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Dolomitic Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	18.0	6.0	0.8	6.5E-04	1.3E-03	49
30	3.0	38.0	12.7	1.7	8.8E-04	1.7E-03	67
45	3.0	55.0	18.3	2.5	9.6E-04	1.9E-03	73
30	3.0	41.0	13.7	1.8	9.7E-04	1.9E-03	74
15	3.0	28.0	9.3	1.2	1.1E-03	2.1E-03	81

Test Notes: Washout

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1 + (\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

GEI Consultants

WATER PRESSURE TEST IN BEDROCK

SEA-2A

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.: 3
Location:	Bergen, NY	Client:	Waste Management	Ground Surface
Performed By:	M. Cummings	Date:	9/9/2013	
Calculated By:	M. Cummings	Date:	9/11/2013	Elevation: 667.3
Checked By:	R. Frappa	Date:	9/11/2013	Datum: NGVD

Packer Installation Details

Type of packer: Pneumatic
Packer pressure: 100 psi
Gauge height:
(above ground surface) 2.8 ft
Estimated depth to water table:
(below ground surface) 11.0 ft

Rock type at test interval: Shale

Test Interval Details

Depth to top of test zone:
(below ground surface) 22 ft
Depth to bottom of test zone:
(below ground surface) 32 ft
Length, L: 10 ft
Borehole diameter, D: 3.8 in

m = sqrt (K_h/K_v): 2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	40.0	13.3	1.8	1.6E-03	3.2E-03	124
30	3.0	65.0	21.7	2.9	1.6E-03	3.2E-03	124
45	2.0	45.0	22.5	3.0	1.1E-03	2.3E-03	87
30	3.0	36.0	12.0	1.6	8.1E-04	1.6E-03	62
15	3.0	39.0	13.0	1.7	1.6E-03	3.1E-03	120

Test Notes: Turbulent Flow

Notes:
1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*L\ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK

SEA-2A

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	2
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	M. Cummings	Date:	9/9/2013	Surface	
Calculated By:	M. Cummings	Date:	9/11/2013	Elevation:	667.3
Checked By:	R. Frappa	Date:	9/11/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone:	
Packer pressure:	100 psi	(below ground surface)	32 ft
Gauge height:		Depth to bottom of test zone:	
(above ground surface)	2.8 ft	(below ground surface)	42 ft
Estimated depth to water table:		Length, L:	10 ft
(below ground surface)	11.0 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	39.0	13.0	1.7	1.6E-03	3.2E-03	125
30	3.0	63.0	21.0	2.8	1.7E-03	3.3E-03	127
45	2.0	50.0	25.0	3.3	1.4E-03	2.7E-03	106
30	3.0	57.0	19.0	2.5	1.5E-03	2.9E-03	110
15	3.0	40.0	13.3	1.8	1.7E-03	3.3E-03	129

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon, $L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$ per Weaver and Bruce, Dam Foundation Grouting, 2007

GEI Consultants

WATER PRESSURE TEST IN BEDROCK

SEA-2A

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.: 1
Location:	Bergen, NY	Client:	Waste Management	Ground
Performed By:	M. Cummings	Date:	9/9/2013	Surface
Calculated By:	M. Cummings	Date:	9/11/2013	Elevation: 667.3
Checked By:	R. Frappa	Date:	9/11/2013	Datum: NGVD

Packer Installation Details

Type of packer: Pneumatic
Packer pressure: 100 psi
Gauge height:
(above ground surface) 2.8 ft
Estimated depth to water table:
(below ground surface) 11.0 ft

Rock type at test interval: Shale

Test Interval Details

Depth to top of test zone:
(below ground surface) 42 ft
Depth to bottom of test zone:
(below ground surface) 52 ft
Length, L: 10 ft
Borehole diameter, D: 3.8 in

m = sqrt (K_h/K_v): 2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	34.0	11.3	1.5	1.4E-03	2.8E-03	109
30	3.0	42.0	14.0	1.9	1.0E-03	2.0E-03	77
45	2.0	65.0	32.5	4.3	2.5E-03	4.9E-03	187
30	3.0	40.0	13.3	1.8	9.5E-04	1.9E-03	73
15	3.0	30.0	10.0	1.3	1.2E-03	2.4E-03	93

Test Notes: Dilation Flow

Notes:
1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1 + (\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon, $$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$ per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK	**SEA-3Z**

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	4
Location:	Bergen, NY	Client:	Waste Management	Ground Surface	
Performed By:	M. Cummings	Date:	8/26/2013		
Calculated By:	M. Cummings	Date:	9/4/2013	Elevation:	666.8
Checked By:	R. Frappa	Date:	9/11/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone: (below ground surface)	20 ft
Packer pressure:	100 psi	Depth to bottom of test zone: (below ground surface)	26 ft
Gauge height: (above ground surface)	2.8 ft	Length, L:	6 ft
Estimated depth to water table: (below ground surface)	15.3 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	26.0	13.0	1.7	2.1E-03	4.2E-03	181
30	3.0	53.0	17.7	2.4	1.8E-03	3.5E-03	150
45	3.0	64.0	21.3	2.9	1.5E-03	3.0E-03	130
30	3.0	61.0	20.3	2.7	2.1E-03	4.1E-03	178
15	2.0	35.0	17.5	2.3	3.1E-03	6.1E-03	261

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK

SEA-3Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	3
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	M. Cummings	Date:	8/26/2013	Surface	
Calculated By:	M. Cummings	Date:	9/4/2013	Elevation:	666.8
Checked By:	R. Frappa	Date:	9/11/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone:	
Packer pressure:	100 psi	(below ground surface)	26 ft
Gauge height:		Depth to bottom of test zone:	
(above ground surface)	2.8 ft	(below ground surface)	36 ft
Estimated depth to water table:		Length, L:	10 ft
(below ground surface)	15.3 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	23.0	11.5	1.5	1.3E-03	2.5E-03	96
30	3.0	51.0	17.0	2.3	1.2E-03	2.3E-03	88
45	3.0	56.0	18.7	2.5	8.9E-04	1.8E-03	68
30	3.0	55.0	18.3	2.5	1.3E-03	2.5E-03	96
15	3.0	36.0	12.0	1.6	1.3E-03	2.6E-03	101

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1 + (\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK

SEA-3Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	2
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	M. Cummings	Date:	8/26/2013	Surface	
Calculated By:	M. Cummings	Date:	9/4/2013	Elevation:	666.8
Checked By:	R. Frappa	Date:	9/11/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone: (below ground surface)	36 ft
Packer pressure:	100 psi	Depth to bottom of test zone: (below ground surface)	46 ft
Gauge height: (above ground surface)	2.8 ft	Length, L:	10 ft
Estimated depth to water table: (below ground surface)	15.3 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	42.0	14.0	1.9	1.7E-03	3.3E-03	127
30	3.0	49.0	16.3	2.2	1.1E-03	2.2E-03	87
45	3.0	59.0	19.7	2.6	9.9E-04	1.9E-03	75
30	3.0	49.0	16.3	2.2	1.1E-03	2.2E-03	87
15	3.0	35.0	11.7	1.6	1.3E-03	2.6E-03	100

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon, $$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$ per Weaver and Bruce, Dam Foundation Grouting, 2007

WATER PRESSURE TEST IN BEDROCK

SEA-3Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	1
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	M. Cummings	Date:	8/26/2013	Surface	
Calculated By:	M. Cummings	Date:	9/4/2013	Elevation:	666.8
Checked By:	R. Frappa	Date:	9/11/2013	Datum:	NGVD

Packer Installation Details

Type of packer: Pneumatic
Packer pressure: 75 psi
Gauge height:
(above ground surface) 2.8 ft
Estimated depth to water table:
(below ground surface) 15.3 ft

Rock type at test interval: Shale

Test Interval Details

Depth to top of test zone:
(below ground surface) 46 ft
Depth to bottom of test zone:
(below ground surface) 58 ft
Length, L: 12 ft
Borehole diameter, D: 3.8 in

m = sqrt (K_h/K_v): 2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
30	2.0	36.0	18.0	2.4	1.2E-03	2.3E-03	86
45	2.0	48.7	24.4	3.3	1.2E-03	2.4E-03	90
30	2.0	30.5	15.3	2.0	9.2E-04	1.8E-03	67

Test Notes: Dilation Flow

Notes:
1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK

SEA-4A

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.: 1
Location:	Bergen, NY	Client:	Waste Management	Ground
Performed By:	M. Cummings	Date:	9/9/2013	Surface
Calculated By:	M. Cummings	Date:	9/11/2013	Elevation: 675.8
Checked By:	R. Frappa	Date:	9/11/2013	Datum: NGVD

Packer Installation Details

Type of packer: Pneumatic
Packer pressure: 100 psi
Gauge height:
(above ground surface) 3.7 ft
Estimated depth to water table:
(below ground surface) 25.4 ft

Rock type at test interval: Shale

Test Interval Details

Depth to top of test zone:
(below ground surface) 42 ft
Depth to bottom of test zone:
(below ground surface) 52 ft
Length, L: 10 ft
Borehole diameter, D: 3.8 in

m = sqrt (K_h/K_v): 2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	30.0	15.0	2.0	1.5E-03	3.0E-03	115
30	2.0	37.0	18.5	2.5	1.2E-03	2.4E-03	92
45	2.0	46.0	23.0	3.1	1.1E-03	2.2E-03	86
30	2.0	36.0	18.0	2.4	1.2E-03	2.3E-03	88
15	2.0	31.0	15.5	2.1	1.6E-03	3.1E-03	120

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln\left[\frac{m*L}{D} + \sqrt{1 + \left(\frac{m*L}{D}\right)^2}\right]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

WATER PRESSURE TEST IN BEDROCK

SEA-5Z

Project: Mill Seat LF South Expansion
Project No.: 1328270
Test No.: 3
Location: Bergen, NY
Client: Waste Management
Ground Surface Elevation: 656.9
Performed By: G. Combes
Date: 9/23/2013
Calculated By: M. Cummings
Date: 9/23/2013
Checked By: R. Frappa
Date: 9/23/2013
Datum: NGVD

Packer Installation Details

Type of packer: Pneumatic
Packer pressure: 100 psi
Gauge height: (above ground surface) 2.8 ft
Estimated depth to water table: (below ground surface) 10.7 ft

Rock type at test interval: Shale

Test Interval Details

Depth to top of test zone: (below ground surface) 23 ft
Depth to bottom of test zone: (below ground surface) 33 ft
Length, L: 10 ft
Borehole diameter, D: 3.8 in

m = sqrt (K_h/K_v): 2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	16.0	8.0	1.1	9.2E-04	1.8E-03	70
30	2.0	25.0	12.5	1.7	8.5E-04	1.7E-03	65
45	2.0	30.0	15.0	2.0	7.2E-04	1.4E-03	55
30	2.0	24.0	12.0	1.6	8.2E-04	1.6E-03	62
15	2.0	15.0	7.5	1.0	8.6E-04	1.7E-03	65

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln\left[\frac{m*L}{D} + \sqrt{1+\left(\frac{m*L}{D}\right)^2}\right]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon, $L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$ per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK	**SEA-5Z**

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	2
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	G. Combes	Date:	9/23/2013	Surface	
Calculated By:	M. Cummings	Date:	9/23/2013	Elevation:	656.9
Checked By:	R. Frappa	Date:	9/23/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone:	
Packer pressure:	100 psi	(below ground surface)	32 ft
Gauge height:		Depth to bottom of test zone:	
(above ground surface)	2.8 ft	(below ground surface)	42 ft
Estimated depth to water table:		Length, L:	10 ft
(below ground surface)	10.7 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	21.0	10.5	1.4	1.3E-03	2.5E-03	97
30	2.0	33.0	16.5	2.2	1.2E-03	2.4E-03	92
45	2.0	42.0	21.0	2.8	1.1E-03	2.2E-03	84
30	2.0	34.0	17.0	2.3	1.3E-03	2.5E-03	96
15	2.0	22.0	11.0	1.5	1.3E-03	2.7E-03	102

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

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WATER PRESSURE TEST IN BEDROCK

SEA-5Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	1
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	G. Combes	Date:	9/23/2013	Surface	
Calculated By:	M. Cummings	Date:	9/23/2013	Elevation:	656.9
Checked By:	R. Frappa	Date:	9/23/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone: (below ground surface)	42 ft
Packer pressure:	100 psi	Depth to bottom of test zone: (below ground surface)	52 ft
Gauge height: (above ground surface)	2.8 ft	Length, L:	10 ft
Estimated depth to water table: (below ground surface)	10.7 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	0.0	0.0	0.0	5.6E-07	1.1E-06	0
30	2.0	0.7	0.4	0.0	2.3E-05	4.5E-05	2
45	2.0	0.6	0.3	0.0	1.4E-05	2.7E-05	1
30	2.0	0.0	0.0	0.0	3.2E-07	6.4E-07	0
15	2.0	0.0	0.0	0.0	5.6E-07	1.1E-06	0

Test Notes: Laminar Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon, $L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$ per Weaver and Bruce, Dam Foundation Grouting, 2007

WATER PRESSURE TEST IN BEDROCK

SEA-6Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	4
Location:	Bergen, NY	Client:	Waste Management	Ground Surface	
Performed By:	G. Combes	Date:	9/13/2013		
Calculated By:	M. Cummings	Date:	9/16/2013	Elevation:	669.70
Checked By:	R. Frappa	Date:	9/16/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone: (below ground surface)	30 ft
Packer pressure:	100 psi	Depth to bottom of test zone: (below ground surface)	40 ft
Gauge height: (above ground surface)	2.8 ft	Length, L:	10 ft
Estimated depth to water table: (below ground surface)	15.8 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	25.0	12.5	1.7	1.4E-03	2.8E-03	106
30	2.0	36.0	18.0	2.4	1.3E-03	2.5E-03	95
45	2.0	45.0	22.5	3.0	1.1E-03	2.2E-03	86
30	2.0	36.0	18.0	2.4	1.3E-03	2.5E-03	95
15	2.0	25.0	12.5	1.7	1.4E-03	2.8E-03	106

Test Notes: Turbulent Flow

Notes:
1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

GEI Consultants

WATER PRESSURE TEST IN BEDROCK

SEA-6Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.:	3
Location:	Bergen, NY	Client:	Waste Management	Ground	
Performed By:	G. Combes	Date:	9/13/2013	Surface	
Calculated By:	M. Cummings	Date:	9/16/2013	Elevation:	669.70
Checked By:	R. Frappa	Date:	9/16/2013	Datum:	NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone:	
Packer pressure:	100 psi	(below ground surface)	40 ft
Gauge height:		Depth to bottom of test zone:	
(above ground surface)	2.8 ft	(below ground surface)	50 ft
Estimated depth to water table:		Length, L:	10 ft
(below ground surface)	15.8 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	2.0	26.0	13.0	1.7	1.5E-03	3.0E-03	116
30	2.0	36.0	18.0	2.4	1.3E-03	2.6E-03	100
45	2.0	45.0	22.5	3.0	1.2E-03	2.4E-03	91
30	2.0	37.0	18.5	2.5	1.4E-03	2.7E-03	103
15	2.0	26.0	13.0	1.7	1.5E-03	3.0E-03	116

Test Notes: Turbulent Flow

Notes:
1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

WATER PRESSURE TEST IN BEDROCK

SEA-6Z

Project:	Mill Seat LF South Expansion	Project No.:	1328270	Test No.: 2
Location:	Bergen, NY	Client:	Waste Management	Ground
Performed By:	G. Combes	Date:	9/13/2013	Surface
Calculated By:	M. Cummings	Date:	9/16/2013	Elevation: 669.70
Checked By:	R. Frappa	Date:	9/16/2013	Datum: NGVD

Packer Installation Details		Test Interval Details	
Type of packer:	Pneumatic	Depth to top of test zone: (below ground surface)	50 ft
Packer pressure:	100 psi	Depth to bottom of test zone: (below ground surface)	60 ft
Gauge height: (above ground surface)	2.8 ft	Length, L:	10 ft
Estimated depth to water table: (below ground surface)	15.8 ft	Borehole diameter, D:	3.8 in
Rock type at test interval:	Shale	m = sqrt (K_h/K_v):	2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	27.0	9.0	1.2	9.9E-04	1.9E-03	75
30	3.0	38.0	12.7	1.7	8.6E-04	1.7E-03	65
45	3.0	49.0	16.3	2.2	8.1E-04	1.6E-03	61
30	3.0	40.0	13.3	1.8	9.1E-04	1.8E-03	69
15	3.0	28.0	9.3	1.2	1.0E-03	2.0E-03	78

Test Notes: Turbulent Flow

Notes:

1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q*Ln[\frac{m*L}{D} + \sqrt{1+(\frac{m*L}{D})^2}]}{2\pi*L*H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min)*(142)}{H_c(ft)*L(ft)*(0.01076)*(0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

GEI Consultants

WATER PRESSURE TEST IN BEDROCK

SEA-6Z

Project: Mill Seat LF South Expansion
Location: Bergen, NY
Performed By: G. Combes
Calculated By: M. Cummings
Checked By: R. Frappa

Project No.: 1328270
Client: Waste Management
Date: 9/13/2013
Date: 9/16/2013
Date: 9/16/2013

Test No.: 1
Ground Surface Elevation: 669.1
Datum: NGVD

Packer Installation Details

Type of packer: Pneumatic
Packer pressure: 100 psi
Gauge height: (above ground surface) 2.8 ft
Estimated depth to water table: (below ground surface) 15.8 ft

Rock type at test interval: Dolostone

Test Interval Details

Depth to top of test zone: (below ground surface) 60 ft
Depth to bottom of test zone: (below ground surface) 70 ft
Length, L: 10 ft
Borehole diameter, D: 3.8 in

m = sqrt (K_h/K_v): 2.24

Applied Water Pressure, P	Time Interval At This Pressure	Total Volume of Water	Average Flow Rate, q		Coefficient of Permeability, K		Lugeons
(psi)	(min)	(gal)	(gal/min)	(ft^3/min)	(cm/sec)	(ft/min)	(L)
15	3.0	14.0	4.7	0.6	4.8E-04	9.5E-04	37
30	3.0	19.0	6.3	0.8	4.0E-04	7.8E-04	30
45	3.0	24.0	8.0	1.1	3.6E-04	7.1E-04	28
30	3.0	18.0	6.0	0.8	3.8E-04	7.4E-04	29
15	3.0	12.0	4.0	0.5	4.1E-04	8.1E-04	31

Test Notes: Turbulent Flow

Notes:
1. Water pressure, p, was measured with a pressure gauge attached to the water line above ground.
2. Volume of water was measured with a flow meter.
3. Hc represents the total head of water in feet at the midpoint of the test section length,

$$H_C = \frac{p}{.433} + h - h_f$$

4. Hydraulic Conductivity,

$$K_h = \frac{q * Ln[\frac{m*L}{D} + \sqrt{1 + (\frac{m*L}{D})^2}]}{2\pi * L * H_C}$$

per Lambe & Whitman, Soil Mechanics, 1969, p. 285, case G, constant head test.

5. Lugeon,

$$L = \frac{q(ft^3/\min) * (142)}{H_c(ft) * L(ft) * (0.01076) * (0.433)}$$

per Weaver and Bruce, Dam Foundation Grouting, 2007

GEI Consultants

Appendix G

Groundwater Usage Survey Results

Mill Seat Landfill - Private Water Well Survey
Summary

OWN_ADDR	OWN_ADD2	PROP_DESC	WATERSUP	PAR_ZCTY	PAR_ZIP	MUNI	DISP_ADDR	**Questionaire Status (as of 10-9-14)**
1 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	1 Edgewood Lane	
100 O Brien Rd	CHURCHVILLE, NY 1442	Rural res	Comm/public	CHURCHVI	14428	Riga	100 O Brien Road	
1000 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1000 Johnson Road	Well
1001 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1001 Johnson Road	
1004 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1004 Johnson Road	Well
1010 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1010 Johnson Road	Well
1035 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1035 Johnson Road	
1048 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1048 Johnson Road	No Well
1059 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1059 Johnson Road	No Well
1064 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1064 Johnson Road	
1067 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1067 and 1073 Johnson Road	No Well
1080 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1080 Johnson Road	Well
111 O Brien Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	111 O Brien Road	Well
116 Bridgeman Rd	Churchville, NY 14428	Vac farmland	Comm/public	BERGEN	14416	Riga	7901 Chili Riga Center Road	No Well
118 O'Brien Rd	Churchville, NY 14428	Rural res	Comm/public	CHURCHVI	14428	Riga	118 O Brien Road and Johnson Rd	
1201 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1201 Johnson Road	Well
1211 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1211 Johnson Road	
1214 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1214 Johnson Road	
1220 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1220 Johnson Road	Well
1221 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1221 Johnson Road	
1231 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1231 Johnson Road	
1241 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1241 Johnson Road	
125 O Brien Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	125 O Brien Road	
1251 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1251 Johnson Road	Well
1260 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1260 Johnson Road	
1275 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1275 Johnson Road	
1293 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1293 Johnson Road	
1294 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1294 Johnson Road	No Well
1331 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1331 Johnson Road	
1336 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1336 Johnson Road	
1337 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1337 Johnson Road	
1379 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1379 Johnson Road	
1380 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1380 Johnson Road	No Well
1400 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	1400 Johnson Road	Well
16 Entress Dr	Rochester, NY 14624	Abandoned ag	Comm/public	CHURCHVI	14428	Riga	Johnson Road	No Well
17564 SE 119th Cir	Summerfield, FL 34491	Vac w/imprv	Comm/public	BERGEN	14416	Riga	520 Bovee Road	No Well
2 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	2 Edgewood Lane	Well
274 Bovee Rd	Churchville, NY 14428	Vac farmland	Comm/public	CHURCHVI	14428	Riga	Bovee Road	No Well
274 Bovee Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	274 Bovee Road	
3 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	3 Edgewood Lane	Well
32 Carrie Marie Ln	Hilton, NY 14468	Social org.	Comm/public	BERGEN	14416	Riga	283 Brew Road	Well
321 Bovee Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	321 Bovee Road	Well
4 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	Bergen	14416	Riga	4 Edgewood Lane	Well
490 Bovee Rd	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	490 Bovee Road	Well
5 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	5 Edgewood Lane	
500 Bovee Rd	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	500 Bovee Road	
515 Bovee Rd	BERGEN, NY 14416	Vac farmland	Comm/public	BERGEN	14416	Riga	Bovee Road	No Well
515 Bovee Road	Bergen, NY 14416	Vac farmland	Comm/public	Bergen	14416	Riga	515 Bovee Road	No Well
55 Appletree Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	55 Appletree Road	
6 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	6 Edgewood Lane	
61 Sableridge Ct	Spencerport, NY 14559	Vac farmland	Comm/public	CHURCHVI	14428	Riga	Johnson Road	No Well
620 Bovee Rd	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	620 Bovee Road	Well
6460 E Buffalo Rd	Churchville, NY 14428	Rural vac<10	Comm/public	BERGEN	14416	Riga	Bovee Road	No Well
650 Bovee Road	Bergen, NY 14416	Rural res	Comm/public	BERGEN	14416	Riga	650 Bovee Road	Well
7 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	7 Edgewood Lane	
741 Johnson Rd	CHURCHVILLE, NY 1442	Rural vac<10	Comm/public	CHURCHVI	14428	Riga	740, 741, 759 Johnson Road	No Well
7523 Chili Riga Ctr Rd	Churchville, NY 14428	3 Family Res	Comm/public	CHURCHVI	14428	Riga	7519 Chili Riga Center Road	No Well
771 Bovee Rd	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	771 Bovee Road	Well
796 Johnson Rd	Churchville, NY 14428	Rural res	Comm/public	CHURCHVI	14428	Riga	796 Johnson Road	
797 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	797 Johnson Road	No Well
8 Edgewood Ln	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	8 Edgewood Lane	
805 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	805 Johnson Road	No Well
8237 Vallance Rd	LeRoy, NY 14482	Vac farmland	None	Bergen	14416	Riga	Bovee Road	No Well
834 Brew Road	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	834 Brew Road	Well
835 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	835 Johnson Road	Well
835 Malloch Rd	Churchville, NY 14428	Vac farmland	None	Riga	14428	Riga	Blue Road	No Well
845 Bovee Rd	Bergen, NY 14416	1 Family Res	Comm/public	BERGEN	14416	Riga	845 Bovee Road	Well
8465 Vallance Rd	Leroy, NY 14482	Vac farmland	None	BERGEN	14416	Riga	Bovee Road	Well
850 Bovee Road	Bergen, NY 14416	Rural res	Comm/public	BERGEN	14416	Riga	850 Bovee Road	Well
854 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	854 Johnson Road	
873 Johnson Rd	Churchville, NY 14428	Vac farmland	Comm/public	CHURCHVI	14428	Riga	873 Johnson Road	No Well
89 O Brien Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	89 O Brien Road	
90 Jenkins Rd	Churchville, NY 14428	Vac w/imprv	Comm/public	Churchville	14428	Riga	1266 Johnson Road	No Well
900 Johnson Rd	CHURCHVILLE, NY 1442	1 Family Res	Comm/public	CHURCHVI	14428	Riga	900 Johnson Road	Well
920 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	Churchville	14428	Riga	920 Johnson Road	Well
935 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	935 Johnson Road	
940 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	940 Johnson Road	
945 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	CHURCHVI	14428	Riga	945 Johnson Road	No Well
965 Johnson Rd	CHURCHVILLE, NY 1442	1 Family Res	Comm/public	CHURCHVI	14428	Riga	965 Johnson Road	
976 Johnson Rd	Churchville, NY 14428	1 Family Res	Comm/public	Churchville	14428	Riga	976 Johnson Road	
993 Bovee Rd	Bergen, NY 14416	Dairy farm	Comm/public	BERGEN	14416	Riga	993 Bovee Road	No Well
999 Bovee Rd	Bergen, NY 14416	Rural res	Comm/public	BERGEN	14416	Riga	999 Bovee Road	

Blank indicates no response

Appendix H

USDA Soil Resource Report

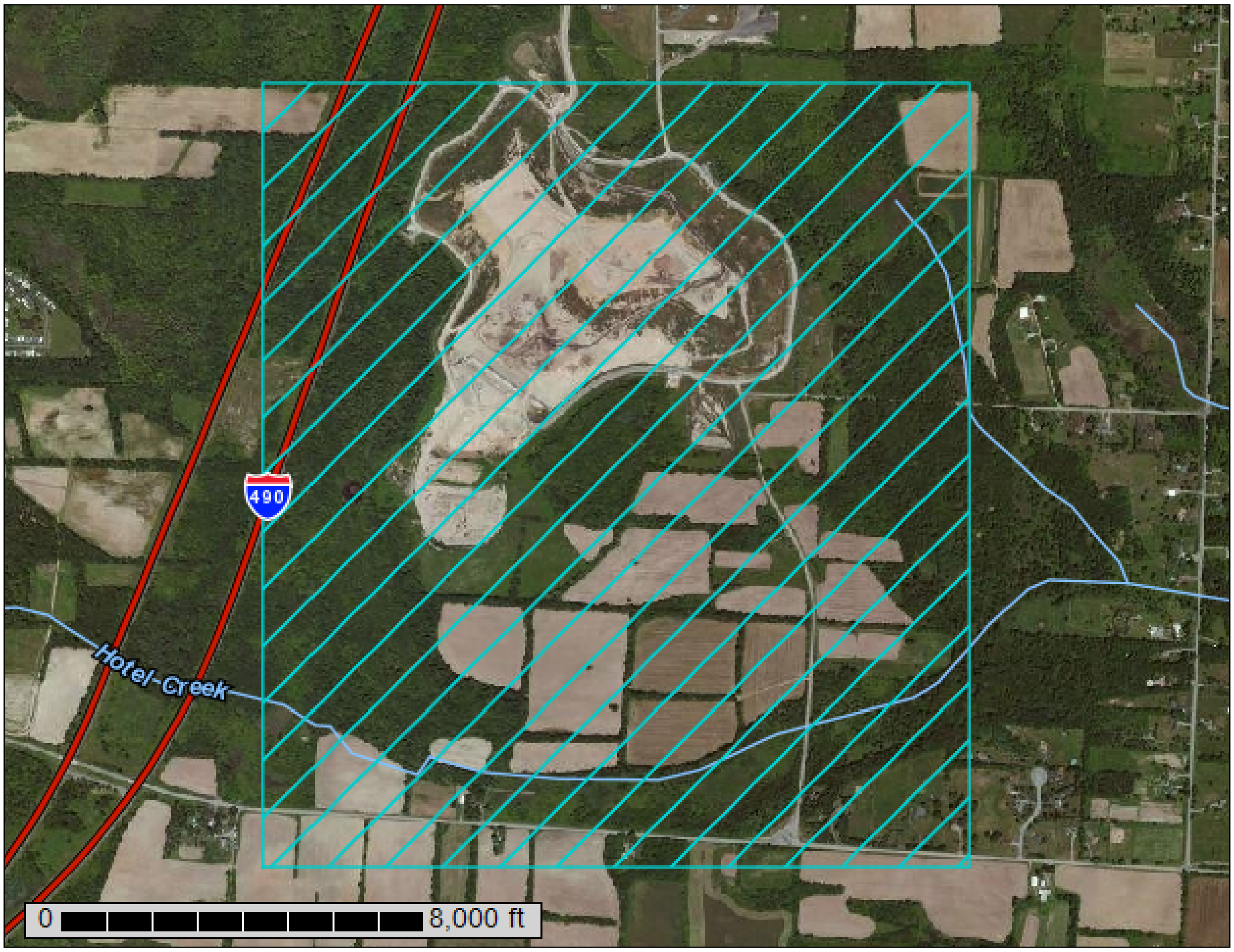
United States
Department of
Agriculture

Natural
Resources
Conservation
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Genesee County, New York, and Monroe County, New York

Mill Seat Landfill - South Expansion Area Surface Soil



September 17, 2013

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Genesee County, New York
Survey Area Data: Version 12, Dec 1, 2011

Soil Survey Area: Monroe County, New York
Survey Area Data: Version 10, Sep 25, 2012

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 2, 2010—Jul 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Genesee County, New York (NY037)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Ad	Alden mucky silt loam	3.5	0.5%
ApA	Appleton silt loam, 0 to 3 percent slopes	13.2	1.9%
La	Lakemont silty clay loam	1.3	0.2%
LmA	Lima silt loam, 0 to 3 percent slopes	0.2	0.0%
LmB	Lima silt loam, 3 to 8 percent slopes	4.3	0.6%
LoA	Lyons silt loam, 0 to 3 percent slopes	4.8	0.7%
OnB	Ontario loam, 3 to 8 percent slopes	2.2	0.3%
OnC	Ontario loam, 8 to 15 percent slopes	0.6	0.1%
OnD	Ontario loam, 15 to 25 percent slopes	1.0	0.1%
Subtotals for Soil Survey Area		**31.1**	**4.4%**
Totals for Area of Interest		**703.2**	**100.0%**

Monroe County, New York (NY055)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AnA	Alton gravelly sandy loam, 0 to 3 percent slopes	0.8	0.1%
ApA	Appleton loam, 0 to 3 percent slopes	5.3	0.8%
BrA	Brockport silty clay loam, 0 to 2 percent slopes	21.7	3.1%
CeA	Cayuga silt loam, 0 to 2 percent slopes	2.0	0.3%
CeB	Cayuga silt loam, 2 to 6 percent slopes	46.9	6.7%
ChA	Churchville silt loam, 0 to 2 percent slopes	95.3	13.6%
Ed	Edwards muck	70.1	10.0%
HlB	Hilton loam, 3 to 8 percent slopes	3.0	0.4%
HnB	Honeoye silt loam, 3 to 8 percent slopes	50.1	7.1%
HnC	Honeoye silt loam, 8 to 15 percent slopes	12.9	1.8%
HoB	Honeoye silt loam, limestone substratum, 3 to 8 percent slopes	0.1	0.0%

Monroe County, New York (NY055)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Le	Lakemont silt loam	30.9	4.4%
Lk	Lakemont silt loam, loamy subsoil variant	54.0	7.7%
LnA	Lima silt loam, 0 to 3 percent slopes	18.6	2.6%
LnB	Lima silt loam, 3 to 8 percent slopes	20.6	2.9%
LoB	Lima and Cazenovia silt loams, limestone substratum, 0 to 6 percent slopes	3.1	0.4%
Lp	Lockport silty clay loam	6.3	0.9%
Ly	Lyons silt loam	1.7	0.2%
Ms	Muck, shallow	7.1	1.0%
OnB	Ontario loam, 3 to 8 percent slopes	118.3	16.8%
OnC	Ontario loam, 8 to 15 percent slopes	14.6	2.1%
OnD3	Ontario loam, 15 to 25 percent slopes, eroded	14.4	2.0%
OnF	Ontario loam, 25 to 60 percent slopes	18.2	2.6%
PaB	Palmyra gravelly fine sandy loam, 3 to 8 percent slopes	8.5	1.2%
Pu	Pits and quarries	2.9	0.4%
RgB	Riga silt loam, 2 to 8 percent slopes	26.7	3.8%
St	Sun loam, moderately shallow variant	2.6	0.4%
WcB	Wampsville cobbly loam, 3 to 8 percent slopes	6.4	0.9%
WcC	Wampsville cobbly loam, 8 to 15 percent slopes	0.0	0.0%
Wg	Wayland silt loam	8.8	1.3%
Subtotals for Soil Survey Area		**672.1**	**95.6%**
Totals for Area of Interest		**703.2**	**100.0%**

Appendix I

Test America Groundwater Analytical Data Packages (on Compact Disc)

Given the size of these documents, they are made available on compact disc at the public respositories identifed in the public notice.

Appendix J

Data Validation Report

MAKUEHL CO.

TECHNICAL MEMORANDUM

DATE: June 18, 2014

TO: Richard H. Frappa, P.G.
GEI Consultants, Inc.

FROM: Marcia A. Kuehl
President/Owner
MAKuehl Company

SUBJECT: Data Validation for Mill Seat Landfill
NYSDEC Expanded Parameter sampling MW-2
November, 2013 sampling event

1.0 OVERVIEW

Analytical results for a randomly selected location (MW-2) collected from the Mill Seat Landfill on October 31, 2013 have been evaluated using the Waste Management "Standard Operating Procedure Data Validation Procedures for EPA Level III Data, 1996" modified to reflect the specific criteria in the SW 846 and other EPA cited analytical methods. This protocol for data validation was approved for use by NYSDEC in September, 2002.

The review was based on the CD data packages supplied by the analytical laboratory, TestAmericaBuffalo, in Buffalo, New York.

Zinc and boron results for MW-2 were qualified as undetected as the concentrations reported were not significantly different (> 10 X) from lab background.

All MW-2 volatile organic data was usable as reported without additional qualification.

COD and TOC in MW-2 were undetected as the detected concentrations were not significantly different (> 10 X) the field sampling background.

Results in MW-2 for 3,3'dimethylbenzidine, famphur, kepone, methyl methanesulfonate and p-phenylene diamine were qualified as estimated from a possible low bias as evidenced by the low LCS recoveries.

All pesticide, herbicide and PCB data was usable as reported without additional qualification.

The data validation process is described in detail below. The validated data sheets are attached.

2.0 METALS DATA

2.1 Completeness Assessment

The TestAmerica data package received for metals was complete.

2.2 Compliance Assessment

EPA methods 3005A (digestion), 6010C and 7470A (mercury) were followed. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the methods. No action was needed to qualify sample data.

2.2.1 Holding Time/Preservation

The sample was analyzed within the 6 month holding time for metals and the 28 day holding time for mercury. The pH verification by the lab indicated that the pH was < 2 in MW-2. No action was needed to qualify sample data.

2.2.2 Calibration

All initial instrument calibrations (ICV) were properly performed using the appropriate number of standards. Continuing calibration checks (CCV) were performed at least once every 10 samples. The EPA method recovery criteria of 90 - 110 % for the ICV and CCV solutions were met for all analytes in the calibrations associated with the validated sample except for low level cadmium in a CCV sample (132 %). TestAmerica qualified the cadmium data in MW-2 with a "^" qualifier to indicate this. No further action was needed to qualify MW-2 cadmium data, as no cadmium was present in this sample and therefore no high bias is possible.

2.2.3 Laboratory Blanks

Initial and preparation blanks analyzed with the samples validated were done at the required frequency. Continuing calibration blanks bracketing the sample validated were done at the required frequency. Boron (5.17 ug/L), lead (3.04 ug/L) and zinc (7.12 ug/L) were detected above the Method Detection Limit (MDL) in blanks associated with MW-2. TestAmerica qualified MW-2 detected boron and zinc sample data with a "B" qualifier. Action taken was to qualify the zinc and boron results for MW-2 as undetected with a "U" qualifier as the concentrations reported were not significantly different (> 10 X) from lab background.

2.2.4 Interference Check Sample/Serial Dilution

An interference check sample (ICS) was analyzed at the required frequency to determine the effect of high concentrations of interferant ions on target metals. Recovery of target metals, in the presence of interferants, were all within the acceptable range for the check samples associated with the validated sample. No metals were detected in the Interference Check Sample at a positive concentration above the Reporting Limit (RL) for the check samples associated with the validated sample. No metals were detected in the Interference Check Sample at a negative concentration above the RL for the check samples associated with the validated sample. There was no evidence of false negatives in the validated sample. No action was needed to qualify sample data.

Serial dilution percent differences for the sample associated with MW-2 were all less than the 10 % acceptable limit in the EPA method for metals at concentrations exceeding 50 X IDL. No action was needed to qualify sample data.

2.2.5 Laboratory Control Sample (LCS)

All LCS recoveries were within the 80 -120 % limit. No action was needed to qualify sample data.

2.2.6 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike (MS) and matrix spike duplicate (MSD) sample recoveries associated with the sample validated were within the 75 -125 % EPA method data validation limits for sample concentrations that did not exceed the spike concentrations by more than a factor of 4. No action was needed to qualify sample data.

2.3 Field QC Results

The field blank collected with MW-2 did not contain any detectable metals above the MDL. No action was needed to qualify sample data.

No field duplicate was collected with MW-2. No action was needed to qualify sample data.

2.4 Data Usability

Zinc and boron results for MW-2 were qualified as undetected as the concentrations reported were not significantly different (> 10 X) from lab background.

3.0 VOLATILE ORGANICS DATA

3.1 Completeness Assessment

The TestAmerica data package received for volatile organic analysis was complete.

3.2 Compliance Assessment

TestAmerica utilized EPA methods 5030B for sample purging and 8260C for analysis. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

3.2.1 Holding Times/Preservation

The preservation pH was less than 2 and the holding time of 14 days was met in MW-2. The sample was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data.

3.2.2 Initial Calibration and Tuning

A six point initial calibration curve with concentrations ranging from 1-100 ug/L was analyzed in accordance with method 8260C on 10/29/13 for reported volatile organics. Tuning using bromofluorobenzene (BFB) was done at the start of the analysis and every 12 hours. All tuning results met the method criteria.

Method System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the EPA method data validation criteria of > 0.30 for 1,1,2,2-tetrachloroethane and chlorobenzene and > 0.10 for chloromethane, 1,1-dichloroethane, and bromoform. All Calibration Check Compounds (vinyl chloride, 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene) and System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the data validation criteria of < 30 % Relative Standard Deviation (RSD). All RSD valus for all reported compounds were less than the 15 % method criteria or the linear calibration coefficient was > 0.990. No action was needed to qualify sample data.

3.2.3 Continuing Calibration

A 20 ug/L continuing calibration standard (CCAL) was analyzed according to method 8260B every 12 hours. Method System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the EPA method data validation criteria of > 0.30 for 1,1,2,2-tetrachloroethane and chlorobenzene and > 0.10 for chloromethane, 1,1-dichloroethane, and bromoform. All Calibration Check Compounds (vinyl chloride, 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene) and System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the data validation criteria of < 25 % difference and method 8260B limits of < 20 % difference. No action was needed to qualify sample data.

3.2.4 Laboratory Blanks

Method blanks were prepared and analyzed at the required method 8260C frequency. No detectable volatile organics were present above the MDL or RL in the lab blanks analyzed with the sample validated. No action was needed to qualify sample data.

3.2.5 Surrogate Recoveries

All surrogate recoveries in MW-2 were within the TestAmerica, data validation and method 8260C limits. No action was needed to qualify sample data.

3.2.6 Lab Control Standard (LCS)

An LCS at 25 ug/L was prepared and analyzed at the required method 8260C frequency. All recoveries were within TestAmerica, data validation and method limits, except for methacrylonitrile (220 %) in the LCS analyzed with sample MW-2. TestAmerica qualified the undetected sample result for methacrylonitrile in MW-2 with a "*" qualifier to indicate this non-compliance. No action was taken by the lab to reanalyze the LCS and sample and no further action was taken to qualify sample data, as no detectable methacrylonitrile was present in this sample and therefore no high bias was possible.

3.2.7 Internal Standards

All internal standard areas were within the -50 % to +100 % method and validation limits. All internal standards retention times were within ± 30 seconds of the last calibration standard. No action was needed to qualify sample data.

3.2.8 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Matrix spike (MS) and matrix spike duplicate (MSD) sample recoveries associated with MW-2 were within the EPA and TestAmerica data validation limits. No action was needed to qualify sample data.

3.3 Field QC Results

No field duplicates were collected with MW-2. No action was needed to qualify sample data.

The trip blank, field blank and equipment blanks collected with MW-2 did not contain any detectable volatile organics above the MDL. No action was needed to qualify sample data.

3.4 Data Usability

All MW-2 volatile organic data was usable as reported without additional qualification.

4.0 CONVENTIONAL CHEMISTRY DATA

Conventional chemistry parameters are defined as the following for this sampling event: alkalinity, ammonia, BOD, bromide, hardness, COD, chloride, color, cyanide, hexavalent chromium, nitrate, TKN, sulfate, sulfide, TOC, TDS and total phenols.

4.1 Completeness Assessment

The TestAmerica data package received was complete.

4.2 Compliance Assessment

The following EPA methods were followed: alkalinity (SM 2320B), ammonia (350.1), BOD (Standard Methods (SM) 5210B), bromide (300.0), hardness (SM 2340C), COD (410.4), chloride (300.0), color (SM 2120B), cyanide (9012A), hexavalent chromium (7196A), nitrate (353.2 by calculation), TKN (351.2), sulfate (300.0), sulfide (SM 4500S2F),,TOC (SM 5310D), TDS (SM2540C) and total phenols (420.4). Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

4.2.1 Holding Time/Preservation

All EPA recommended holding times for the methods cited above were met. The validated sample MW-2 was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data. Preservation pH was acceptable for analyses requiring pH adjustment. No action was needed to qualify sample data.

4.2.2 Calibration

All initial instrument calibrations associated with the samples validated were properly performed using the appropriate number of standards and met the correlation coefficient criteria. Continuing calibration checks associated with the samples validated were performed at least once every 10 samples and all checks met performance criteria. No action was needed to qualify sample data.

4.2.3 Laboratory Blanks

The unseeded laboratory blank analyzed with the validated sample MW-2 contained 0.40 mg/L BOD, above the MDL of 0.2 mg/L, but less than the Reporting Limit of 2.0 mg/L. No action was needed to qualify MW-2 data, as no detectable BOD was present in this sample and therefore no high bias is possible.

4.2.4 Lab Control Standards (LCS/LCSD)

All recoveries associated with the validated sample MW-2 were acceptable based on TestAmerica, data validation and vendor acceptance limits. No action was needed to qualify sample data.

4.2.5 Laboratory Duplicate Sample Analysis

All laboratory duplicate and MS/MSD RPD values associated with the validated samples were within the TestAmerica and data validation limits. No action was needed to qualify sample data.

4.2.6 Matrix Spike Samples

All MS/MSD recoveries were within 75-125 % validation limits. No action was needed to qualify sample data.

4.3 Field QC Results

The equipment blank collected with MW-2 contained detectable COD at 5.8 mg/L, TOC at 0.50 mg/L and hardness at 9 mg/L. The field blank collected with MW-2 contained detectable COD at 5.5 mg/L and TOC at 0.43 mg/L. Action taken was to qualify detected COD and TOC in MW-2 as undetected with a "U" qualifier as the COD and TOC concentrations were not significantly different (> 10 X) the field sampling background.

No field duplicate of MW-2 was collected. No action was needed to qualify sample data.

4.4 Data Usability

COD and TOC in MW-2 were undetected as the detected concentrations were not significantly different (> 10 X) the field sampling background.

5.0 SEMIVOLATILE ORGANICS DATA

5.1 Completeness Assessment

The TestAmerica data package received for semivolatile organic analysis was complete.

5.2 Compliance Assessment

TestAmerica utilized method 8270D for analysis. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

5.2.1 Holding Times/Preservation

Sample MW-2 was extracted within 7 days of collection and analyzed within 40 days after extraction. No action was needed to qualify sample data. The sample was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data.

5.2.2 Initial Calibration and Tuning

A seven point initial calibration with concentrations ranging from 5 - 160 ug/L was analyzed on 11/14-15/13 in accordance with method 8270. Tuning using decafluorotriphenylphosphine (DFTPP) was done at the start of the analysis and every 12 hours. Tuning criteria in the method and data validation protocols were met.

All SPCC semivolatile compounds met the WM data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All semivolatile compounds met the NFG data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All CCC semivolatile compounds met the WM data validation criteria of RSD < 30 %. All semivolatile compounds met the NFG data validation criteria of RSD < 30 %. No action was needed to qualify sample data.

5.2.3 Continuing Calibration

A 50 ug/L continuing calibration standard (CCAL) was analyzed according to method 8270 every 12 hours. All SPCC semivolatile compounds met the WM data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All semivolatile compounds met the NFG data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All CCC semivolatile compounds met the WM data validation criteria of percent difference < 30 % and NFG data validation criteria of percent difference < 25 %. No action was needed to qualify sample data.

5.2.4 Laboratory Blanks

Method blanks were prepared and analyzed at the required method 8270 frequency. No detectable semivolatile organics above the laboratory Reporting Limit were present in the lab blanks analyzed with the sample validated. No action was needed to qualify sample data.

5.2.5 Surrogate Recoveries

All surrogate recoveries in MW-2 were within the TestAmerica limits. No action was needed to qualify sample data.

5.2.6 Lab Control Standard/Lab Control Standard Duplicates

A Lab Control Standard (LCS) and a Lab Control Standard Duplicate (LCSD) were were prepared and analyzed at the required method 8270 frequency. LCS and LCSD spike recoveries and relative percent difference (RPD) values associated with MW-2 were all within TestAmerica historical limits, except for 3 & 4 methylphenol (165 % recovery, limit 39-120 %), 3,3'dimethylbenzidine (27 % recovery, limit 40-160 %), diallate (290 % recovery, limit 40-160 %), famphur (10 % recovery, limit 40-160 %), kepone (12 % recovery, limit 40-160 %), methyl methanesulfonate (14 % recovery, limit 40-160 %), N-nitrosodiphenylamine (278 % recovery, limit 25-125 %) and p-phenylene diamine (6 % recovery, limit 40-160 %). TestAmerica qualified MW-2 results for these compounds with a "*" qualifier to indicate the out of limit LCS recovery.

Undetected results in MW-2 for 3 & 4 methylphenol, diallate and N-nitrosodiphenylamine did not require any further qualification, as no high bias is possible for these undetected compounds. Results in MW-2 for 3,3'dimethylbenzidine, famphur, kepone, methyl methanesulfonate and p-phenylene diamine were qualified as estimated with a J code from a possible low bias as evidenced by the low LCS recoveries.

5.2.7 Internal Standards

All internal standard areas were within the -50 % to +100 % method and validation limits. All internal standards retention times were within ± 30 seconds of the last calibration standard. No action was needed to qualify sample data.

5.3 Field QC Results

The field and equipment blanks collected with MW-2 did not contain any semivolatile organics above the MDL. No action was needed to qualify sample data.

No field duplicate of MW-2 was collected. No action was needed to qualify sample data.

5.4 Data Usability

Results in MW-2 for 3,3'dimethylbenzidine, famphur, kepone, methyl methanesulfonate and p-phenylene diamine were qualified as estimated from a possible low bias as evidenced by the low LCS recoveries.

6.0 PCB/PESTICIDES/HERBICIDES DATA

6.1 Completeness Assessment

The TestAmerica data packages received for PCB, pesticide and herbicide analysis were complete.

6.2 Compliance Assessment

TestAmerica followed EPA methods 3510C, 8081B, 8082A and 8151A. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

6.2.1 Holding Times

The validated sample MW-2 was extracted within 7 days of collection and analyzed within 40 days after extraction. No action was needed to qualify sample data.

The validated sample MW-2 was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data.

6.2.2 GC/ECD Instrument Performance Check

The Resolution and Performance Evaluation check mixtures were analyzed as required by the method and all DDT and endrin degradation checks were less than the 15 % criteria.

6.2.3 Initial Calibration

All initial calibrations contained the required number of standards and all rsd values were within the NFG 30 % limit for pesticides and PCBs , and two or less pesticides or herbicides exhibited rsd values > 20 %. All herbicide initial calibrations met the method 8151B 20 % limit for herbicides.

All initial calibrations were within the WM 20 % rsd limit for pesticides and herbicides and 30 % rsd for PCBs, chlordane and toxaphene. No action was needed to qualify sample data.

6.2.4 Calibration Verification

All continuing calibrations associated with the validated samples were analyzed as required by the methods every 12 hours. PCB and herbicide calibrations were all within the WM and method 8151A and 8081A percent difference limits. No action was needed to qualify PCB and herbicide sample data.

Pesticide continuing calibration percent difference exceeded the 15 % method 8151A limit for 2,4,5-T (15.7 %). As 2,4,5-T was not present in MW-2 and therefore no quantitation variability was possible, no action was needed to qualify sample data.

6.2.5 Laboratory Blanks

Detectable delta-BHC (0.0120 ug/L) and gamma-BHC (0.00853 ug/L) were present in the lab blank extracted and analyzed with MW-2. No action was needed to qualify sample data, as neither delta-BHC or gamma-BHC was detected in MW-2 and therefore no high bias was possible.

No detectable PCBs or herbicides were present in the lab blanks extracted and analyzed with the samples. No action was needed to qualify sample data.

6.2.6 Surrogate Recoveries

All herbicide, PCB and pesticide surrogate recoveries were within TestAmerica limits and greater than 10 %. No action was needed to qualify herbicide and pesticide sample data.

6.2.7 Lab Control Standard/Lab Control Standard Duplicates

A Lab Control Standard (LCS) and a Lab Control Standard Duplicate (LCSD) were were prepared and analyzed at the required method 8081A, 8151A and 608 frequency. LCS and LCSD spike recoveries and relative percent difference (RPD) values were all within TestAmerica historical limits for the LCS/LCSD analyzed with MW-2. No action was needed to qualify sample data.

6.3 Field QC Results

The field and equipment blanks collected with MW-2 did not contain any PCB, pesticides or herbicides above the MDL. No action was needed to qualify sample data.

No field duplicate of MW-2 was collected. No action was needed to qualify sample data.

6.4 Data Usability

All pesticide, herbicide and PCB data was usable as reported without additional qualification.

If you have any questions regarding the qualification of data or the data validation process/criteria used, please contact me at (920) 469-9113.

Attachments:

Validated MW-2 data sheets

Validated
6/18/14
MSA

TABLE 1
NOVEMBER 2013 GROUNDWATER ANALYTICAL SUMMARY

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-4A		MW-SEA-4B		MW-SEA-5A		MW-SEA-5
		11/01/2013		10/31/2013		11/01/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/201
Volatile Organic Compounds																								
1,1,1,2-Tetrachloroethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35
1,1,1-Trichloroethane	ug/L	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82
1,1,2,2-Tetrachloroethane	ug/L	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21
1,1,2-Trichloroethane	ug/L	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23
1,1-Dichloroethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38
1,1-Dichloroethene	ug/L	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29	U	0.29
1,1-Dichloropropene	ug/L	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72
1,2,3-Trichloropropane	ug/L	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89
1,2-Dibromo-3-Chloropropane	ug/L	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39
1,2-Dibromoethane	ug/L	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73
1,2-Dichlorobenzene	ug/L	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79
1,2-Dichloroethane	ug/L	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21
1,2-Dichloropropane	ug/L	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72
1,3-Dichlorobenzene	ug/L	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78
1,3-Dichloropropane	ug/L	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75
1,4-Dichlorobenzene	ug/L	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84
2,2-Dichloropropane	ug/L	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4
2-Butanone	ug/L	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3
2-Chloro-1,3-butadiene	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U	0.49
2-Hexanone	ug/L	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2
3-Chloropropene (Allyl Chloride)	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44
4-Methyl-2-pentanone	ug/L	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1
Acetone	ug/L	3.5	J	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3
Acetonitrile	ug/L	26	U	26	U	26	U	26	U	26	U	26	U	26	U	26	U	26	U	26	U	26	U	26
Acrolein	ug/L	18	U	18	U	18	U	18	U	18	U	18	U	18	U	18	U	18	U	18	U	18	U	18
Acrylonitrile	ug/L	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83
Benzene	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41
Bromochloromethane	ug/L	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87
Bromodichloromethane	ug/L	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39
Bromoform	ug/L	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26
Bromomethane	ug/L	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69
Carbon disulfide	ug/L	0.65	J	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19
Carbon tetrachloride	ug/L	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27
Chlorobenzene	ug/L	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75
Chloroethane	ug/L	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32
Chloroform	ug/L	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34
Chloromethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35
cis-1,2-Dichloroethene	ug/L	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81
cis-1,3-Dichloropropene	ug/L	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36
Dibromochloromethane	ug/L	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32
Dibromomethane	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41
Dichlorodifluoromethane	ug/L	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68	U	0.68
Ethyl methacrylate	ug/L	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59
Ethylbenzene	ug/L	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74
Iodomethane	ug/L	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
Isobutanol	ug/L	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20
Methacrylonitrile	ug/L	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69
Methyl methacrylate	ug/L	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61
Methylene Chloride	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44
Propionitrile	ug/L	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8	U	5.8
Styrene	ug/L	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73
Tetrachloroethene	ug/L	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36
Toluene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51
trans-1,2-Dichloroethene	ug/L	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9
trans-1,3-Dichloropropene	ug/L	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37
trans-1,4-Dichloro-2-butene	ug/L	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1
Trichloroethene	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46
Trichlorofluoromethane	ug/L	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88
Vinyl acetate	ug/L	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85
Vinyl chloride	ug/L	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9
Xylenes, Total	ug/L	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66

validated
6/18/14

TABLE 1
NOVEMBER 2013 GROUNDWATER ANALYTICAL SUMMARY

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	MW-1S		✓ MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-4A		MW-SEA-4B		MW-SEA-5A		MW-SEA-5
		11/01/2013		10/31/2013		11/01/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/201
Semi-Volatile Organic Compounds																								
4,4'-DDD	ug/L	0.011	J	0.0091	U	0.0088	U	0.0087	U	0.0087	U	0.0088	U	0.0087	U	0.0087	U	0.009	U	0.0089	U	0.0087	U	0.0088
4,4'-DDE	ug/L	0.012	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011
4,4'-DDT	ug/L	0.012	J	0.011	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.011	U	0.011	U	0.01	U	0.011
Aldrin	ug/L	0.0069	U	0.0065	U	0.0063	U	0.0062	U	0.0063	U	0.0063	U	0.0063	U	0.0063	U	0.0064	U	0.0064	U	0.0063	U	0.0063
alpha-BHC	ug/L	0.011	J	0.0096	J	0.0063	U	0.0091	J	0.0089	J	0.01	J	0.01	J	0.0063	U	0.0064	U	0.011	J	0.0063	U	0.0063
beta-BHC	ug/L	0.033	J	0.025	U	0.024	U	0.023	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024	U	0.024
Chlordane	ug/L	0.3	U	0.29	U	0.28	U	0.27	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28
delta-BHC	ug/L	0.018	J B	0.0099	U	0.012	J B	0.011	J B	0.0095	U	0.0095	U	0.0095	U	0.012	J B	0.012	J B	0.0097	U	0.011	J B	0.012
Dieldrin	ug/L	0.01	U	0.0097	U	0.0093	U	0.0093	U	0.0093	U	0.0093	U	0.0093	U	0.0093	U	0.0095	U	0.0095	U	0.0093	U	0.0094
Endosulfan I	ug/L	0.012	U	0.011	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.011	U	0.011	U	0.01	U	0.011
Endosulfan II	ug/L	0.013	U	0.012	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U	0.012	U	0.012	U	0.011	U	0.011
Endosulfan sulfate	ug/L	0.016	U	0.016	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015
Endrin	ug/L	0.014	U	0.014	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013
Endrin aldehyde	ug/L	0.017	U	0.016	U	0.016	U	0.015	U	0.015	U	0.016	U	0.015	U	0.015	U	0.016	U	0.016	U	0.015	U	0.016
gamma-BHC (Lindane)	ug/L	0.0086	J B	0.0059	U	0.0057	U	0.0078	J B	0.0078	J B	0.0078	J B	0.0057	U	0.0081	J B	0.0058	U	0.0058	U	0.0057	U	0.0082
Heptachlor	ug/L	0.0089	U	0.0084	U	0.0081	U	0.008	U	0.0081	U	0.0081	U	0.0081	U	0.0081	U	0.0083	U	0.0082	U	0.0081	U	0.0081
Heptachlor epoxide	ug/L	0.0056	U	0.0052	U	0.0051	U	0.005	U	0.005	U	0.0051	U	0.005	U	0.005	U	0.0052	U	0.0051	U	0.005	U	0.0051
Methoxychlor	ug/L	0.015	U	0.014	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.013	U	0.014	U	0.014	U	0.013	U	0.013
Toxaphene	ug/L	0.13	U	0.12	U	0.11	U	0.11	U	0.11	U	0.11	U	0.11	U	0.11	U	0.12	U	0.12	U	0.11	U	0.11
Aroclor 1016	ug/L	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17
Aroclor 1221	ug/L	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17
Aroclor 1232	ug/L	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17
Aroclor 1242	ug/L	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17
Aroclor 1248	ug/L	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17
Aroclor 1254	ug/L	0.24	U	0.25	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24
Aroclor 1260	ug/L	0.24	U	0.25	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24
2,4,5-T	ug/L	0.16	U	0.15	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14
2,4,5-TP (Silvex)	ug/L	0.38	U	0.36	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.35	U	0.35	U	0.34	U	0.34
2,4-D	ug/L	0.42	U	0.4	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.39	U	0.39	U	0.38	U	0.38
Dinoseb	ug/L	0.19	U	0.18	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17
1,2,4,5-Tetrachlorobenzene	ug/L	0.57	U	0.58	U	0.55	U	0.55	U	0.55	U	0.56	U	0.55	U	0.55	U	0.57	U	0.57	U	0.55	U	0.55
1,2,4-Trichlorobenzene	ug/L	0.43	U	0.44	U	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U	0.43	U	0.43	U	0.42	U	0.42
1,4-Naphthoquinone	ug/L	0.24	U	0.24	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.24	U	0.24	U	0.23	U	0.23
1-Naphthylamine	ug/L	1.3	U	1.3	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.3	U	1.3	U	1.2	U	1.2
2,2'-Oxybis(1-chloropropane)	ug/L	0.51	U	0.52	U	0.5	U	0.49	U	0.49	U	0.5	U	0.5	U	0.5	U	0.51	U	0.51	U	0.49	U	0.5
2,3,4,6-Tetrachlorophenol	ug/L	0.32	U	0.32	U	0.3	U	0.3	U	0.3	U	0.31	U	0.3	U	0.31	U	0.32	U	0.31	U	0.3	U	0.3
2,4,5-Trichlorophenol	ug/L	0.47	U	0.48	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.47	U	0.47	U	0.45	U	0.46
2,4,6-Trichlorophenol	ug/L	0.6	U	0.6	U	0.58	U	0.58	U	0.58	U	0.58	U	0.58	U	0.58	U	0.6	U	0.6	U	0.58	U	0.58
2,4-Dichlorophenol	ug/L	0.5	U	0.51	U	0.49	U	0.48	U	0.48	U	0.49	U	0.49	U	0.49	U	0.5	U	0.5	U	0.48	U	0.49
2,4-Dimethylphenol	ug/L	0.49	U	0.5	U	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U	0.49	U	0.49	U	0.47	U	0.48
2,4-Dinitrophenol	ug/L	2.2	U	2.2	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.2	U	2.2	U	2.1	U	2.1
2,4-Dinitrotoluene	ug/L	0.44	U	0.44	U	0.43	U	0.42	U	0.43	U	0.43	U	0.43	U	0.43	U	0.44	U	0.44	U	0.42	U	0.43
2,6-Dichlorophenol	ug/L	0.45	U	0.46	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.45	U	0.45	U	0.44	U	0.44
2,6-Dinitrotoluene	ug/L	0.39	U	0.4	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.39	U	0.39	U	0.38	U	0.38
2-Acetylaminofluorene	ug/L	2.3	U	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U	2.3	U	2.3	U	2.2	U	2.2
2-Chloronaphthalene	ug/L	0.45	U	0.46	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.45	U	0.45	U	0.44	U	0.44
2-Chlorophenol	ug/L	0.52	U	0.53	U	0.5	U	0.5	U	0.5	U	0.51	U	0.5	U	0.51	U	0.52	U	0.52	U	0.5	U	0.5
2-Methylnaphthalene	ug/L	0.59	U	0.59	U	0.57	U	0.57	U	0.57	U	0.58	U	0.57	U	0.57	U	0.59	U	0.59	U	0.57	U	0.57
2-Methylphenol	ug/L	0.39	U	0.4	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.39	U	0.39	U	0.38	U	0.38
2-Naphthylamine	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
2-Nitroaniline	ug/L	0.41	U	0.42	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.41	U	0.41	U	0.4	U	0.4
2-Nitrophenol	ug/L	0.47	U	0.48	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.47	U	0.47	U	0.45	U	0.46
3 & 4 Methylphenol	ug/L	0.36	U	0.36	U	0.34	U	0.34	U	0.34	U	0.35	U	0.34	U	0.34	U	0.35	U	0.35	U	0.34	U	0.34
3,3'-Dichlorobenzidine	ug/L	0.39	U	0.4	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.39	U	0.39	U	0.38	U	0.38
3,3'-Dimethylbenzidine	ug/L	2.5	U	2.5	U J	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
3-Methylcholanthrene	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
3-Nitroaniline	ug/L	0.47	U	0.48	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.47	U	0.47	U	0.45	U	0.46
4,6-Dinitro-2-methylphenol	ug/L	2.2	U	2.2	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.2	U	2.2	U	2.1	U	2.1
4-Aminobiphenyl	ug/L	0.8	U	0.8	U	0.77	U	0.77	U	0.77	U	0.78	U	0.77	U	0.77	U	0.8	U	0.79	U	0.77	U	0.77
4-Bromophenyl phenyl ether	ug/L	0.44	U	0.45	U	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U	0.44	U	0.44	U	0.43	U	0.43
4-Chloro-3-methylphenol	ug/L	0.44	U	0.45	U	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U	0.44	U	0.44	U	0.43	U	0.43
4-Chloroaniline	ug/L	0.58	U	0.59	U	0.56	U	0.56	U	0.56	U	0.57	U	0.56	U	0.56	U	0.58	U	0.58	U	0.56	U	0.56
4-Chlorophenyl phenyl ether	ug/L	0.35	U	0.35	U	0.33	U	0.33	U	0.33	U	0.34	U	0.33	U	0.33	U	0.34	U	0.34	U	0.33	U	0.33

Validated
6/18/14
MAH

TABLE 1
NOVEMBER 2013 GROUNDWATER ANALYTICAL SUMMARY

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-4A		MW-SEA-4B		MW-SEA-5A		MW-SEA-5
		11/01/2013		10/31/2013		11/01/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/201
Semi-Volatile Organic Compounds (Cont'd)																								
4-Nitroaniline	ug/L	0.25	U	0.25	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.24	U	0.25	U	0.24	U	0.24	U	0.24
4-Nitrophenol	ug/L	1.5	U	1.5	U	1.4	U	1.4	U	1.4	U	1.5	U	1.4	U	1.5	U	1.5	U	1.5	U	1.4	U	1.4
5-Nitro-o-toluidine	ug/L	0.65	U	0.65	U	0.62	U	0.62	U	0.62	U	0.63	U	0.62	U	0.63	U	0.65	U	0.64	U	0.62	U	0.62
7,12-Dimethylbenz(a)anthracene	ug/L	0.61	U	0.61	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U	0.61	U	0.61	U	0.59	U	0.59
Acenaphthene	ug/L	0.4	U	0.41	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.4	U	0.4	U	0.39	U	0.39
Acenaphthylene	ug/L	0.38	U	0.38	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.37	U	0.37	U	0.36	U	0.36
Acetophenone	ug/L	0.53	U	0.54	U	0.51	U	0.51	U	0.51	U	0.52	U	0.51	U	0.52	U	0.53	U	0.53	U	0.51	U	0.51
Anthracene	ug/L	0.28	U	0.28	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.28	U	0.27	U	0.27	U	0.27
Benz(a)anthracene	ug/L	0.36	U	0.36	U	0.34	U	0.34	U	0.34	U	0.35	U	0.34	U	0.34	U	0.35	U	0.35	U	0.34	U	0.34
Benzo(b)fluoranthene	ug/L	0.34	U	0.34	U	0.32	U	0.32	U	0.32	U	0.33	U	0.32	U	0.32	U	0.34	U	0.33	U	0.32	U	0.32
Benzo(ghi)perylene	ug/L	0.35	U	0.35	U	0.33	U	0.33	U	0.33	U	0.34	U	0.33	U	0.33	U	0.34	U	0.34	U	0.33	U	0.33
Benzo(k)fluoranthene	ug/L	0.72	U	0.72	U	0.69	U	0.69	U	0.69	U	0.7	U	0.7	U	0.7	U	0.72	U	0.72	U	0.69	U	0.69
Benzo[a]pyrene	ug/L	0.46	U	0.47	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.46	U	0.46	U	0.45	U	0.45
Benzyl alcohol	ug/L	0.43	U	0.44	U	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U	0.43	U	0.43	U	0.42	U	0.42
Bis(2-chloroethoxy)methane	ug/L	0.35	U	0.35	U	0.33	U	0.33	U	0.33	U	0.34	U	0.33	U	0.33	U	0.34	U	0.34	U	0.33	U	0.33
Bis(2-chloroethyl)ether	ug/L	0.39	U	0.4	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.39	U	0.39	U	0.38	U	0.38
Bis(2-ethylhexyl) phthalate	ug/L	1.8	U	1.8	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.8	U	1.8	U	1.7	U	1.7
Butyl benzyl phthalate	ug/L	0.41	U	0.42	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.41	U	0.41	U	0.4	U	0.4
Chlorobenzilate	ug/L	0.66	U	0.66	U	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U	0.66	U	0.66	U	0.64	U	0.64
Chrysene	ug/L	0.33	U	0.33	U	0.31	U	0.31	U	0.31	U	0.32	U	0.31	U	0.32	U	0.33	U	0.32	U	0.31	U	0.31
Diallate	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
Dibenz(a,h)anthracene	ug/L	0.41	U	0.42	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.41	U	0.41	U	0.4	U	0.4
Diethyl phthalate	ug/L	0.22	U	0.22	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.22	U	0.22	U	0.21	U	0.21
Dimethoate	ug/L	0.53	U	0.54	U	0.51	U	0.51	U	0.51	U	0.52	U	0.51	U	0.52	U	0.53	U	0.53	U	0.51	U	0.51
Dimethyl phthalate	ug/L	0.36	U	0.36	U	0.34	U	0.34	U	0.34	U	0.35	U	0.34	U	0.34	U	0.35	U	0.35	U	0.34	U	0.34
Di-n-butyl phthalate	ug/L	0.31	U	0.31	U	0.3	U	0.29	U	0.29	U	0.3	U	0.3	U	0.3	U	0.31	U	0.3	U	0.29	U	0.3
Di-n-octyl phthalate	ug/L	0.46	U	0.47	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.46	U	0.46	U	0.45	U	0.45
Diphenylamine	ug/L	0.81	U	0.81	U	0.78	U	0.78	U	0.78	U	0.79	U	0.78	U	0.78	U	0.81	U	0.8	U	0.78	U	0.78
Disulfoton	ug/L	0.41	U	0.42	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.41	U	0.41	U	0.4	U	0.4
Ethyl methanesulfonate	ug/L	0.39	U	0.39	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.38	U	0.38	U	0.37	U	0.37
Famphur	ug/L	1.9	U	1.9	U J	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.9	U	1.9	U	1.8	U	1.8
Fluoranthene	ug/L	0.39	U	0.4	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.39	U	0.39	U	0.38	U	0.38
Fluorene	ug/L	0.36	U	0.36	U	0.34	U	0.34	U	0.34	U	0.35	U	0.34	U	0.34	U	0.35	U	0.35	U	0.34	U	0.34
Hexachlorobenzene	ug/L	0.5	U	0.51	U	0.49	U	0.48	U	0.48	U	0.49	U	0.49	U	0.49	U	0.5	U	0.5	U	0.48	U	0.49
Hexachlorobutadiene	ug/L	0.67	U	0.67	U	0.65	U	0.65	U	0.65	U	0.65	U	0.65	U	0.65	U	0.67	U	0.67	U	0.64	U	0.65
Hexachlorocyclopentadiene	ug/L	0.58	U	0.59	U	0.56	U	0.56	U	0.56	U	0.57	U	0.56	U	0.56	U	0.58	U	0.58	U	0.56	U	0.56
Hexachloroethane	ug/L	0.58	U	0.59	U	0.56	U	0.56	U	0.56	U	0.57	U	0.56	U	0.56	U	0.58	U	0.58	U	0.56	U	0.56
Hexachloropropene	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
Indeno[1,2,3-cd]pyrene	ug/L	0.46	U	0.47	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.46	U	0.46	U	0.45	U	0.45
Isodrin	ug/L	0.18	U	0.18	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.17	U	0.18	U	0.18	U	0.17	U	0.17
Isophorone	ug/L	0.42	U	0.43	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.42	U	0.42	U	0.41	U	0.41
Isosafrole	ug/L	0.57	U	0.58	U	0.55	U	0.55	U	0.55	U	0.56	U	0.55	U	0.55	U	0.57	U	0.57	U	0.55	U	0.55
Kepone	ug/L	1.8	U	1.8	U J	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.8	U	1.8	U	1.7	U	1.7
m-Dinitrobenzene	ug/L	0.81	U	0.81	U	0.78	U	0.78	U	0.78	U	0.79	U	0.78	U	0.78	U	0.81	U	0.8	U	0.78	U	0.78
Methapyrilene	ug/L	1.8	U	1.8	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.8	U	1.8	U	1.7	U	1.7
Methyl methanesulfonate	ug/L	2.5	U	2.5	U J	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
Methyl parathion	ug/L	0.37	U	0.37	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.36	U	0.36	U	0.35	U	0.35
Naphthalene	ug/L	0.75	U	0.75	U	0.72	U	0.72	U	0.72	U	0.73	U	0.72	U	0.73	U	0.75	U	0.74	U	0.72	U	0.72
Nitrobenzene	ug/L	0.29	U	0.29	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.29	U	0.28	U	0.27	U	0.28
N-Nitrosodiethylamine	ug/L	0.36	U	0.36	U	0.34	U	0.34	U	0.34	U	0.35	U	0.34	U	0.34	U	0.35	U	0.35	U	0.34	U	0.34
N-Nitrosodimethylamine	ug/L	2.2	U	2.2	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.2	U	2.2	U	2.1	U	2.1
N-Nitrosodi-n-butylamine	ug/L	0.59	U	0.59	U	0.57	U	0.57	U	0.57	U	0.58	U	0.57	U	0.57	U	0.59	U	0.59	U	0.57	U	0.57
N-Nitrosodi-n-propylamine	ug/L	0.53	U	0.54	U	0.51	U	0.51	U	0.51	U	0.52	U	0.51	U	0.52	U	0.53	U	0.53	U	0.51	U	0.51
N-Nitrosodiphenylamine	ug/L	0.5	U	0.51	U	0.49	U	0.48	U	0.48	U	0.49	U	0.49	U	0.49	U	0.5	U	0.5	U	0.48	U	0.49
N-Nitrosomethylethylamine	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
N-Nitrosopiperidine	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
N-Nitrosopyrrolidine	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
o,o',o''-Triethylphosphorothioate	ug/L	0.42	U	0.43	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.42	U	0.42	U	0.41	U	0.41
o-Toluidine	ug/L	1.5	U	1.5	U	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U	1.5	U	1.5	U	1.4	U	1.4
Parathion	ug/L	0.63	U	0.63	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.63	U	0.63	U	0.61	U	0.61
p-Dimethylamino azobenzene	ug/L	0.74	U	0.74	U	0.71	U	0.71	U	0.71	U	0.72	U	0.71	U	0.72	U	0.74	U	0.73	U	0.71	U	0.71
Pentachlorobenzene	ug/L	0.52	U	0.53	U	0.5	U	0.5	U	0.5	U	0.51	U	0.5	U	0.51	U	0.52	U	0.52	U	0.5	U	0.5
Pentachloronitrobenzene	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4

Validated 6/18/14 MAH ✓

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Mill Seat Landfill
Town of Riga, New York

Parameter	Units	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-4A		MW-SEA-4B		MW-SEA-5A		MW-SEA-5
		11/01/2013		10/31/2013		11/01/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/2013		10/31/2013		10/31/2013		10/31/2013		11/01/201
Semi-Volatile Organic Compounds (Cont'd)																								
Pentachlorophenol	ug/L	2.2	U	2.2	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.2	U	2.2	U	2.1	U	2.1
Phenacetin	ug/L	0.6	U	0.6	U	0.58	U	0.58	U	0.58	U	0.58	U	0.58	U	0.58	U	0.6	U	0.6	U	0.58	U	0.58
Phenanthrene	ug/L	0.43	U	0.44	U	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U	0.43	U	0.43	U	0.42	U	0.42
Phenol	ug/L	0.39	U	0.39	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.38	U	0.38	U	0.37	U	0.37
Phorate	ug/L	0.49	U	0.5	U	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U	0.49	U	0.49	U	0.47	U	0.48
p-Phenylene diamine	ug/L	200	U	200	U J	190	U	190	U	190	U	190	U	190	U	190	U	200	U	200	U	190	U	190
Pronamide	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
Pyrene	ug/L	0.34	U	0.34	U	0.32	U	0.32	U	0.32	U	0.33	U	0.32	U	0.32	U	0.34	U	0.33	U	0.32	U	0.32
Safrole	ug/L	0.45	U	0.46	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.45	U	0.45	U	0.44	U	0.44
sym-Trinitrobenzene	ug/L	2.5	U	2.5	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.4	U	2.5	U	2.4	U	2.4	U	2.4
Thionazin	ug/L	0.38	U	0.38	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.37	U	0.37	U	0.36	U	0.36
Metals																								
Aluminum, Total Recoverable	ug/L	4430		1250		60	U	625		154		2380		931		842		60	U	6110		181		201
Antimony, Total Recoverable	ug/L	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8
Arsenic, Total Recoverable	ug/L	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	27.8	U	5.6	U	5.6	U	5.6	U	15.1		5.6	U	5.6
Barium, Total Recoverable	ug/L	111	J	50.4	J	47.5	J	98.7	J	99.7	J	107	J	120	J	119	J	27.5	J	60.2	J	39.1	J	63.3
Beryllium, Total Recoverable	ug/L	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.39	J	0.3	U	0.3
Boron, Total Recoverable	ug/L	131	J	27.2	J B U	222	J	42.8	J	71.2	J B	32.3	J B	86.6	J B	89.6	J	316	J B	252	J B	232	J B	82.7
Cadmium, Total Recoverable	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	3.3		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5
Calcium, Total Recoverable	ug/L	77100		79000		328000		109000		113000		94200		109000		77100		381000		177000		210000		94000
Chromium, Total Recoverable	ug/L	10.5	J	2.1	J	1	U	1.3	J	1	U	3.6	J	1.2	J	1.4	J	1	U	9	J	1.2	J	1
Cobalt, Total Recoverable	ug/L	2.9	J	0.63	U	0.63	U	1.1	J	0.63	U	3.7	J	0.74	J	0.81	J	0.63	U	2.7	J	0.63	U	0.63
Copper, Total Recoverable	ug/L	5.2	J	2.5	J	1.6	U	2	J	1.6	U	3.6	J	1.6	U	1.6	U	1.7	J	5.4	J	2.4	J	1.6
Iron, Total Recoverable	ug/L	5520		1040		757		568		253		1890		902		1040		665		6620		358		125
Lead, Total Recoverable	ug/L	5.6		3	U	3	U	3	U	3	U	29.8	B	3	U	3	U	3	U	5.4	B	3	U	3
Magnesium, Total Recoverable	ug/L	62100		37100		45500		61700		38100		42400		37200		67400		30700		42000		54000		86100
Manganese, Total Recoverable	ug/L	111		10.7	J	10	J	22.6	J	5.1	J	46.7		24	J	81.7		8.7	J	115		19.7	J	59.5
Mercury, Total Recoverable	ug/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12
Nickel, Total Recoverable	ug/L	6.8	J	1.3	J	1.3	U	1.6	J	1.3	U	8.2	J	2.2	J	1.7	J	1.3	U	7.2	J	1.3	U	1.5
Potassium, Total Recoverable	ug/L	8470		1500	J	3060		2670	J	1710	J	2410	J	2280	J	7830		4020		5570		3210		10900
Selenium, Total Recoverable	ug/L	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	68		8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7
Silver, Total Recoverable	ug/L	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7
Sodium, Total Recoverable	ug/L	20400		2790		16600		6390		4600		3370		4280		10500		6030		18200		14700		9550
Thallium, Total Recoverable	ug/L	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2
Tin, Total Recoverable	ug/L	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1
Vanadium, Total Recoverable	ug/L	7.2	J	1.8	J	1.5	U	1.5	U	1.5	U	3.6	J	1.7	J	1.7	J	1.5	U	9.7	J	1.5	U	1.5
Zinc, Total Recoverable	ug/L	20.6		2.2	J B U	12.1		5	J	1.5	U	4.8	J B	2.9	J B	4.3	J	1.5	U	11.6	B	1.5	U	7.3
General Chemistry																								
Bromide	mg/L	0.073	U	0.073	U	0.073	U	0.08	J	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073
Chloride	mg/L	9.4		4.6		55.3		6		8.9		6		10.1		16.1		15.3		2.7		14.9		37.2
Sulfate	mg/L	127		13.5		635		165		103		21.6		59.2		78.5		741		378		515		213
Ammonia, distilled	mg/L as N	0.12	J	0.12	J	0.5	B	0.1	U	0.1	U	0.1	U	0.11	J B	0.14	J	0.2	B	0.14	J B	0.15	J	0.15
Total Kjeldahl Nitrogen	mg/L as N	0.98		0.15	U	0.31		0.55		0.15	U	0.15	U	0.15	U	0.77		0.27		0.22		0.22		0.15
Chemical Oxygen Demand	mg/L	5	U	5.2	J U	5	U	5	U	5	U	5	U	7.1	J	5	U	9.3	J	5	U	11.8		5
Phenolics, Total Recoverable	mg/L	0.0062	J	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.0052	J	0.005	U	0.005	U	0.005	U	0.005
Chromium, hexavalent	mg/L	0.005	U	0.026		0.005	U	0.005	U	0.0066		0.005	U	0.0084		0.005	U	0.005	U	0.11		0.005	U	0.0084
Cyanide, Total	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.019		0.005	U	0.0064		0.005
Nitrate	mg/L as N	2.9		2.6		0.02	U	0.038	J	0.02	U	9.1		2		5.9		0.02	U	0.02	U	0.02	U	0.02
Color	Color Units	20		10		25		20		0.01	U	0.01	U	0.01	U	10		30		0.01	U	10		5
Alkalinity, Total	mg/L	340		316		321		370		319		331		342		350		287		202		270		400
Hardness	mg/L	560		350		1060		620		390		390		420		520		1060		596		770		620
Total Dissolved Solids	mg/L	536		327		1290		586		449		387		427		493		1400		790		1050		755
Sulfide	ug/L	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670
Biochemical Oxygen Demand	mg/L	7.5		2	U	8.3		10.6		2	U	2	U	2	U	10.5		2	U	2	U	2	U	7.2
Total Organic Carbon	mg/L	2.8		1.2	U	2.2		0.87	J	0.82	J	0.89	J	1.1		1.2		2.3		0.8	J	2		1.3
Field Parameters																								
Temperature	Degrees C	10.7		13		10.4		14.2		10.7		13.4		11		14		10.3		10.6		12		11.6
Oxidation Reduction Potential	millivolts	171		231		89		176		188		163		122		183		89		77		210		153
Turbidity	NTU	50.3		6.61		0.8		37.8		4.7		32		4.9		24.4		10.1		47.5		2.5		8.62
Field pH	SU	7.25		7.29		7.19		7.37		6.94		7.4		7.26		6.7		7.24		7.42		7.01		7.11
Specific Conductance	umhos/cm	805		580		1490		820		637		627		656		747		1610		1037		1160		1020

See last page for notes.

MAKUEHL CO.

Data Validation

Lab/Field Audits

QA Plans

TECHNICAL MEMORANDUM

DATE: June 18, 2014

TO: Richard H. Frappa, P.G.
GEI Consultants, Inc.

FROM: Marcia A. Kuehl
President/Owner
MAKuehl Company

SUBJECT: Data Validation for Mill Seat Landfill
NYSDEC Baseline Parameter sampling MW-1S
April, 2014 sampling event

1.0 OVERVIEW

Analytical results for a randomly selected location (MW-1S) collected from the Mill Seat Landfill on April 2, 2014 have been evaluated using the Waste Management "Standard Operating Procedure Data Validation Procedures for EPA Level III Data, 1996" modified to reflect the specific criteria in the SW 846 and other EPA cited analytical methods. This protocol for data validation was approved for use by NYSDEC in September, 2002.

The review was based on the CD data packages supplied by the analytical laboratory, TestAmericaBuffalo, in Buffalo, New York.

Zinc and nickel results for MW-1S were qualified as undetected as the concentrations reported were not significantly different (> 10 X) from lab background.

All MW-1S volatile organic data was usable as reported without additional qualification.

TOC in MW-1S was undetected as the concentration reported does not differ significantly (> 10X) from field background.

The bis(2-ethylhexyl)phthalate result for MW-1S was useable as reported without additional qualification.

The data validation process is described in detail below. The validated data sheets are attached.

2.0 METALS DATA

2.1 Completeness Assessment

The TestAmerica data package received for metals was complete.

2.2 Compliance Assessment

EPA methods 3005A (digestion), 6010C and 7470A (mercury) were followed. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the methods. No action was needed to qualify sample data.

2.2.1 Holding Time/Preservation

The sample was analyzed within the 6 month holding time for metals and the 28 day holding time for mercury. The pH verification by the lab indicated that the pH was < 2 in MW-1S. No action was needed to qualify sample data.

2.2.2 Calibration

All initial instrument calibrations (ICV) were properly performed using the appropriate number of standards. Continuing calibration checks (CCV) were performed at least once every 10 samples. The EPA method recovery criteria of 90 - 110 % for the ICV and CCV solutions were met for all analytes in the calibrations associated with the validated sample. No action was needed to qualify sample data.

2.2.3 Laboratory Blanks

Initial and preparation blanks analyzed with the samples validated were done at the required frequency. Continuing calibration blanks bracketing the sample validated were done at the required frequency. No metals were detected above the Method Detection Limit (MDL) in blanks associated with MW-1S. No action was needed to qualify sample data.

2.2.4 Interference Check Sample/Serial Dilution

An interference check sample (ICS) was analyzed at the required frequency to determine the effect of high concentrations of interferant ions on target metals. Recovery of target metals, in the presence of interferants, were all within the acceptable range for the check samples associated with the validated sample. No metals were detected in the Interference Check Sample at a positive concentration above the Reporting Limit (RL) for the check samples associated with the validated sample. No metals were detected in the Interference Check Sample at a negative concentration above the RL for the check samples associated with the validated sample. There was no evidence of false negatives in the validated sample. No action was needed to qualify sample data.

Serial dilution percent differences for the sample associated with MW-1S were all less than the 10 % acceptable limit in the EPA method for metals at concentrations exceeding 50 X IDL. No action was needed to qualify sample data.

2.2.5 Laboratory Control Sample (LCS)

All LCS recoveries were within the 80 -120 % limit. No action was needed to qualify sample data.

2.2.6 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike (MS) and matrix spike duplicate (MSD) sample recoveries associated with the sample validated were within the 75 -125 % EPA method data validation limits for sample concentrations that did not exceed the spike concentrations by more than a factor of 4. No action was needed to qualify sample data.

2.3 Field QC Results

The field and equipment blanks collected with MW-1S contained detectable metals above the mdl as follows:

Field blank:	nickel	1.4 ug/L
Equipment blank:	potassium	105 ug/L
	Zinc	2.4 ug/L

Action taken was to qualify detected nickel and zinc in MW-1S as undetected with a "U" code as the concentration reported does not differ significantly (> 10X) from field background.

No field duplicate was collected with MW-1S. No action was needed to qualify sample data.

2.4 Data Usability

Zinc and nickel results for MW-1S were qualified as undetected as the concentrations reported were not significantly different (> 10 X) from lab background.

3.0 VOLATILE ORGANICS DATA

3.1 Completeness Assessment

The TestAmerica data package received for volatile organic analysis was complete.

3.2 Compliance Assessment

TestAmerica utilized EPA methods 5030B for sample purging and 8260C for analysis. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

3.2.1 Holding Times/Preservation

The preservation pH was less than 2 and the holding time of 14 days was met in MW-1S. The sample was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data.

3.2.2 Initial Calibration and Tuning

A six point initial calibration curve with concentrations ranging from 1-100 ug/L was analyzed in accordance with method 8260C on 4/3/14 for reported volatile organics. Tuning using bromofluorobenzene (BFB) was done at the start of the analysis and every 12 hours. All tuning results met the method criteria.

Method System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the EPA method data validation criteria of > 0.30 for 1,1,2,2-tetrachloroethane and chlorobenzene and > 0.10 for chloromethane, 1,1-dichloroethane, and bromoform. All Calibration Check Compounds (vinyl chloride, 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene) and System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the data validation criteria of < 30 % Relative Standard Deviation (RSD). All RSD valus for all reported compounds were less than the 15 % method criteria or the linear calibration coefficient was > 0.990. No action was needed to qualify sample data.

3.2.3 Continuing Calibration

A 20 ug/L continuing calibration standard (CCAL) was analyzed according to method 8260B every 12 hours. Method System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the EPA method data validation criteria of > 0.30 for 1,1,2,2-tetrachloroethane and chlorobenzene and > 0.10 for chloromethane, 1,1-dichloroethane, and bromoform. All Calibration Check Compounds (vinyl chloride, 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene) and System Performance Check Compounds (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) met the data validation criteria of < 25 % difference and method 8260B limits of < 20 % difference. No action was needed to qualify sample data.

3.2.4 Laboratory Blanks

Method blanks were prepared and analyzed at the required method 8260C frequency. No detectable volatile organics were present above the MDL or RL in the lab blanks analyzed with the sample validated. No action was needed to qualify sample data.

3.2.5 Surrogate Recoveries

All surrogate recoveries in MW-1S were within the TestAmerica, data validation and method 8260C limits. No action was needed to qualify sample data.

3.2.6 Lab Control Standard (LCS)

An LCS at 25 ug/L was prepared and analyzed at the required method 8260C frequency. All recoveries were within TestAmerica, data validation and method limits, except for 1,1,1,2-tetrachloroethane (123 %, limit 77-122 %) and vinyl acetate (170 %, limit 50-144 %) in the LCS analyzed with sample MW-1S. TestAmerica qualified the undetected sample results for 1,1,1,2-tetrachloroethane and vinyl acetate in MW-1S with a "*" qualifier to indicate this non-compliance. No action was taken by the lab to reanalyze the LCS and sample and no further action was taken to qualify sample data, as no detectable 1,1,1,2-tetrachloroethane and vinyl acetate was present in this sample and therefore no high bias was possible.

3.2.7 Internal Standards

All internal standard areas were within the -50 % to +100 % method and validation limits. All internal standards retention times were within ± 30 seconds of the last calibration standard. No action was needed to qualify sample data.

3.2.8 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Matrix spike (MS) and matrix spike duplicate (MSD) sample recoveries associated with MW-1S were within the EPA and TestAmerica data validation limits. No action was needed to qualify sample data.

3.3 Field QC Results

No field duplicates were collected with MW-1S. No action was needed to qualify sample data.

The trip blank, field blank and equipment blanks collected with MW-1S did not contain any detectable volatile organics above the MDL. No action was needed to qualify sample data.

3.4 Data Usability

All MW-1S volatile organic data was usable as reported without additional qualification.

4.0 CONVENTIONAL CHEMISTRY DATA

Conventional chemistry parameters are defined as the following for this sampling event: alkalinity, ammonia, BOD, bromide, hardness, COD, chloride, color, cyanide, hexavalent chromium, nitrate, TKN, sulfate, sulfide, TOC, TDS and total phenols.

4.1 Completeness Assessment

The TestAmerica data package received was complete.

4.2 Compliance Assessment

The following EPA methods were followed: alkalinity (SM 2320B), ammonia (350.1), BOD (Standard Methods (SM) 5210B), bromide (300.0), hardness (SM 2340C), COD (410.4), chloride (300.0), color (SM 2120B), cyanide (9012A), hexavalent chromium (7196A), nitrate (353.2 by calculation), TKN (351.2), sulfate (300.0), sulfide (SM 4500S2F), TOC (SM 5310D), TDS (SM2540C) and total phenols (420.4). Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

4.2.1 Holding Time/Preservation

All EPA recommended holding times for the methods cited above were met. The validated sample MW-1S was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data. Preservation pH was acceptable for analyses requiring pH adjustment. No action was needed to qualify sample data.

4.2.2 Calibration

All initial instrument calibrations associated with the samples validated were properly performed using the appropriate number of standards and met the correlation coefficient criteria. Continuing calibration checks associated with the samples validated were performed at least once every 10 samples and all checks met performance criteria. No action was needed to qualify sample data.

4.2.3 Laboratory Blanks

All laboratory blanks were within method and data validation limits. No detectable analytes above the MDL were present in the lab blanks analyzed with MW-1S. No action was needed to qualify sample data.

4.2.4 Lab Control Standards (LCS/LCSD)

All recoveries associated with the validated sample MW-1S were acceptable based on TestAmerica, data validation and vendor acceptance limits. No action was needed to qualify sample data.

4.2.5 Laboratory Duplicate Sample Analysis

All laboratory duplicate and MS/MSD RPD values associated with the validated sample were within the TestAmerica and data validation limits. No action was needed to qualify sample data.

4.2.6 Matrix Spike Samples

All MS/MSD recoveries were within 75-125 % validation limits. No action was needed to qualify sample data.

4.3 Field QC Results

The field and equipment blanks collected with MW-1S contained detectable metals above the mdl as follows:

Field blank:	COD	6.2 mg/L
	Total phenol	0.0064 mg/L
	TOC	1.6 mg/L
Equipment blank:	ammonia	0.0099 mg/L
	COD	5.6 mg/L
	TDS	12.0 mg/L
	TOC	1.4 mg/L

Action taken was to qualify detected TOC in MW-1S as undetected with a “U” code as the concentration reported does not differ significantly (> 10X) from field background.

No field duplicate of MW-1S was collected. No action was needed to qualify sample data.

4.4 Data Usability

TOC in MW-1S was undetected as the concentration reported does not differ significantly (> 10X) from field background.

5.0 SEMIVOLATILE ORGANICS DATA

5.1 Completeness Assessment

The TestAmerica data package received for semivolatile organic analysis for bis(2-ethylhexyl)phthalate was complete.

5.2 Compliance Assessment

TestAmerica utilized method 8270D for analysis. Based on the documentation reviewed, no significant deviations adversely affecting data quality were made to the method. No action was needed to qualify sample data.

5.2.1 Holding Times/Preservation

Sample MW-1S was extracted within 7 days of collection and analyzed within 40 days after extraction. No action was needed to qualify sample data. The sample was received at TestAmerica within the acceptable temperature range of 2-6°C. No action was needed to qualify sample data.

5.2.2 Initial Calibration and Tuning

A seven point initial calibration with concentrations ranging from 5 - 160 ug/L was analyzed on 3/26/14 in accordance with method 8270. Tuning using decafluorotriphenylphosphine (DFTPP) was done at the start of the analysis and every 12 hours. Tuning criteria in the method and data validation protocols were met.

All SPCC semivolatile compounds met the WM data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All semivolatile compounds met the NFG data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All CCC semivolatile compounds met the WM data validation criteria of RSD < 30 %. All semivolatile compounds met the NFG data validation criteria of RSD < 30 % . No action was needed to qualify sample data.

5.2.3 Continuing Calibration

A 50 ug/L continuing calibration standard (CCAL) was analyzed according to method 8270 every 12 hours. All SPCC semivolatile compounds met the WM data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All semivolatile compounds met the NFG data validation criteria of a minimum relative response factor (RRF) of greater than 0.05. No action was needed to qualify sample data.

All CCC semivolatile compounds met the WM data validation criteria of percent difference < 30 % and NFG data validation criteria of percent difference < 25 %. No action was needed to qualify sample data.

5.2.4 Laboratory Blanks

Method blanks were prepared and analyzed at the required method 8270 frequency. No detectable bis(2-ethylhexyl)phthalate above the laboratory Reporting Limit were present in the lab blanks analyzed with the sample validated. No action was needed to qualify sample data.

5.2.5 Surrogate Recoveries

All surrogate recoveries in MW-1S were within the TestAmerica limits. No action was needed to qualify sample data.

5.2.6 Lab Control Standard/Lab Control Standard Duplicates

A Lab Control Standard (LCS) and a Lab Control Standard Duplicate (LCSD) were were prepared and analyzed at the required method 8270 frequency. LCS and LCSD spike recoveries and relative percent difference (RPD) values associated with MW-1S were all within TestAmerica historical limits. No action was needed to qualify sample data.

5.2.7 Internal Standards

All internal standard areas were within the -50 % to +100 % method and validation limits. All internal standards retention times were within ± 30 seconds of the last calibration standard. No action was needed to qualify sample data.

5.3 Field QC Results

The field and equipment blanks collected with MW-1S did not contain any semivolatile organics above the MDL. No action was needed to qualify sample data.

No field duplicate of MW-1S was collected. No action was needed to qualify sample data.

5.4 Data Usability

The bis(2-ethylhexyl)phthalate result for MW-1S was useable as reported without additional qualification.

If you have any questions regarding the qualification of data or the data validation process/criteria used, please contact me at (920) 469-9113.

Attachments:

Validated MW-1S data sheets

validated
6/18/14
Man

TABLE 2
APRIL 2014 GROUNDWATER ANALYTICAL SUMMARY

Mill Seat Landfill
Town of Riga, New York

Parameter	Units	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-3Z		MW-SEA-4A	
		04/02/2014		04/04/2014		04/07/2014		04/07/2014		04/03/2014		04/03/2014		04/07/2014		04/08/2014		04/07/2014		04/01/2014	
Metals																					
Aluminum, Total Recoverable	ug/L	69.4		84.8		60	U	95.6		79.8		893		60	U	219		60	U	314	
Antimony, Total Recoverable	ug/L	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U	6.8	U
Arsenic, Total Recoverable	ug/L	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U
Barium, Total Recoverable	ug/L	62.8	J	14	J	46.5	J	87.1	J	148	J	55	J	103	J	128	J	26.4	J	29.1	J
Beryllium, Total Recoverable	ug/L	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
Boron, Total Recoverable	ug/L	71.9	J	21.3	J	200	J	28	J	105	J	15.5	J	68.7	J	34.6	J	240	J	265	J
Cadmium, Total Recoverable	ug/L	0.5	U	0.68	J	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Calcium, Total Recoverable	ug/L	90400		49800		300000		103000		166000		87500		93000		78100		334000		353000	
Chromium, Total Recoverable	ug/L	1.3	J	1	U	1.6	J	1.2	J	1	U	1.7	J	1	U	2	J	1.4	J	1.3	J
Cobalt, Total Recoverable	ug/L	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
Copper, Total Recoverable	ug/L	2.8	J	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U	1.6	U
Iron, Total Recoverable	ug/L	120		60.7		910		88.1		885		1030		86.6		218		847		798	
Lead, Total Recoverable	ug/L	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Magnesium, Total Recoverable	ug/L	59300		26100		42200		59100		40900		42600		33300		57000		40600		29800	
Manganese, Total Recoverable	ug/L	23.4	J	2.7	J	10.9	J	4.4	J	7.6	J B	49.5	B	9.5	J	45.4		9.2	J	8.6	J
Mercury, Total Recoverable	ug/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
Nickel, Total Recoverable	ug/L	3.5	J U	1.3	U	1.3	U	1.4	J	1.3	U	1.3	U	1.3	U	1.4	J	1.3	U	1.3	U
Potassium, Total Recoverable	ug/L	6470		326	J	3120		2040	J	2100	J	1260	J	1790	J	3730		3730		5800	
Selenium, Total Recoverable	ug/L	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U	8.7	U
Silver, Total Recoverable	ug/L	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Sodium, Total Recoverable	ug/L	28700		2460		16300		6330		7480		3410		3550		8030		15400		7020	
Thallium, Total Recoverable	ug/L	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U	10.2	U
Vanadium, Total Recoverable	ug/L	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U
Zinc, Total Recoverable	ug/L	5.3	J U	6	J	1.5	U	1.5	U	3.6	J B	4.5	J B	1.9	J	2.6	J	1.5	U	1.5	U
General Chemistry																					
Bromide	mg/L	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	0.073	U	3.3	
Chloride	mg/L	6.2		1.7		50.8		5.9		23.7		8.5		9.5		11.6		55.6		20.4	
Sulfate	mg/L	201		8.3		629		150		293		16.4		50.3		70		704		676	
Ammonia (as N)	mg/L as N	0.009	U	0.009	U	0.048		0.03		0.009	U	0.026		0.022		0.009	U	0.041		0.12	
Total Kjeldahl Nitrogen	mg/L as N	0.15	U	0.24		0.43	B	0.15	U	0.26		0.15	U	0.15	U	0.15	U	0.17	J	0.27	
Chemical Oxygen Demand	mg/L	5	U	6.2	J	5	U	5	U	10.3		10.3		5	U	14.1		5	U	5	U
Phenolics, Total Recoverable	mg/L	0.005	U	0.0054	J B	0.005	U	0.005	U	0.005	U	0.0052	J	0.005	U	0.0059	J B	0.005	U	0.005	U
Chromium, hexavalent	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.0056	J	0.005	U	0.005	U	0.005	U	0.005	U
Cyanide, Total	mg/L	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Nitrate	mg/L as N	10.8		1.5		0.02	U	0.087		0.02	U	15.6		1.9		8.6		0.02	U	0.02	U
Color	Color Units	15		5		20		0.01	U	25		0.01	U	0.01	U	10		20		20	
Alkalinity, Total	mg/L	373		236		317		364		310		295		328		351		301		289	
Total Hardness	mg/L	470		228		1100		530		560		364		390		460		1100		1250	
Total Dissolved Solids	mg/L	713		218		1330		561		731		355		420		511		1400		1370	
Biochemical Oxygen Demand	ug/L	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Total Organic Carbon	mg/L	2.5	U	1.2		3		1.2		1.9		2.1		1.6		1.5		3.5		4.1	
Sulfide	mg/L	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U	670	U
Field Parameters																					
Temperature	Degrees C	9.3		3.8		10.2		9		9.5		5.6		10.3		5.4		10.1		10.1	
Oxidation Reduction Potential	millivolts	110		183		0		113		57		118		64		102		7		31	
Turbidity	NTU	5.8		4.3		3		10.9		5.5		21.1		3.8		13.4		4.4		3.5	
Field pH	SU	7.4		6.3		7.26		6.93		7.31		7.35		7.41		7.83		7.27		6.9	
Specific Conductance	umhos/cm	862		372		1539		789		956		609		652		743		1608		1487	

See last page for notes.

Validated
6/18/14
MAR

TABLE 2
APRIL 2014 GROUNDWATER ANALYTICAL SUMMARY

Mill Seat Landfill
Town of Riga, New York

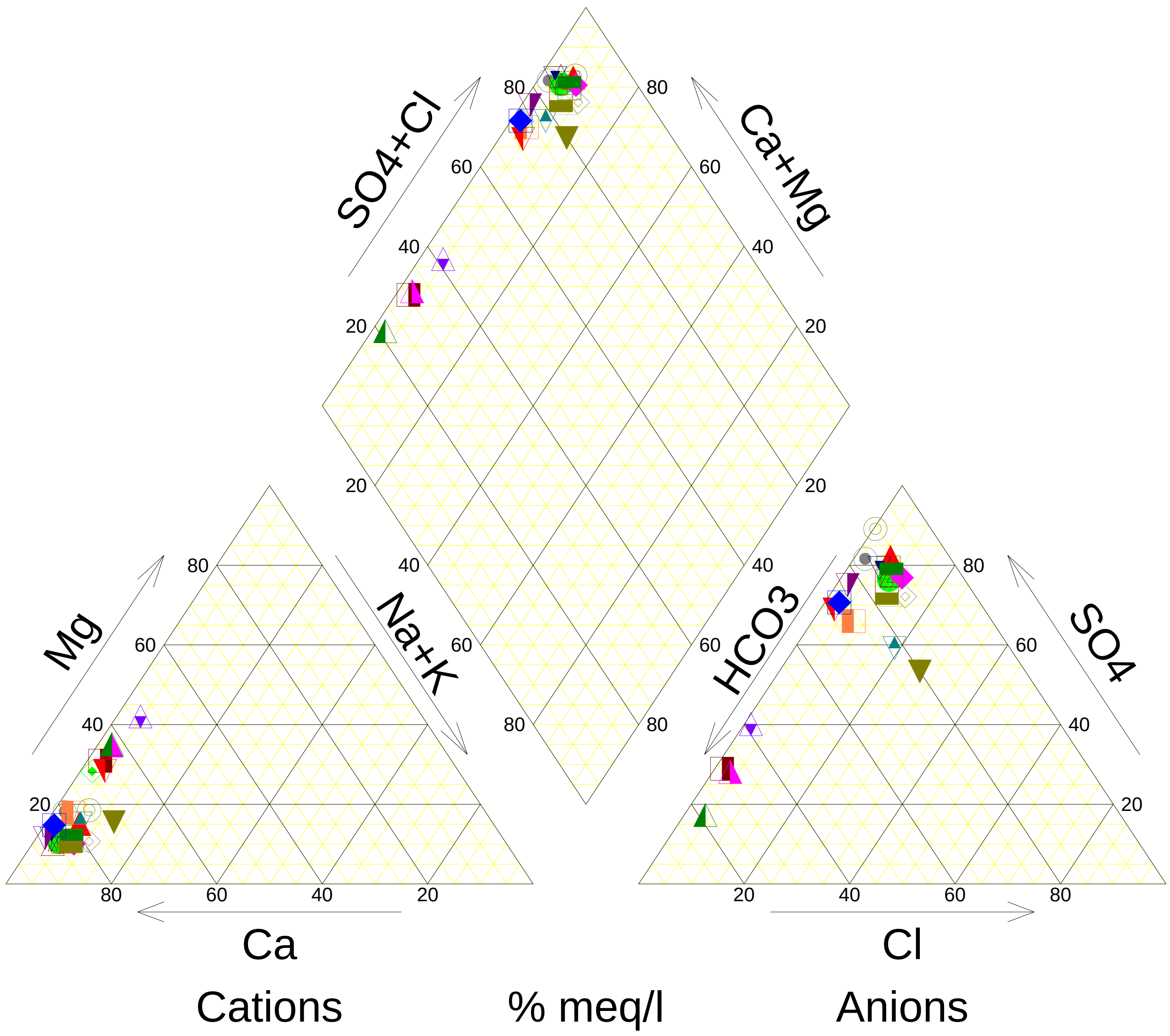
Parameter	Units	MW-1S		MW-2		MW-SEA-1A		MW-SEA-1B		MW-SEA-2A		MW-SEA-2B		MW-SEA-3A		MW-SEA-3B		MW-SEA-3Z		MW-SEA-4A	
		04/02/2014		04/04/2014		04/07/2014		04/07/2014		04/03/2014		04/03/2014		04/07/2014		04/08/2014		04/07/2014		04/01/2014	
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U
1,1,1-Trichloroethane	ug/L	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U	0.82	U
1,1,2,2-Tetrachloroethane	ug/L	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U
1,1,2-Trichloroethane	ug/L	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U	0.23	U
1,1-Dichloroethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
1,2,3-Trichloropropane	ug/L	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U	0.89	U
1,2-Dibromo-3-Chloropropane	ug/L	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U
1,2-Dibromoethane	ug/L	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U
1,2-Dichlorobenzene	ug/L	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U
1,2-Dichloroethane	ug/L	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U	0.21	U
1,2-Dichloroethene	ug/L	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U
1,2-Dichloropropane	ug/L	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U	0.72	U
1,4-Dichlorobenzene	ug/L	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U	0.84	U
2-Butanone	ug/L	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U
2-Hexanone	ug/L	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U *	1.2	U	1.2	U	1.2	U	1.2	U
4-Methyl-2-pentanone	ug/L	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U
Acetone	ug/L	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	8.9		3	U
Acrylonitrile	ug/L	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U	0.83	U
Benzene	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
Bromochloromethane	ug/L	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U
Bromodichloromethane	ug/L	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U	0.39	U
Bromoform	ug/L	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U	0.26	U
Bromomethane	ug/L	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U	0.69	U
Carbon disulfide	ug/L	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U
Carbon tetrachloride	ug/L	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U	0.27	U
Chlorobenzene	ug/L	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U
Chloroethane	ug/L	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U
Chloroform	ug/L	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U
Chloromethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U
cis-1,2-Dichloroethene	ug/L	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U	0.81	U
cis-1,3-Dichloropropene	ug/L	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U
Dibromochloromethane	ug/L	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U
Dibromomethane	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
Dichlorodifluoromethane	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	ug/L	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U	0.74	U
Methylene Chloride	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
Styrene	ug/L	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U
Tetrachloroethene	ug/L	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U
Toluene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
trans-1,2-Dichloroethene	ug/L	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U
trans-1,3-Dichloropropene	ug/L	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U
trans-1,4-Dichloro-2-butene	ug/L	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U
Trichloroethene	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
Trichlorofluoromethane	ug/L	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U
Vinyl acetate	ug/L	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U	0.85	U *	0.85	U
Vinyl chloride	ug/L	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U
Xylenes, Total	ug/L	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U	0.66	U
Semi-Volatile Organic Compounds																					
Bis(2-ethylhexyl) phthalate	ug/L	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U

Appendix K

Geochemical (Stiff and Piper) Diagrams

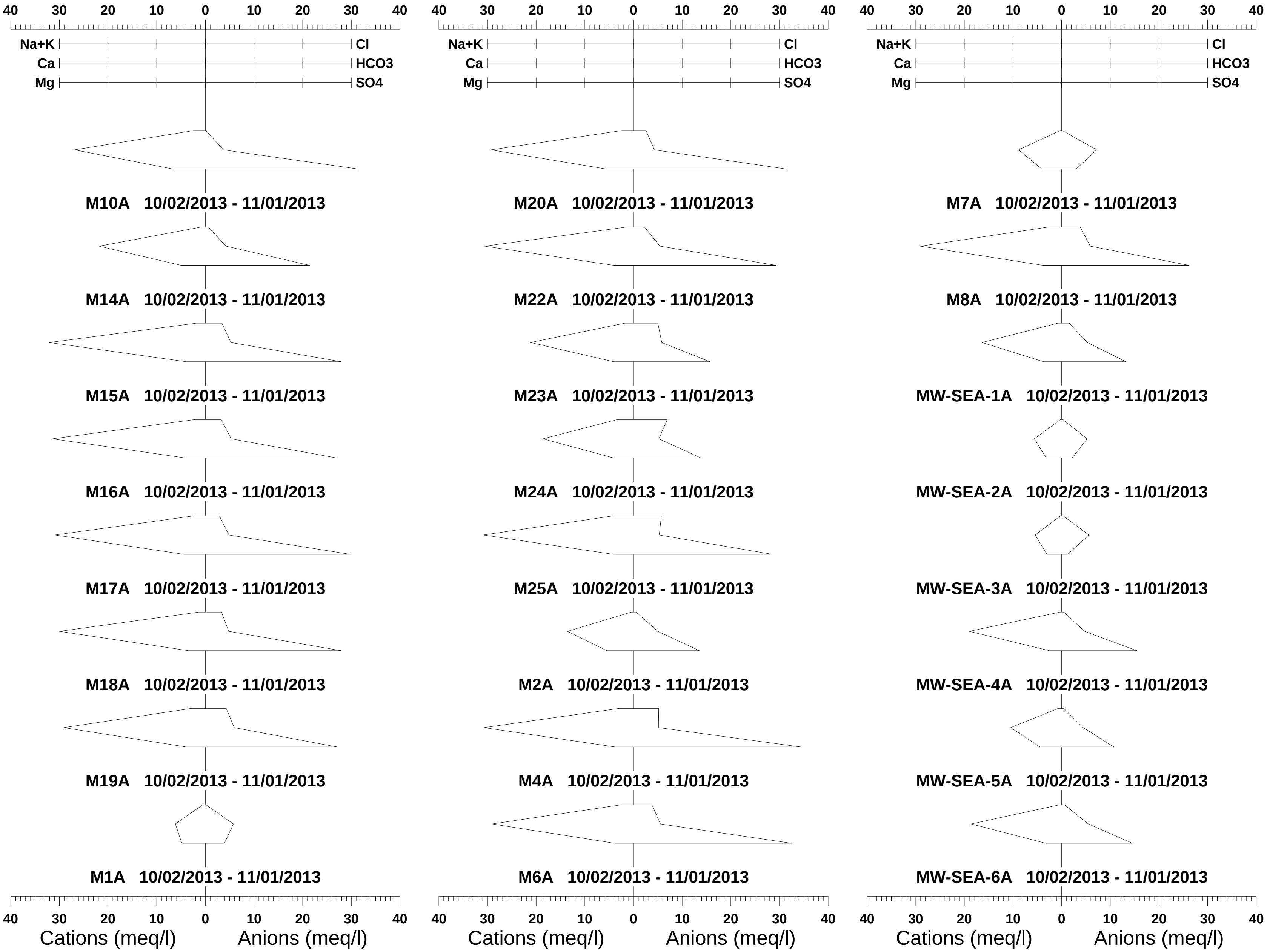
Mill Seat Landfill

◎	M10A	10/02/2013 -11/01/2013
◉	M14A	10/02/2013 -11/01/2013
●	M15A	10/02/2013 -11/01/2013
□	M16A	10/02/2013 -11/01/2013
▣	M17A	10/02/2013 -11/01/2013
△	M18A	10/02/2013 -11/01/2013
△	M19A	10/02/2013 -11/01/2013
△	M1A	10/02/2013 -11/01/2013
▲	M20A	10/02/2013 -11/01/2013
▽	M22A	10/02/2013 -11/01/2013
▽	M23A	10/02/2013 -11/01/2013
▼	M24A	10/02/2013 -11/01/2013
◇	M25A	10/02/2013 -11/01/2013
◇	M2A	10/02/2013 -11/01/2013
◆	M4A	10/02/2013 -11/01/2013
▬	M6A	10/02/2013 -11/01/2013
◨	M7A	10/02/2013 -11/01/2013
▬	M8A	10/02/2013 -11/01/2013
◧	MW-SEA-1A	10/02/2013 -11/01/2013
◮	MW-SEA-2A	10/02/2013 -11/01/2013
◭	MW-SEA-3A	10/02/2013 -11/01/2013
▼	MW-SEA-4A	10/02/2013 -11/01/2013
▼	MW-SEA-5A	10/02/2013 -11/01/2013
◆	MW-SEA-6A	10/02/2013 -11/01/2013



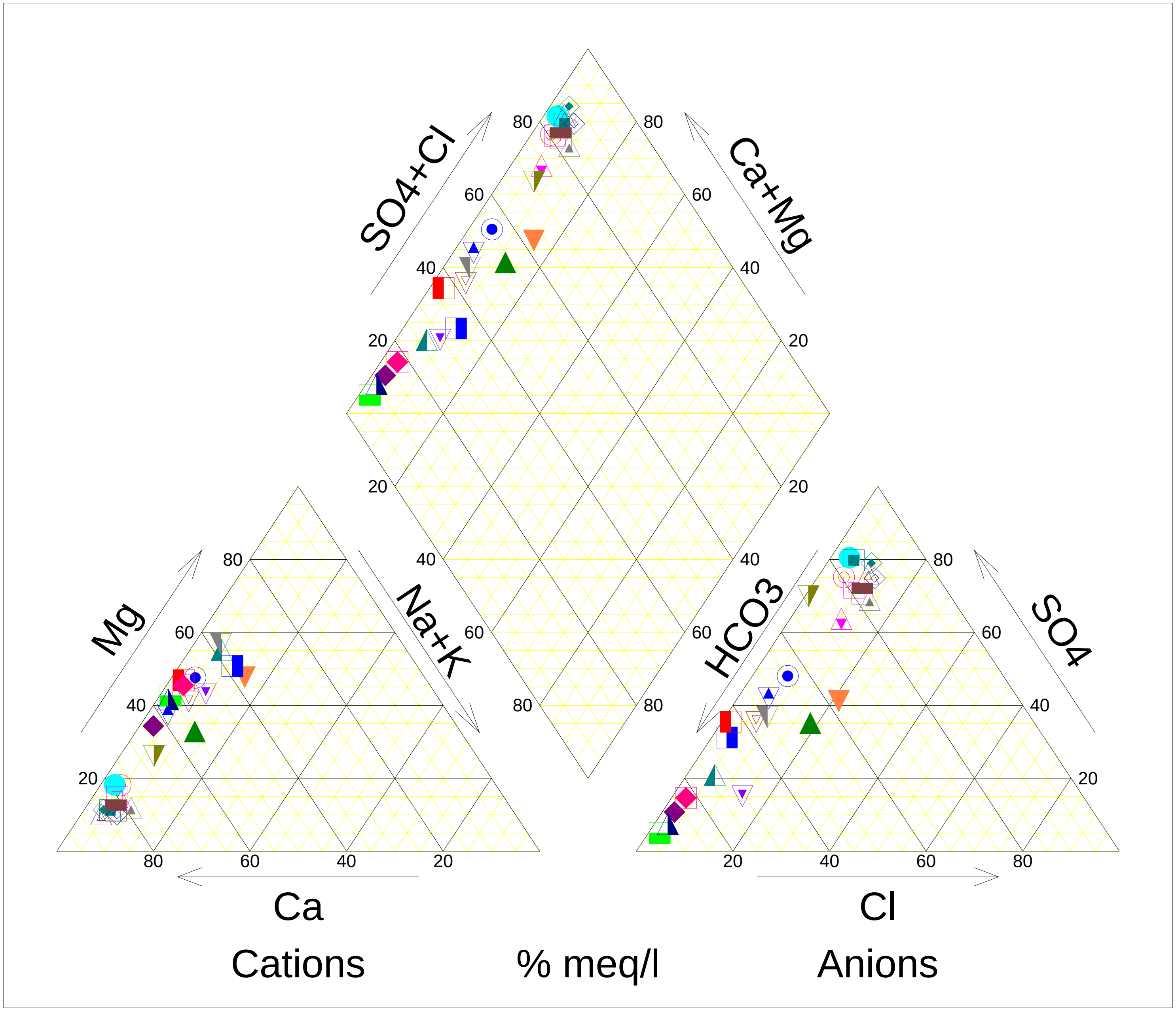
Prepared by: Otter Creek Environmental

Mill Seat Landfill



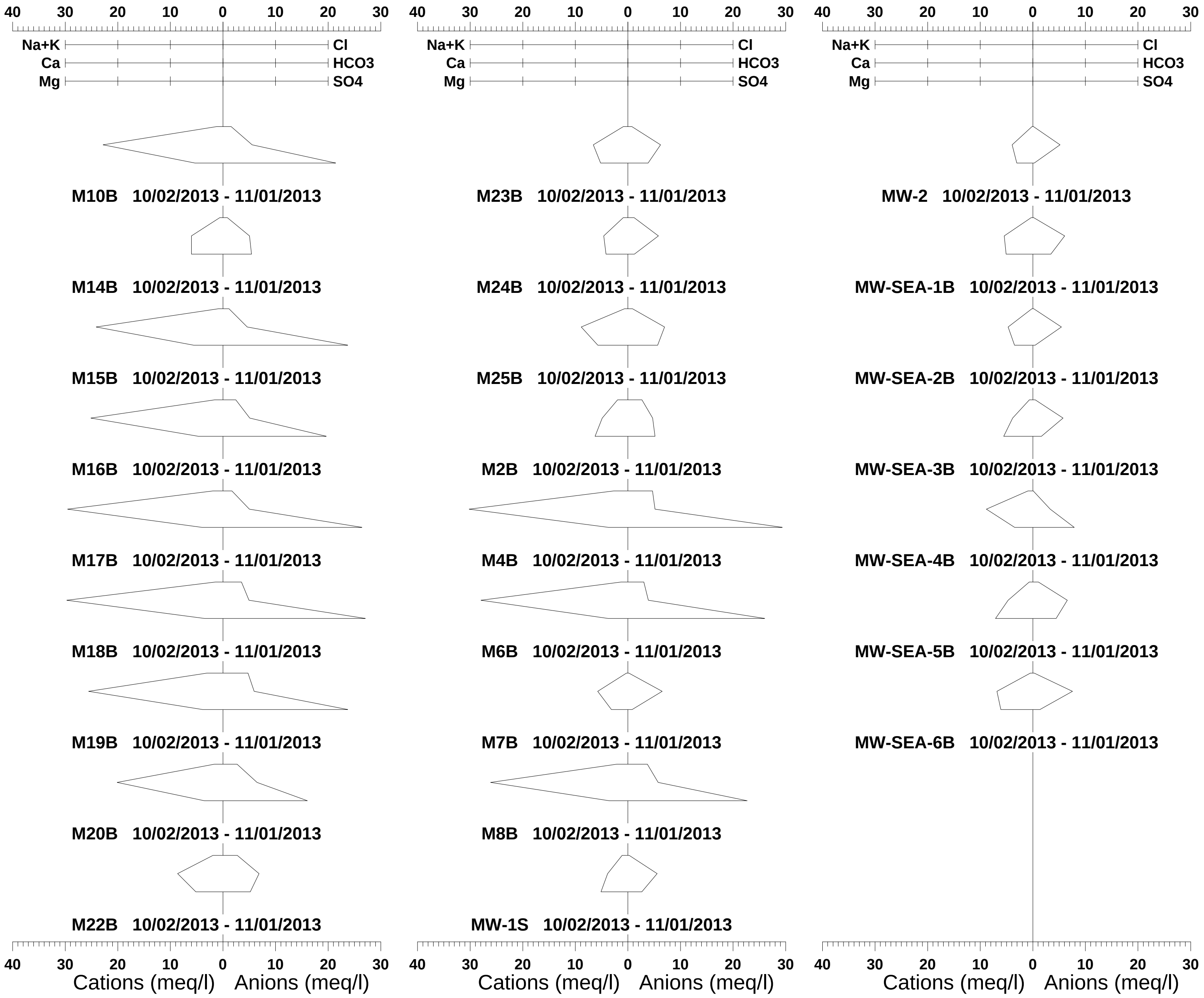
Mill Seat Landfill

M10B	10/02/2013 -11/01/2013
M14B	10/02/2013 -11/01/2013
M15B	10/02/2013 -11/01/2013
M16B	10/02/2013 -11/01/2013
M17B	10/02/2013 -11/01/2013
M18B	10/02/2013 -11/01/2013
M19B	10/02/2013 -11/01/2013
M20B	10/02/2013 -11/01/2013
M22B	10/02/2013 -11/01/2013
M23B	10/02/2013 -11/01/2013
M24B	10/02/2013 -11/01/2013
M25B	10/02/2013 -11/01/2013
M2B	10/02/2013 -11/01/2013
M4B	10/02/2013 -11/01/2013
M6B	10/02/2013 -11/01/2013
M7B	10/02/2013 -11/01/2013
M8B	10/02/2013 -11/01/2013
MW-1S	10/02/2013 -11/01/2013
MW-2	10/02/2013 -11/01/2013
MW-SEA-1B	10/02/2013 -11/01/2013
MW-SEA-2B	10/02/2013 -11/01/2013
MW-SEA-3B	10/02/2013 -11/01/2013
MW-SEA-4B	10/02/2013 -11/01/2013
MW-SEA-5B	10/02/2013 -11/01/2013
MW-SEA-6B	10/02/2013 -11/01/2013



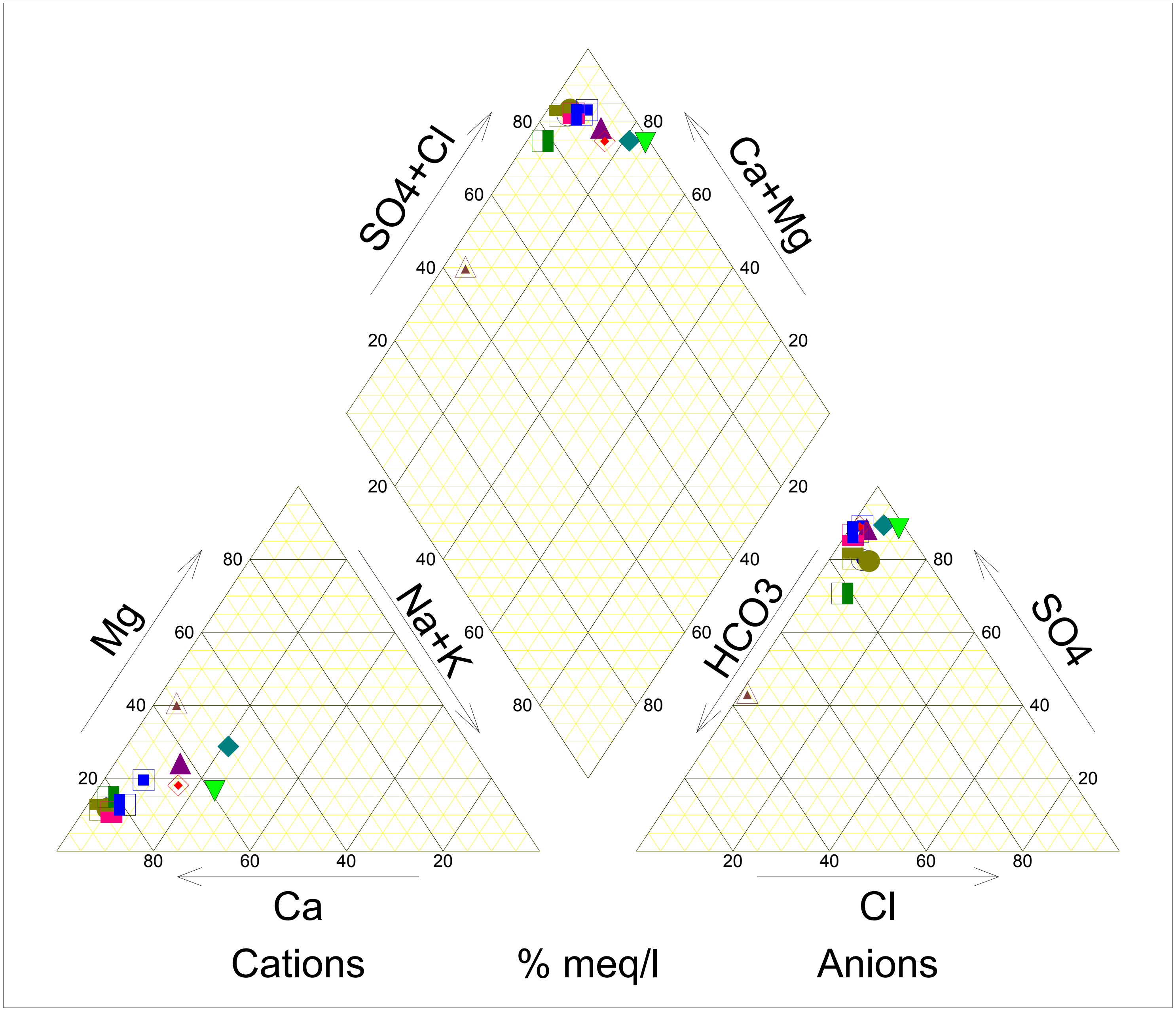
Prepared by: Otter Creek Environmental

Mill Seat Landfill



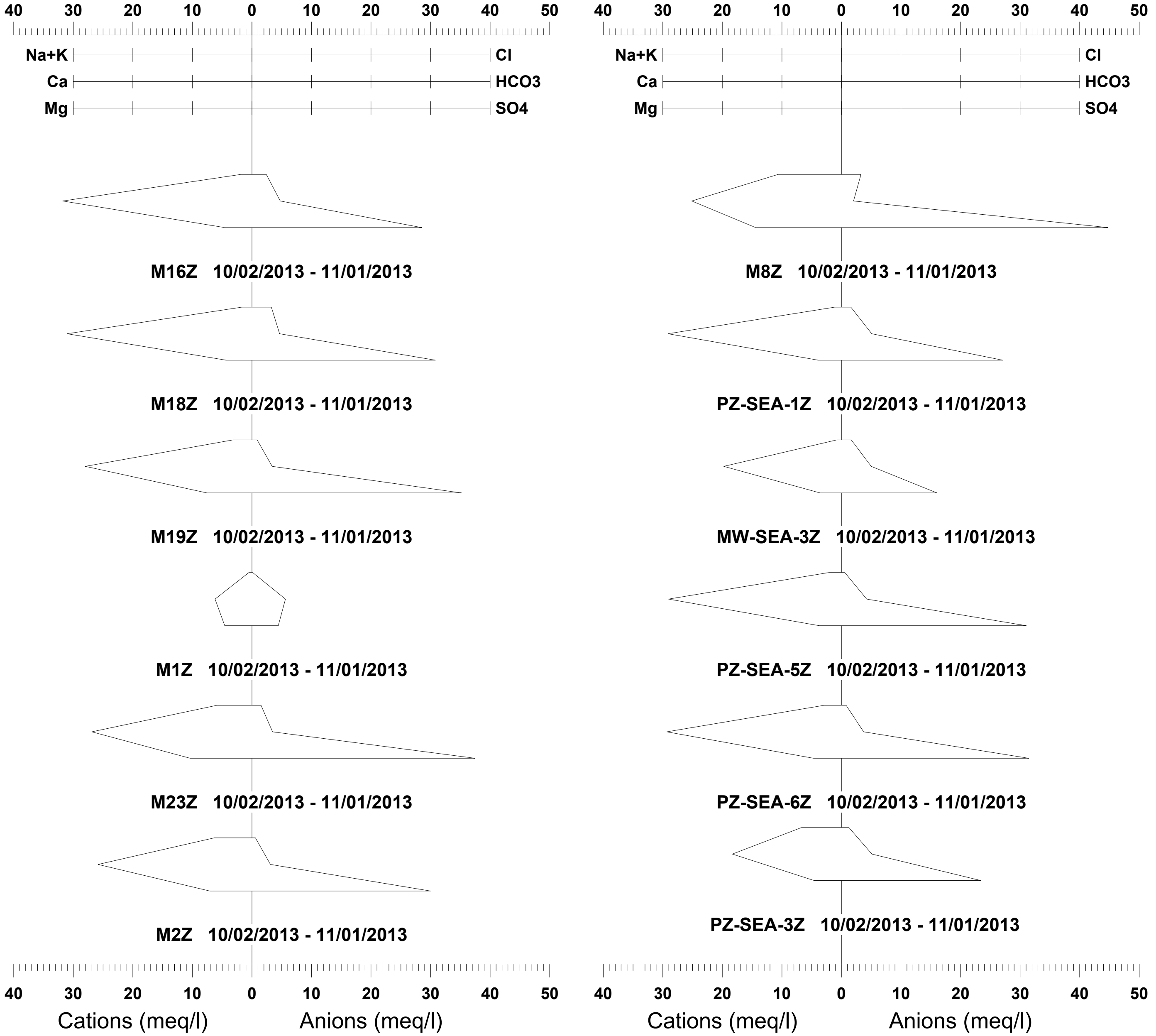
Mill Seat Landfill

◉	M16Z	10/02/2013 -11/01/2013
●	M18Z	10/02/2013 -11/01/2013
▣	M19Z	10/02/2013 -11/01/2013
△	M1Z	10/02/2013 -11/01/2013
▲	M23Z	10/02/2013 -11/01/2013
◇	M2Z	10/02/2013 -11/01/2013
◆	M8Z	10/02/2013 -11/01/2013
⬒	PZ-SEA-1Z	10/02/2013 -11/01/2013
◨	MW-SEA-3Z	10/02/2013 -11/01/2013
⬓	PZ-SEA-5Z	10/02/2013 -11/01/2013
◧	PZ-SEA-6Z	10/02/2013 -11/01/2013
▼	PZ-SEA-3Z	10/02/2013 -11/01/2013



Prepared by: Otter Creek Environmental

Mill Seat Landfill



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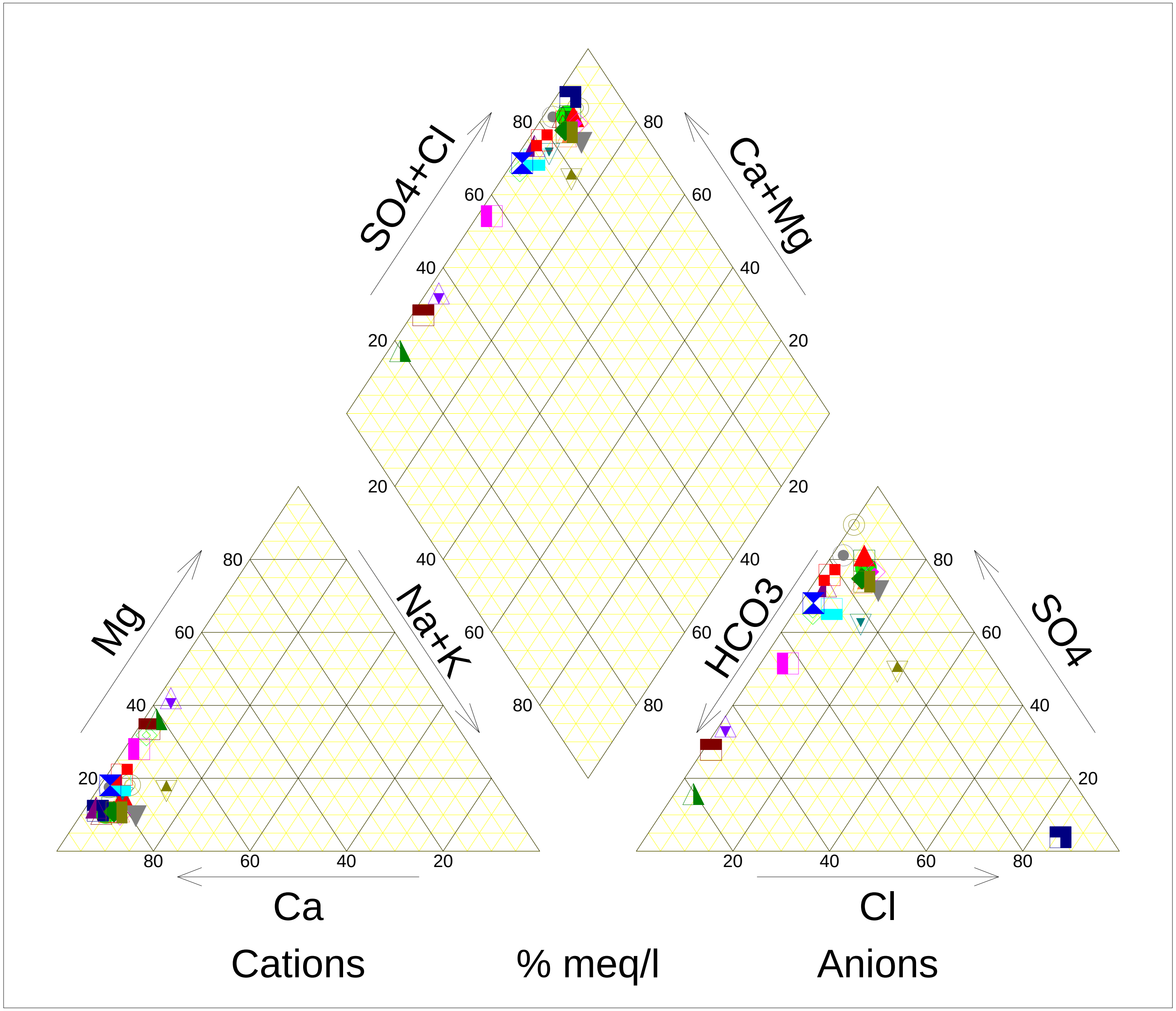
Mill Seat Landfill

◎	M10A	4/01/2014 - 4/25/2014
⊙	M14A	4/01/2014 - 4/25/2014
●	M15A	4/01/2014 - 4/25/2014
▫	M16A	4/01/2014 - 4/25/2014
▣	M17A	4/01/2014 - 4/25/2014
△	M18A	4/01/2014 - 4/25/2014
△	M19A	4/01/2014 - 4/25/2014
△	M1A	4/01/2014 - 4/25/2014
▲	M20A	4/01/2014 - 4/25/2014
■	M22A	4/01/2014 - 4/25/2014
▽	M23A	4/01/2014 - 4/25/2014
▽	M24A	4/01/2014 - 4/25/2014
▼	M25A	4/01/2014 - 4/25/2014
◇	M2A	4/01/2014 - 4/25/2014
◇	M4A	4/01/2014 - 4/25/2014
◆	M6A	4/01/2014 - 4/25/2014
■	M7A	4/01/2014 - 4/25/2014
■	M8A	4/01/2014 - 4/25/2014
■	MW-SEA-1A	4/01/2014 - 4/25/2014
■	MW-SEA-2A	4/01/2014 - 4/25/2014
▲	MW-SEA-3A	4/01/2014 - 4/25/2014
▲	MW-SEA-4A	4/01/2014 - 4/25/2014
■	MW-SEA-5A	4/01/2014 - 4/25/2014
⧗	MW-SEA-6A	4/01/2014 - 4/25/2014



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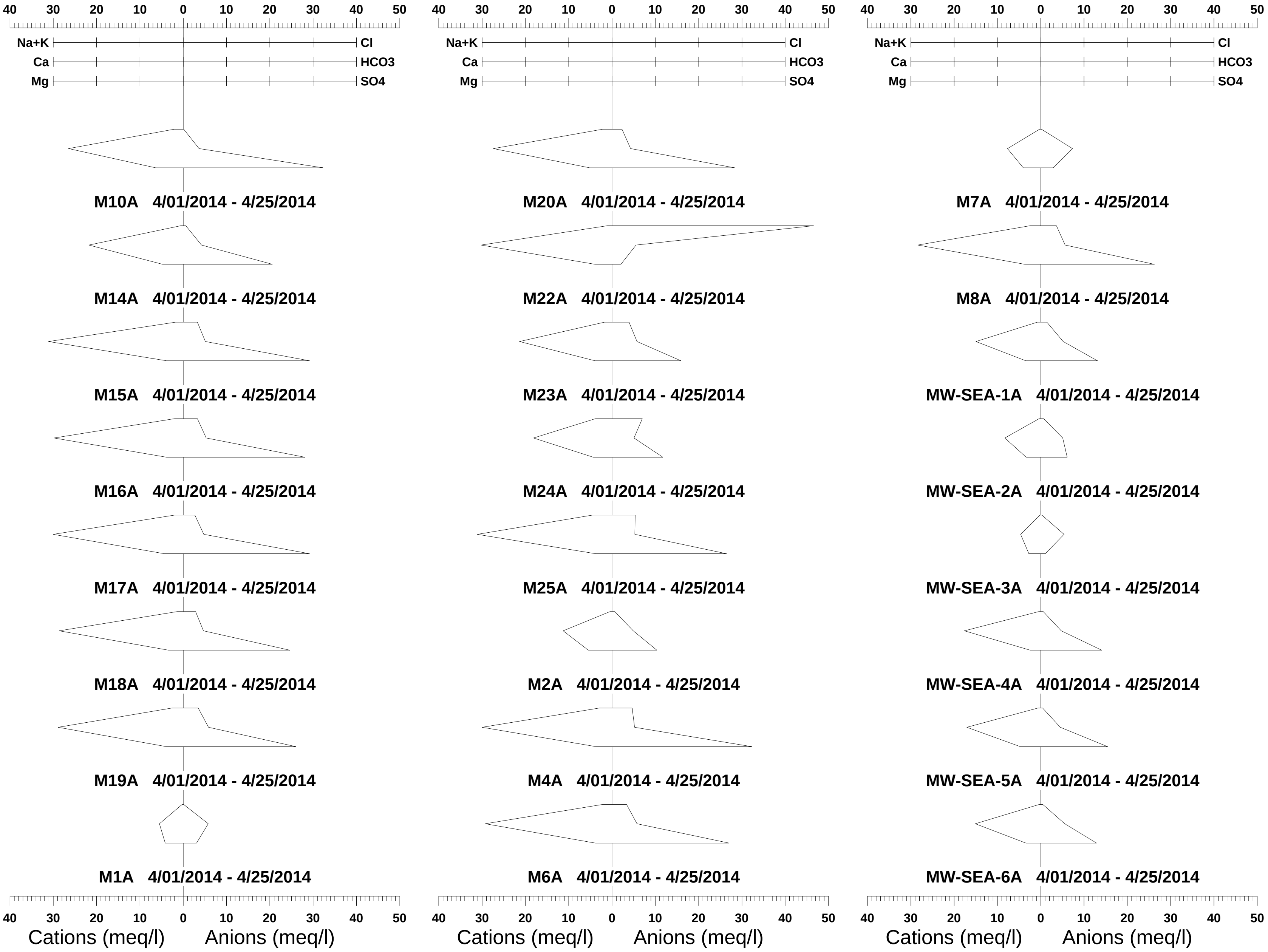
Mill Seat Landfill



Prepared by: Otter Creek Environmental

Mill Seat Landfill

◎	M10B	4/01/2014 - 4/25/2014
◉	M14B	4/01/2014 - 4/25/2014
●	M15B	4/01/2014 - 4/25/2014
▢	M16B	4/01/2014 - 4/25/2014
▣	M17B	4/01/2014 - 4/25/2014
△	M18B	4/01/2014 - 4/25/2014
△	M19B	4/01/2014 - 4/25/2014
▲	M20B	4/01/2014 - 4/25/2014
▲	M22B	4/01/2014 - 4/25/2014
▽	M23B	4/01/2014 - 4/25/2014
▽	M24B	4/01/2014 - 4/25/2014
▲	M25B	4/01/2014 - 4/25/2014
▼	M2B	4/01/2014 - 4/25/2014
◇	M4B	4/01/2014 - 4/25/2014
◈	M6B	4/01/2014 - 4/25/2014
◆	M7B	4/01/2014 - 4/25/2014
⬒	M8B	4/01/2014 - 4/25/2014
◨	MW-1S	4/01/2014 - 4/25/2014
⬓	MW-2	4/01/2014 - 4/25/2014
◧	MW-SEA-1B	4/01/2014 - 4/25/2014
◭	MW-SEA-2B	4/01/2014 - 4/25/2014
◭	MW-SEA-3B	4/01/2014 - 4/25/2014
▼	MW-SEA-4B	4/01/2014 - 4/25/2014
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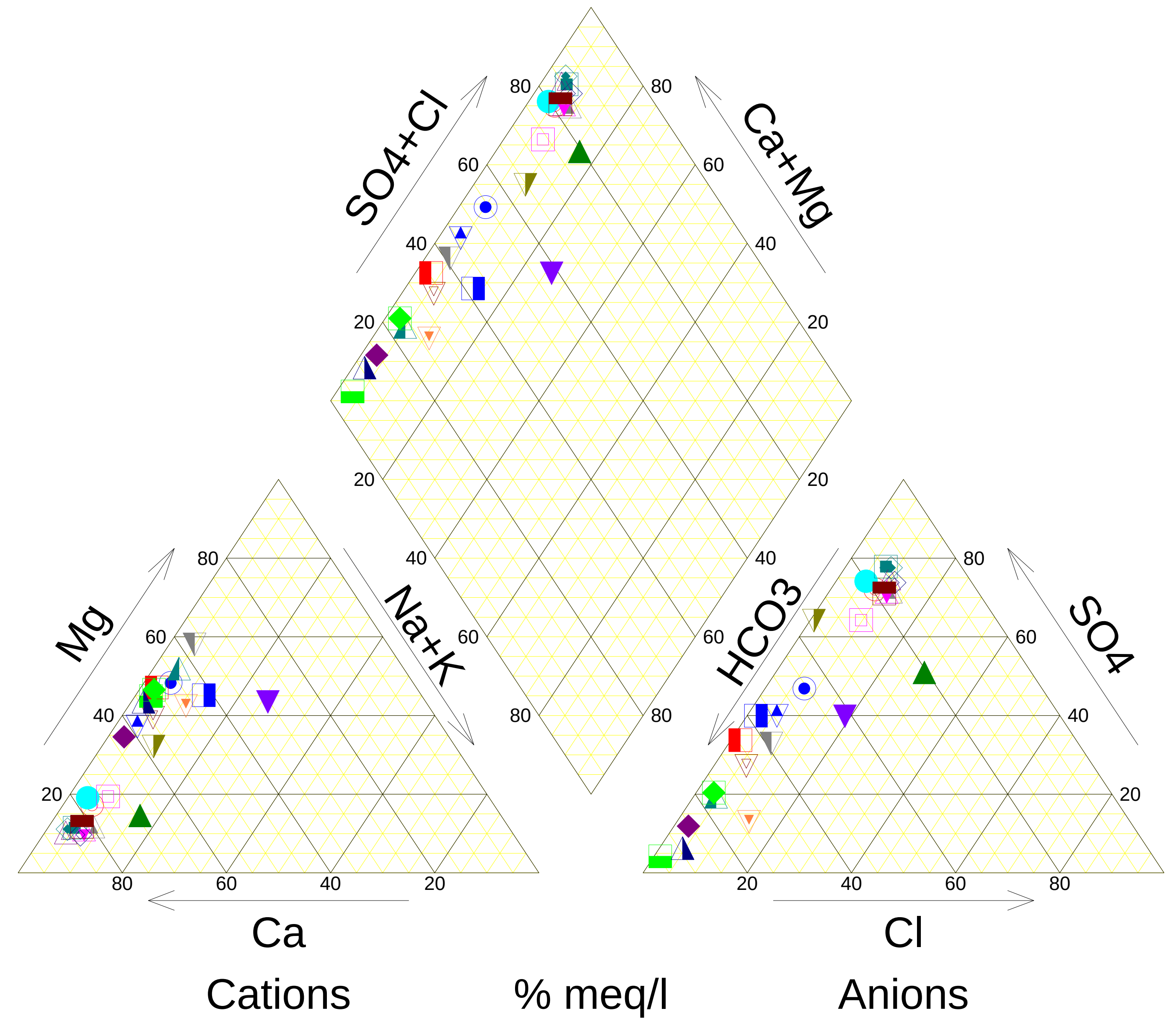
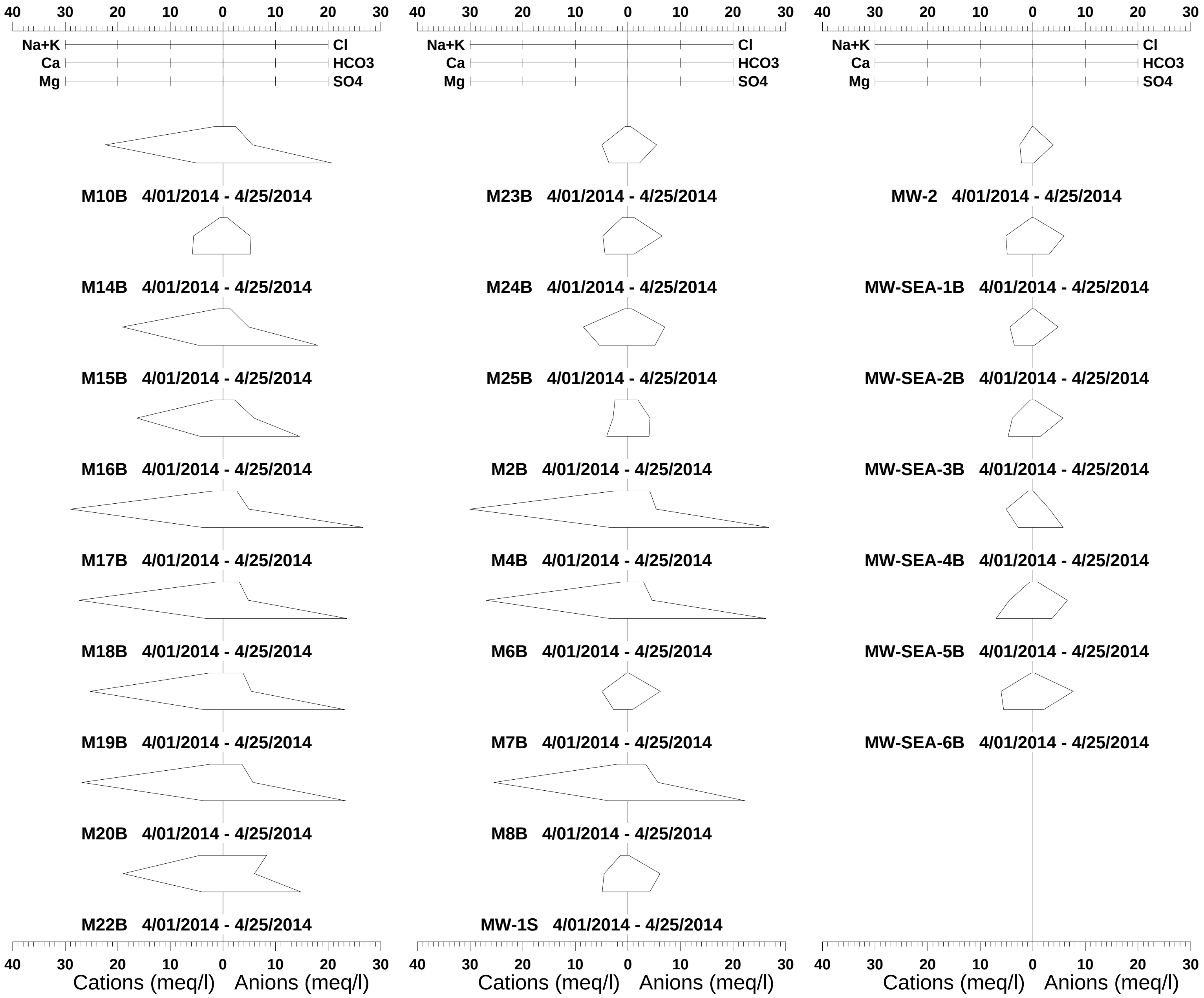


Mill Seat Landfill



Mill Seat Landfill

◉	M16Z	4/01/2014 - 4/25/2014
●	M18Z	4/01/2014 - 4/25/2014
■	M19Z	4/01/2014 - 4/25/2014
▲	M1Z	4/01/2014 - 4/25/2014
▼	M23Z	4/01/2014 - 4/25/2014
▲	M2Z	4/01/2014 - 4/25/2014
▽	M8Z	4/01/2014 - 4/25/2014
▼	MW-SEA-3Z	4/01/2014 - 4/25/2014
▼	PZ-SEA-1Z	4/01/2014 - 4/25/2014
◆	PZ-SEA-3Z	4/01/2014 - 4/25/2014
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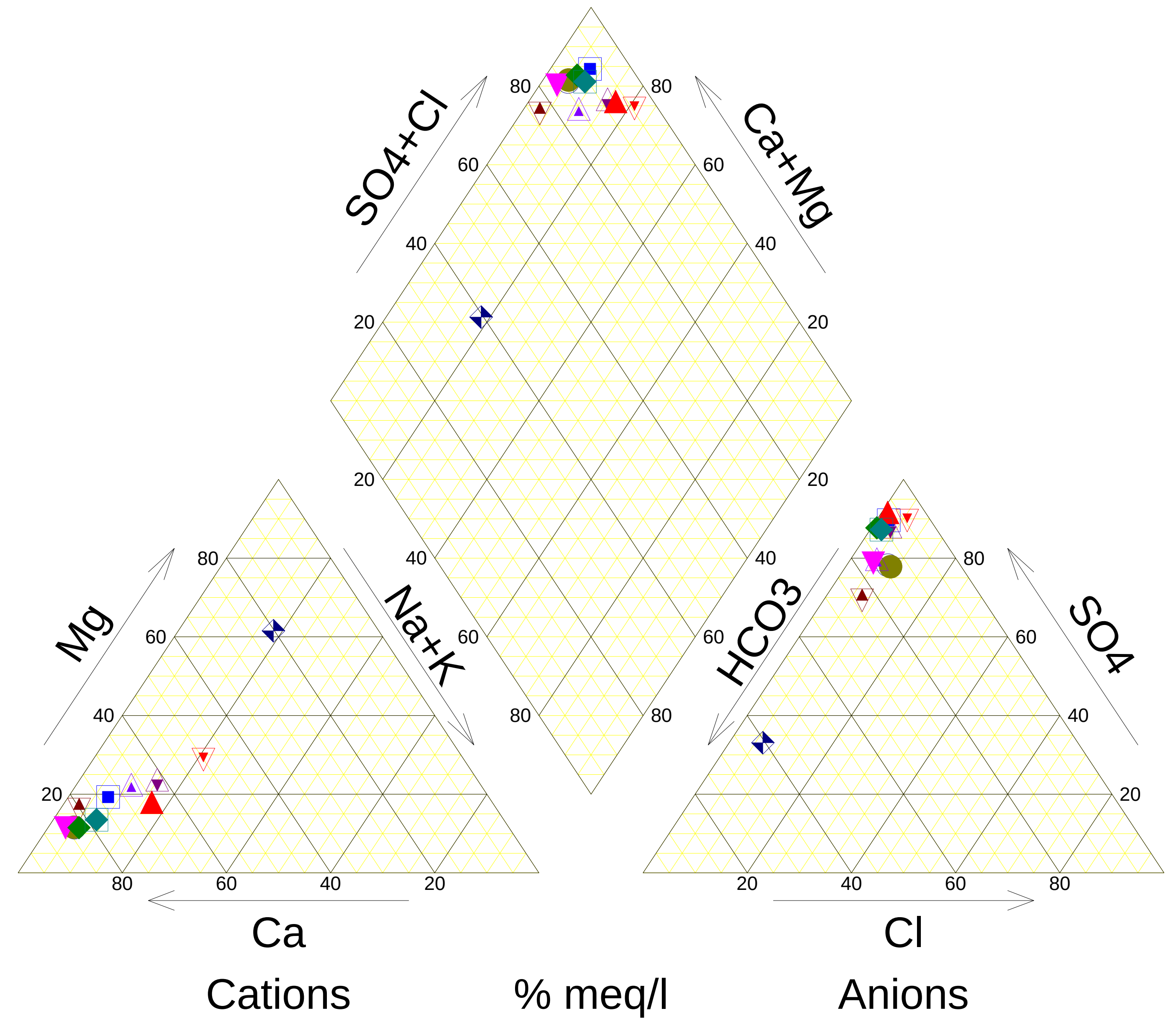
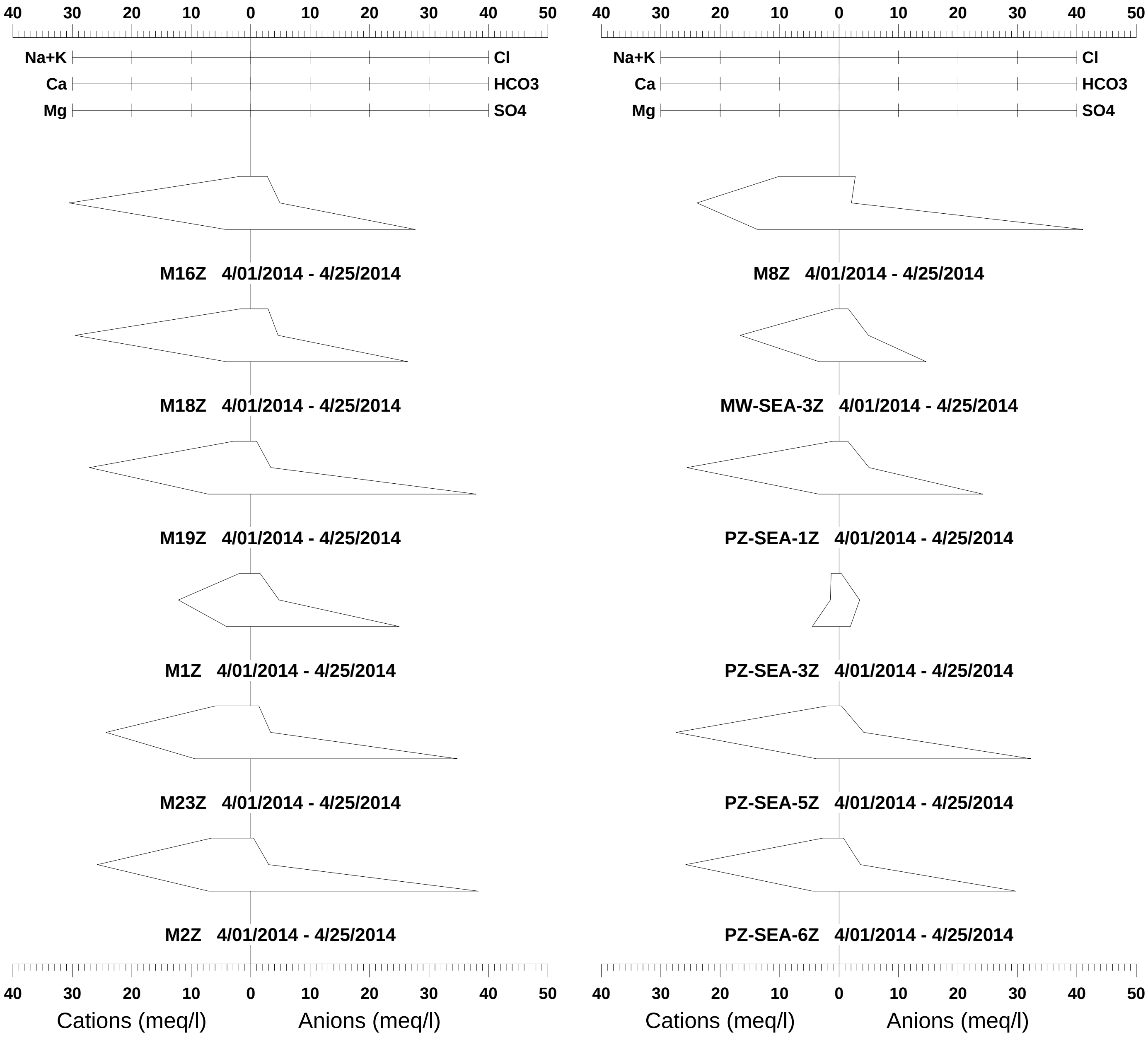


Prepared by: Otter Creek Environmental

Mill Seat Landfill



Prepared by: Otter Creek Environmental

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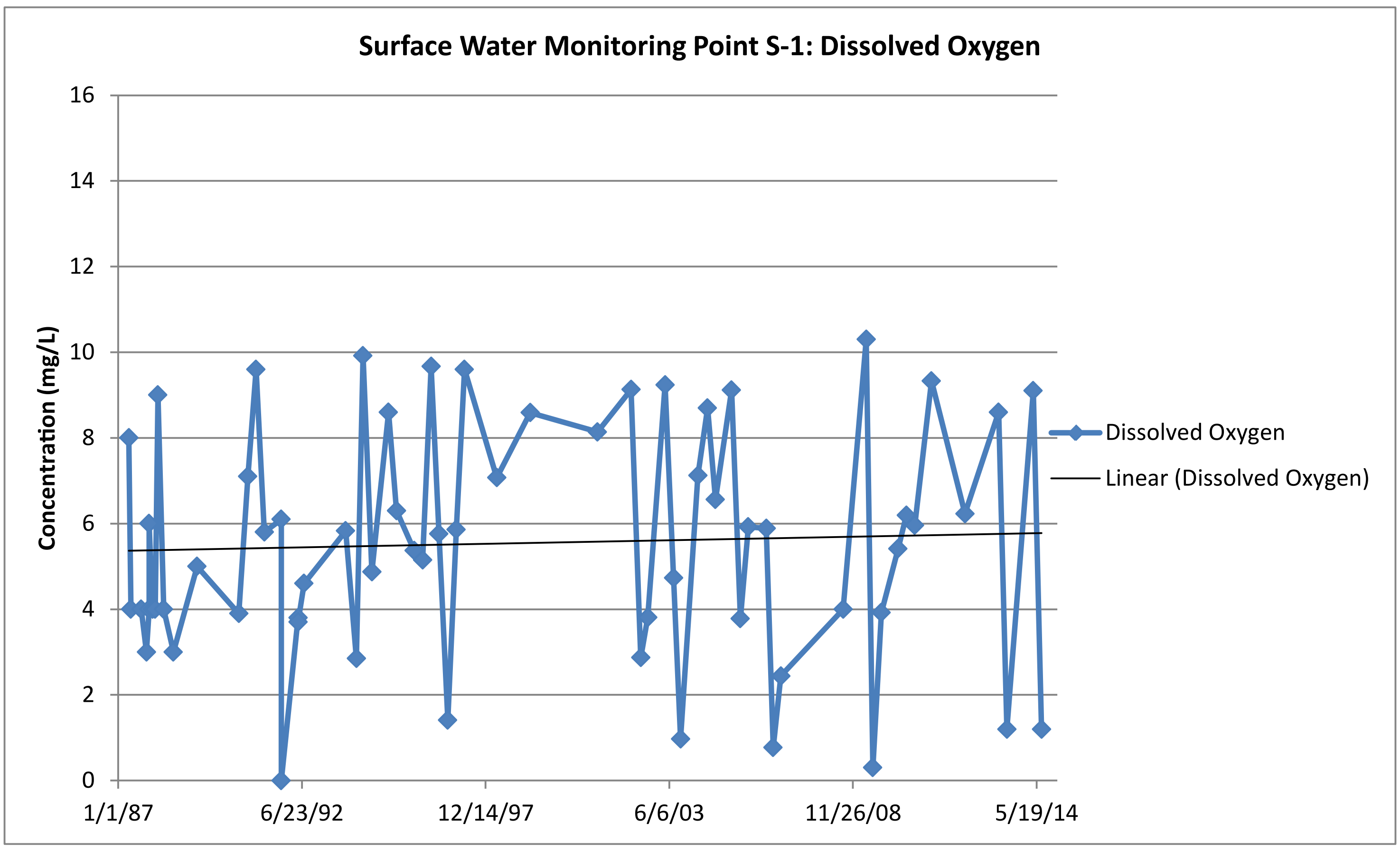
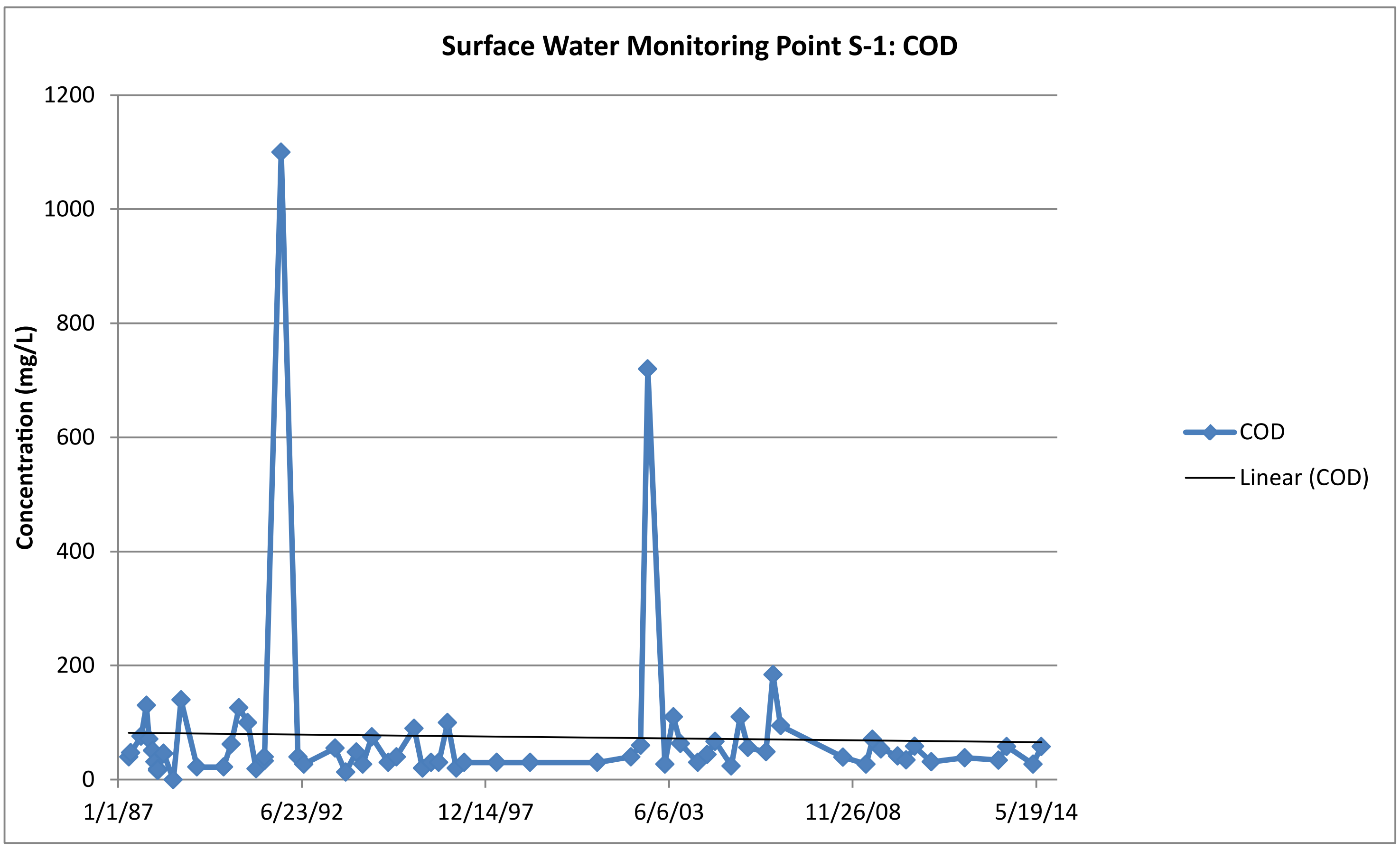
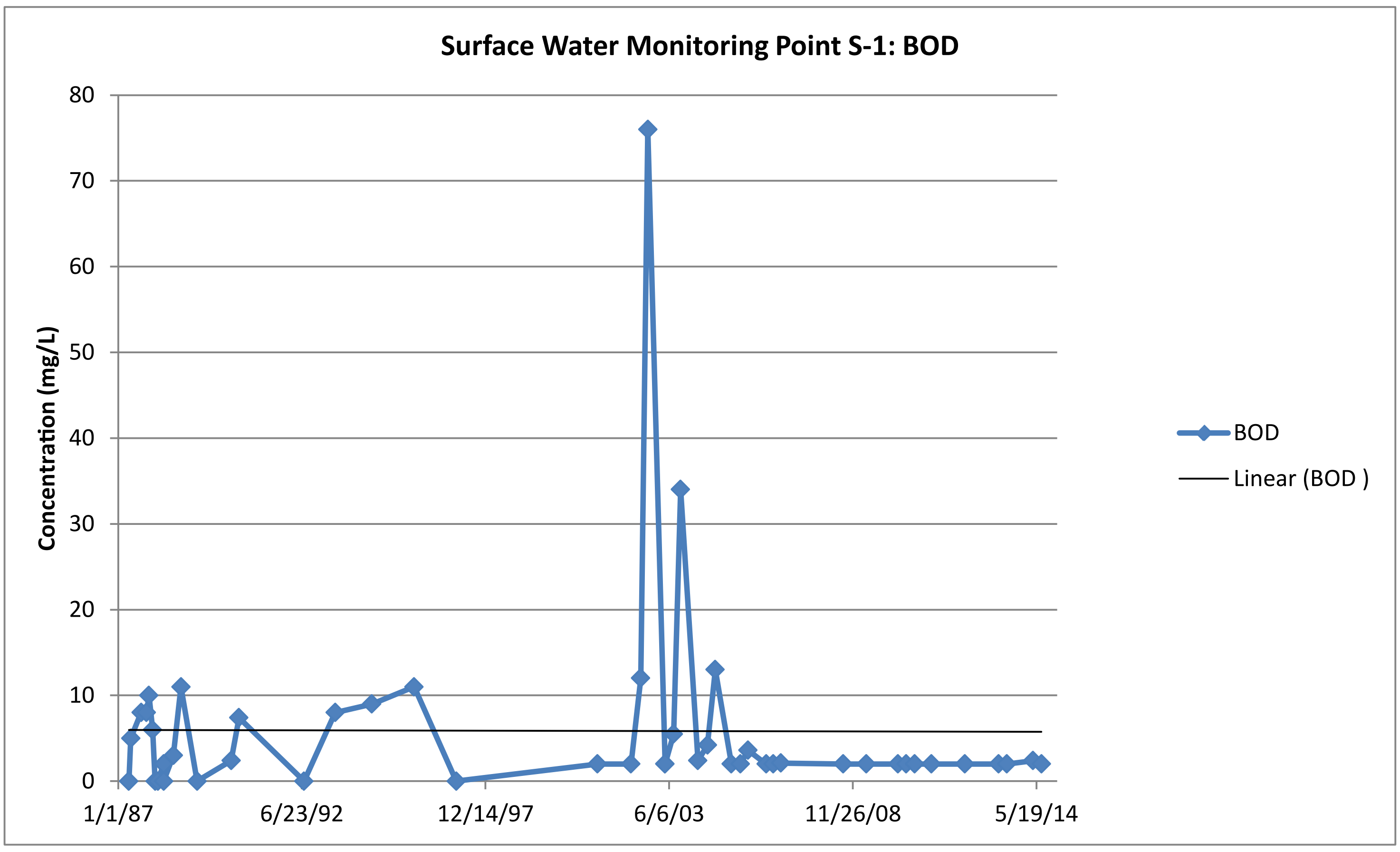
Surface Water Quality Trend Plots


Surface Water Monitoring Point S-1: Dissolved Oxygen


Surface Water Monitoring Point S-1: COD


Surface Water Monitoring Point S-1: BOD

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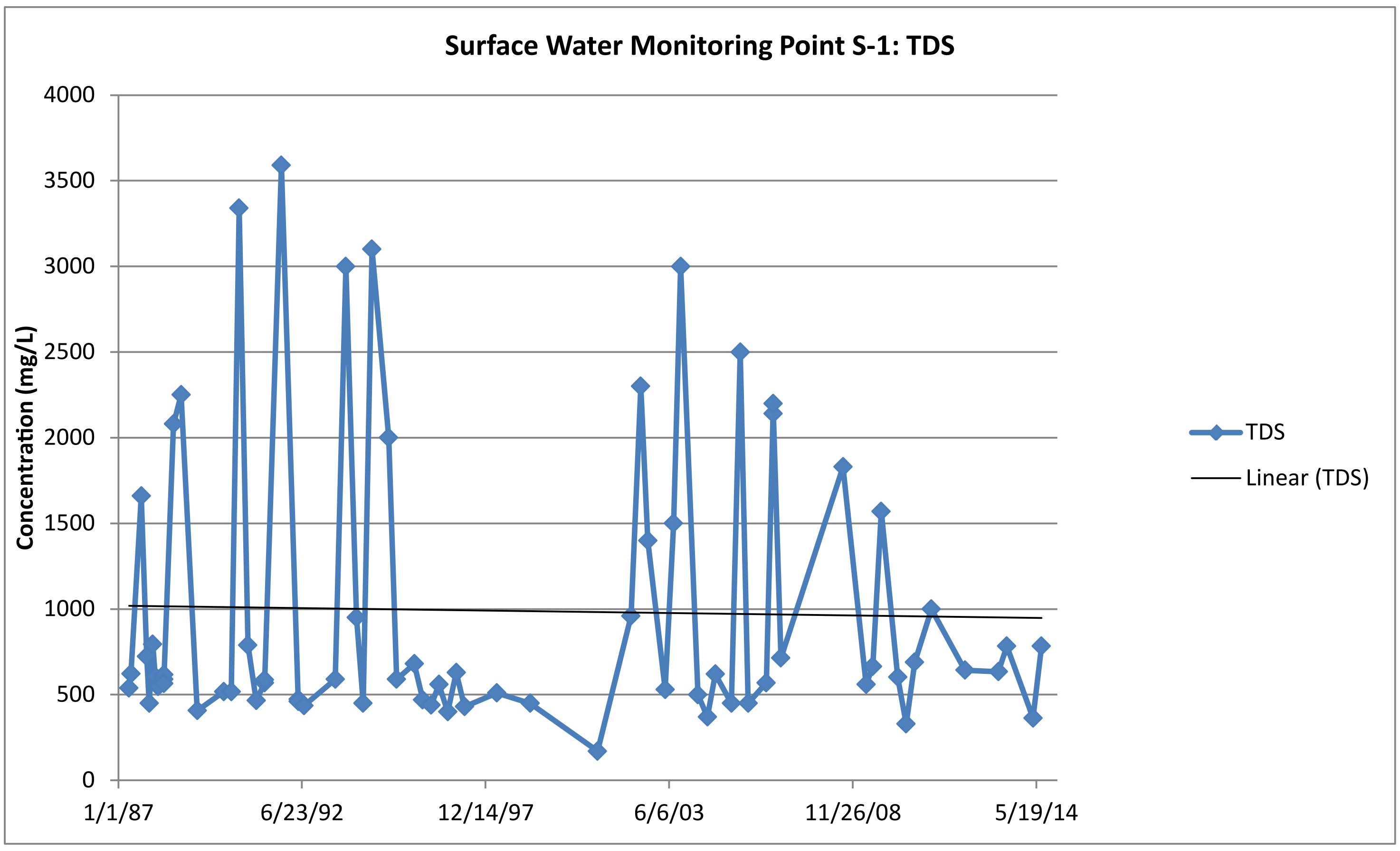

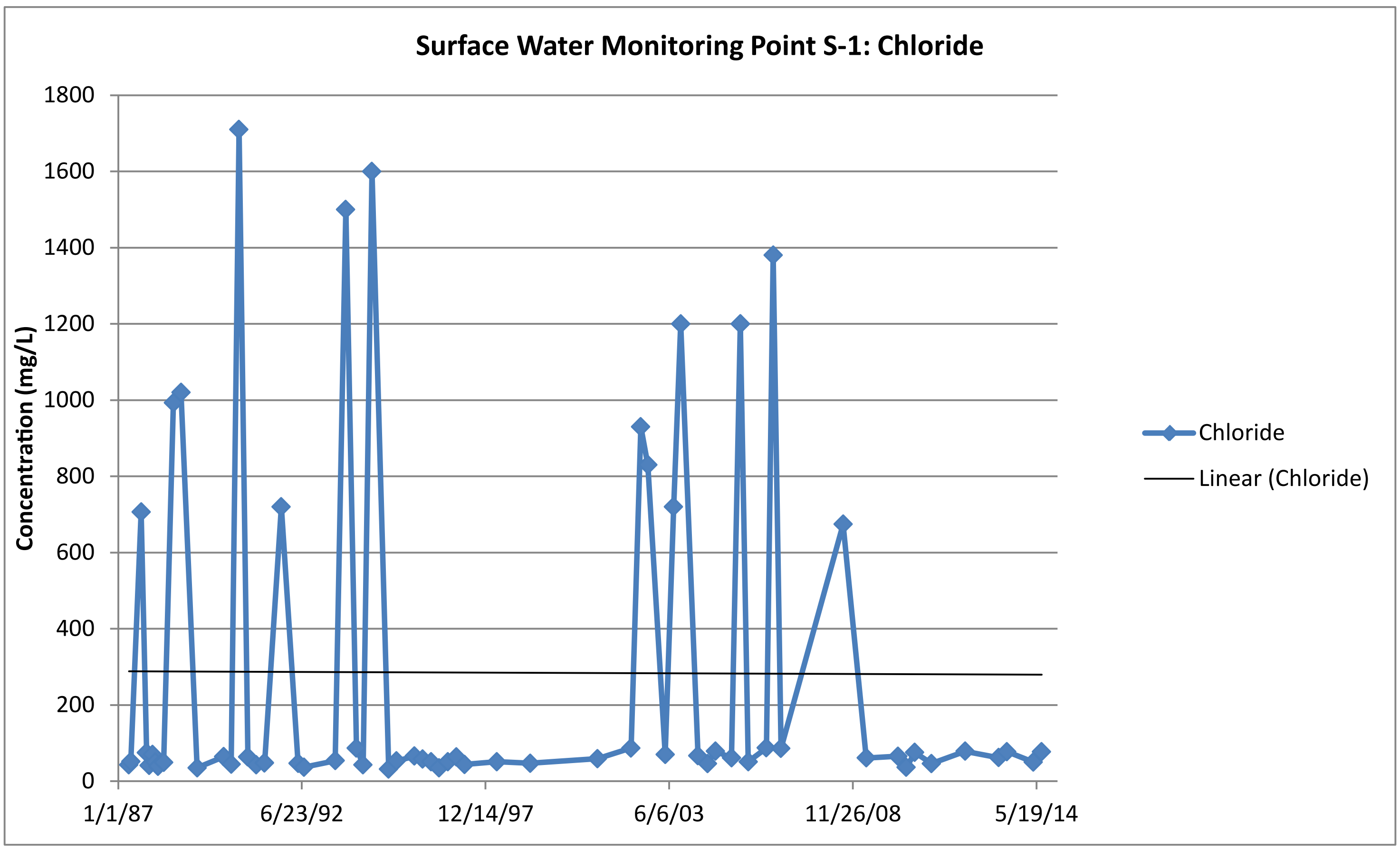

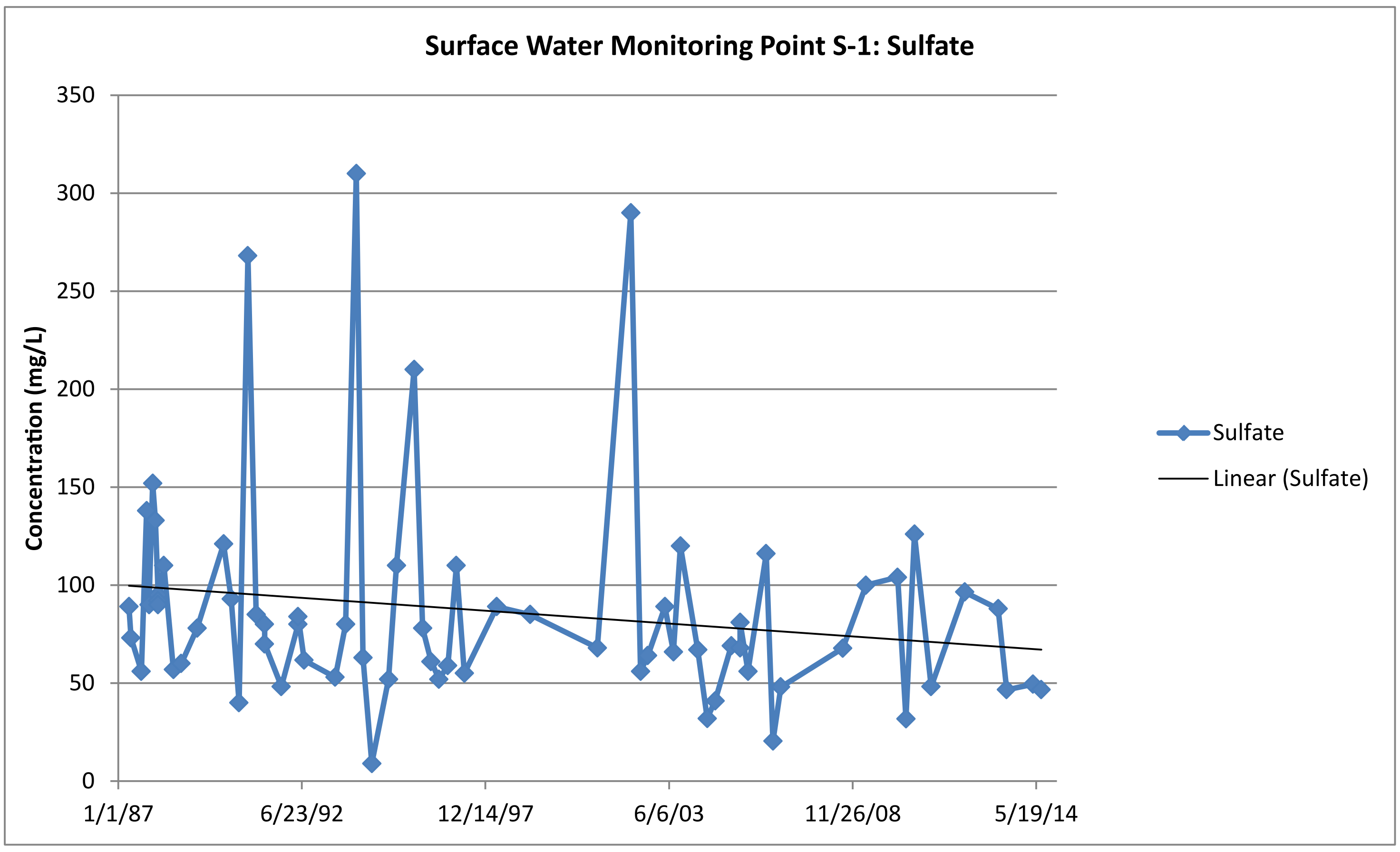

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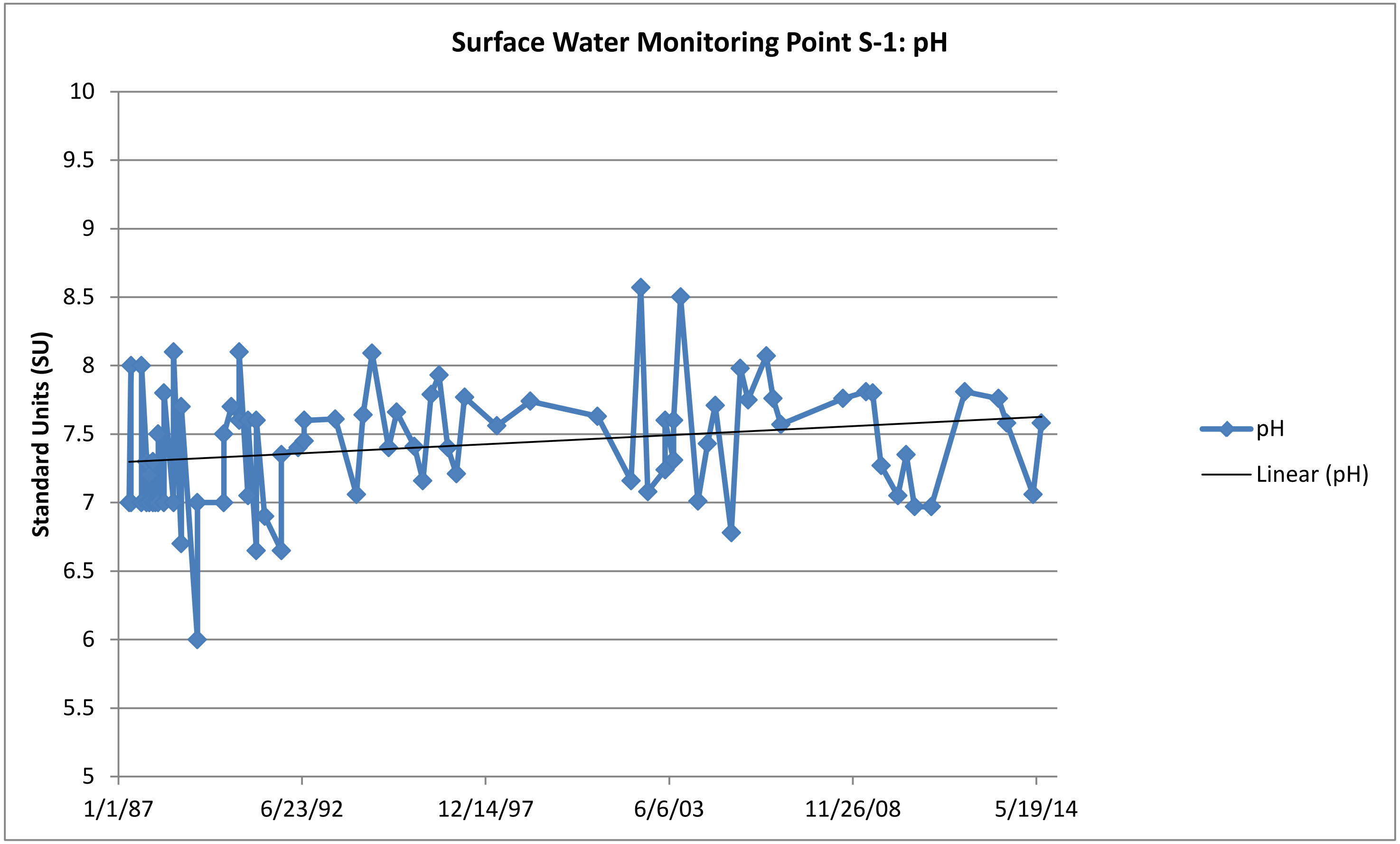

Mill Seat Landfill Proposed Landfill Expansion Hydrogeologic Investigation	GEI Consultants	**SURFACE WATER QUALITY TIME SERIES PLOT MONITORING LOCATION S-1**
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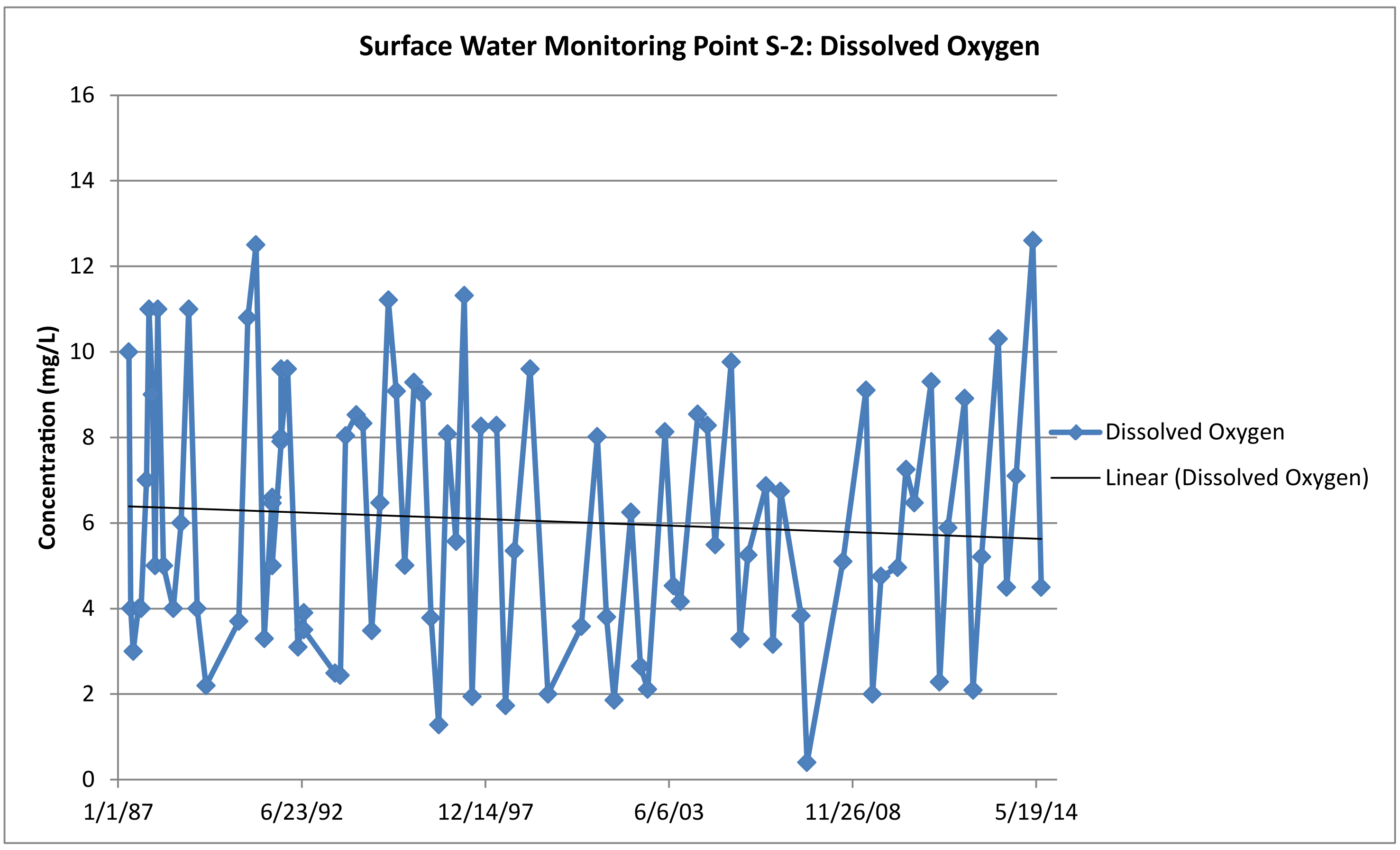

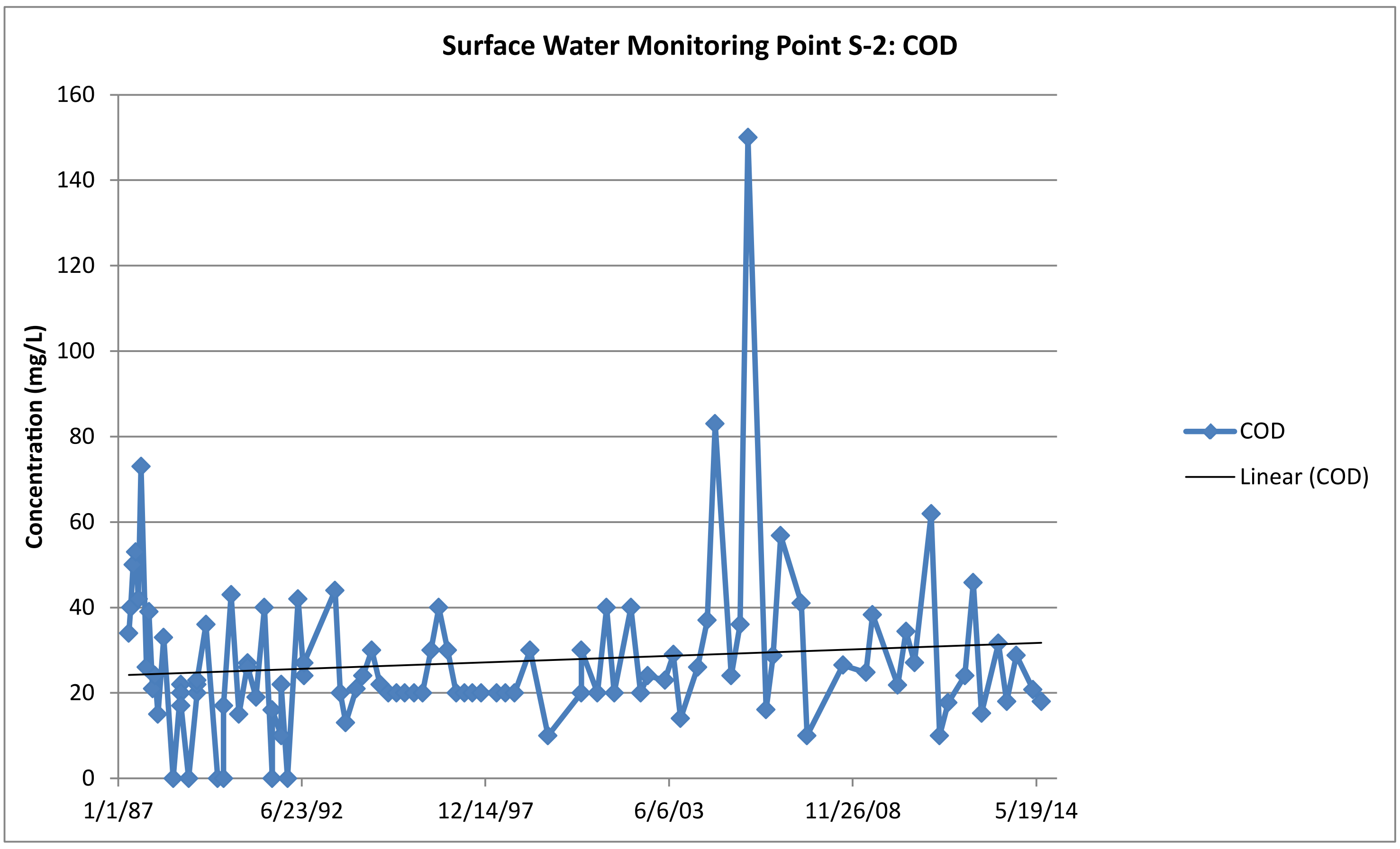

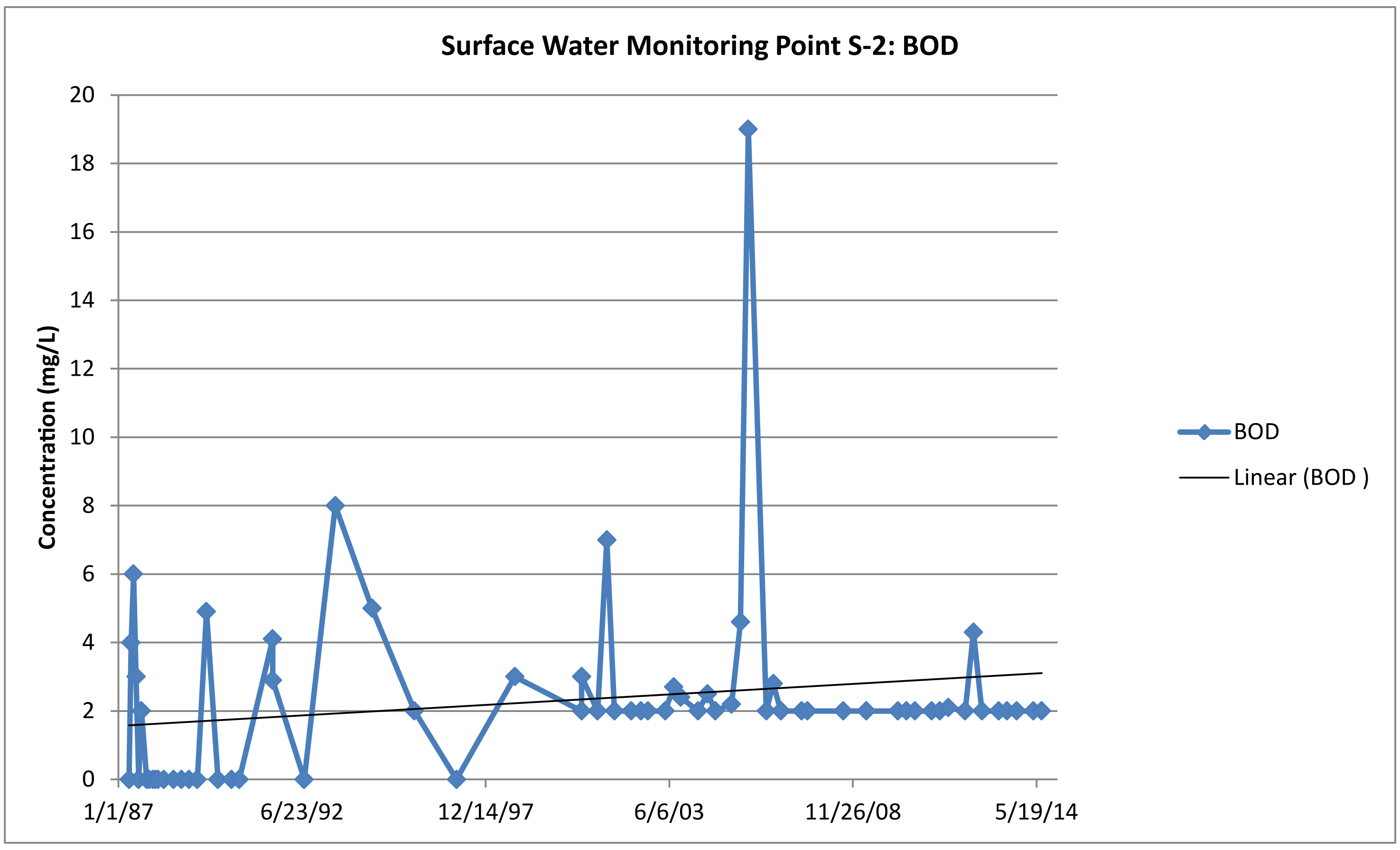

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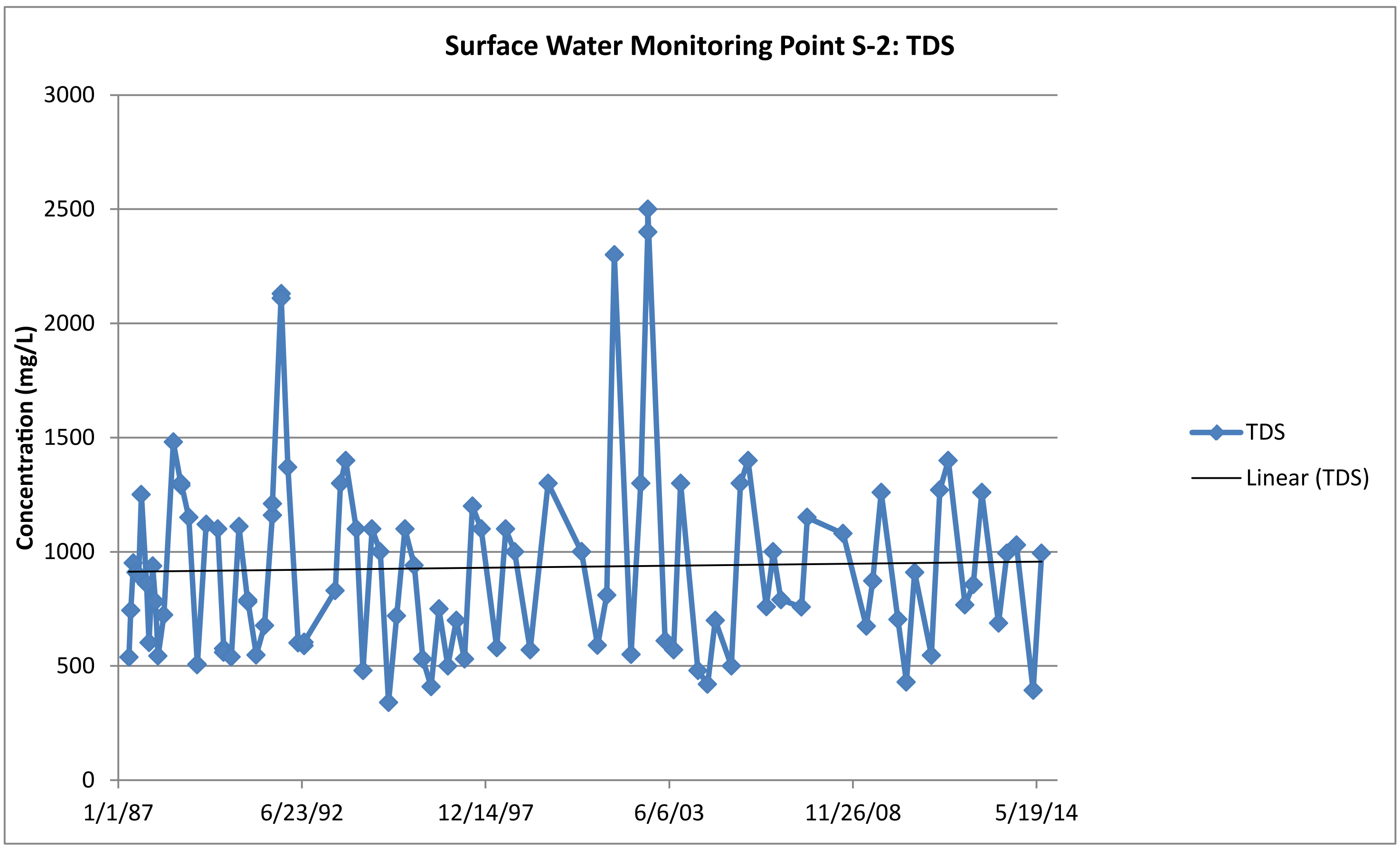

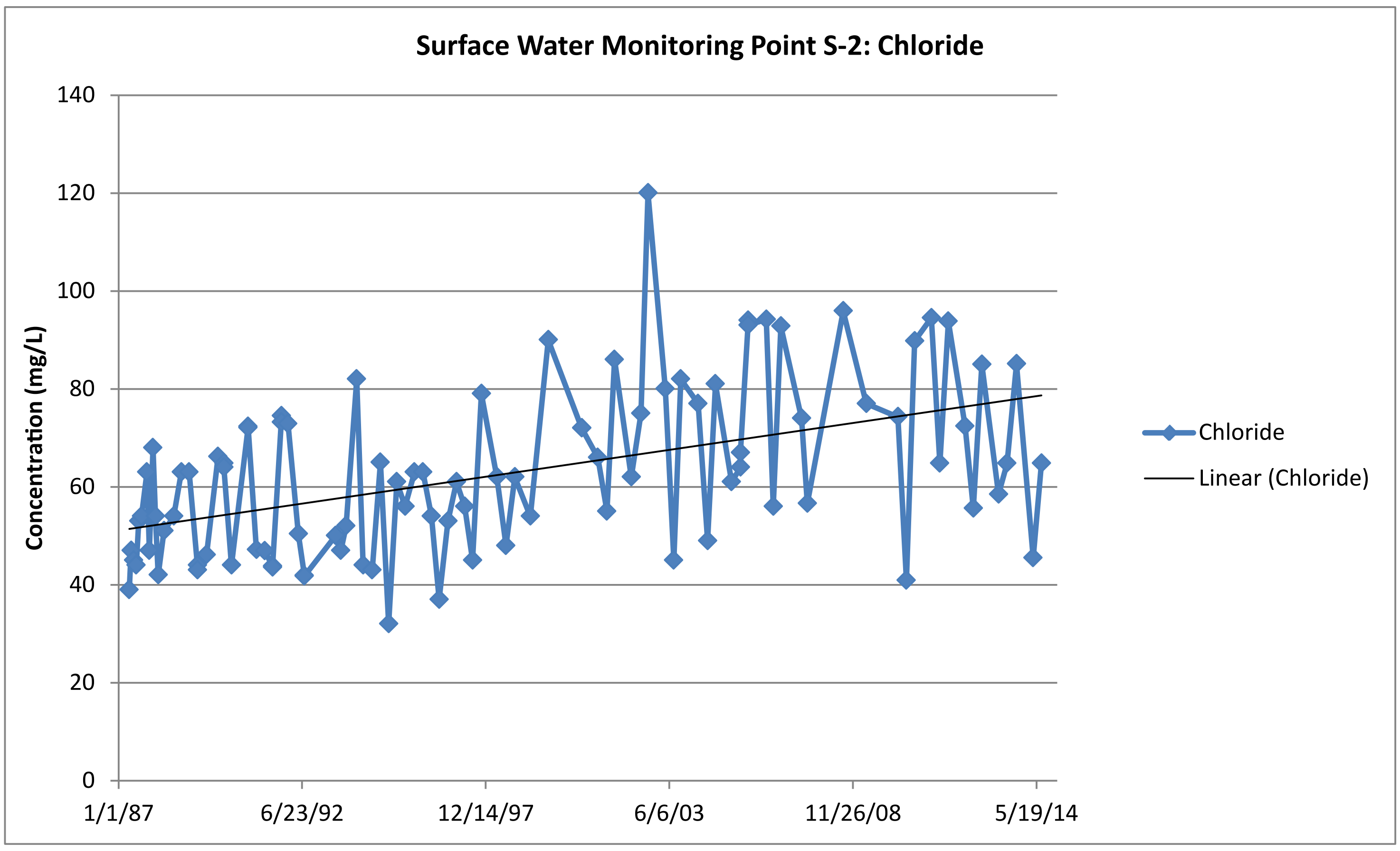

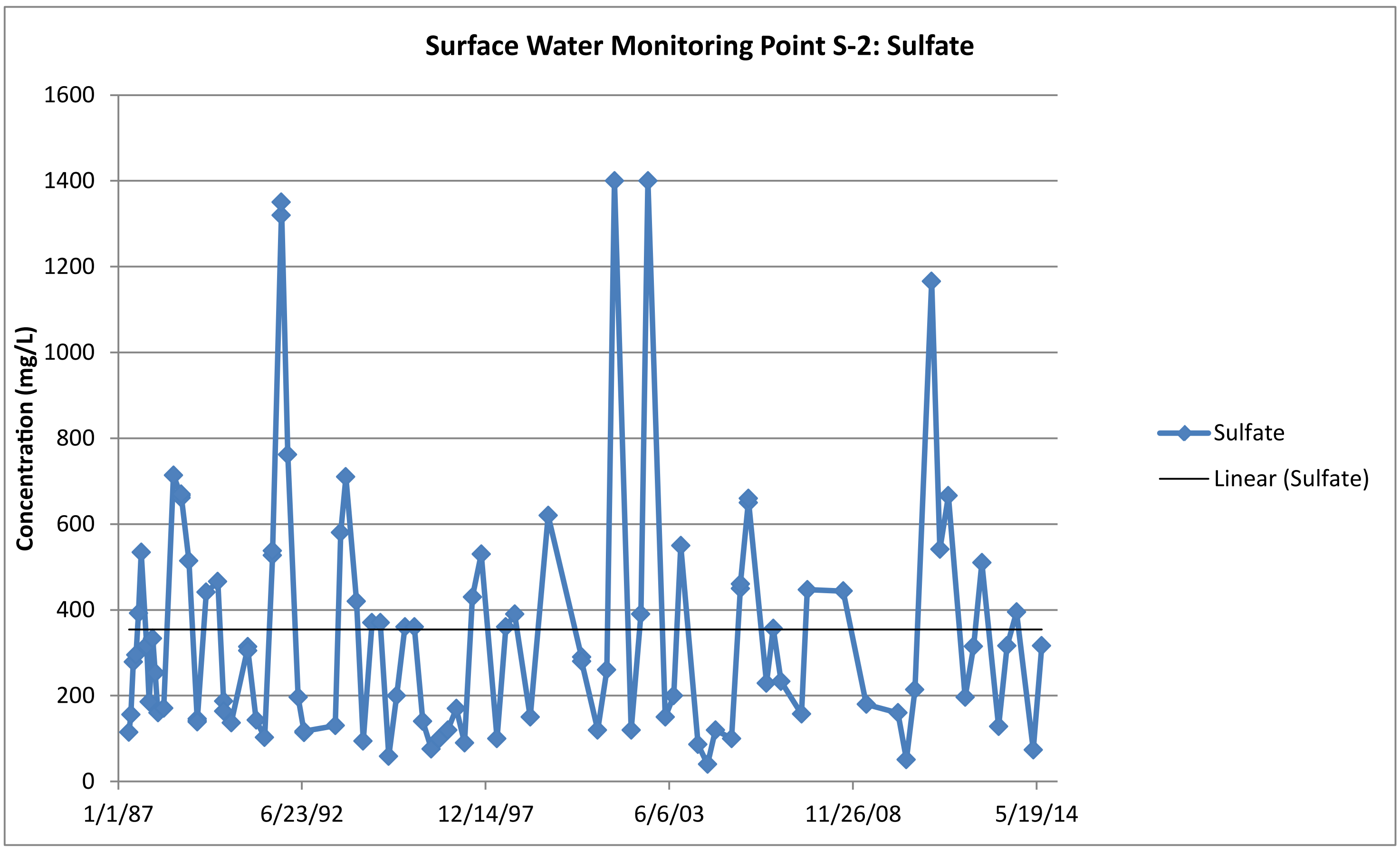

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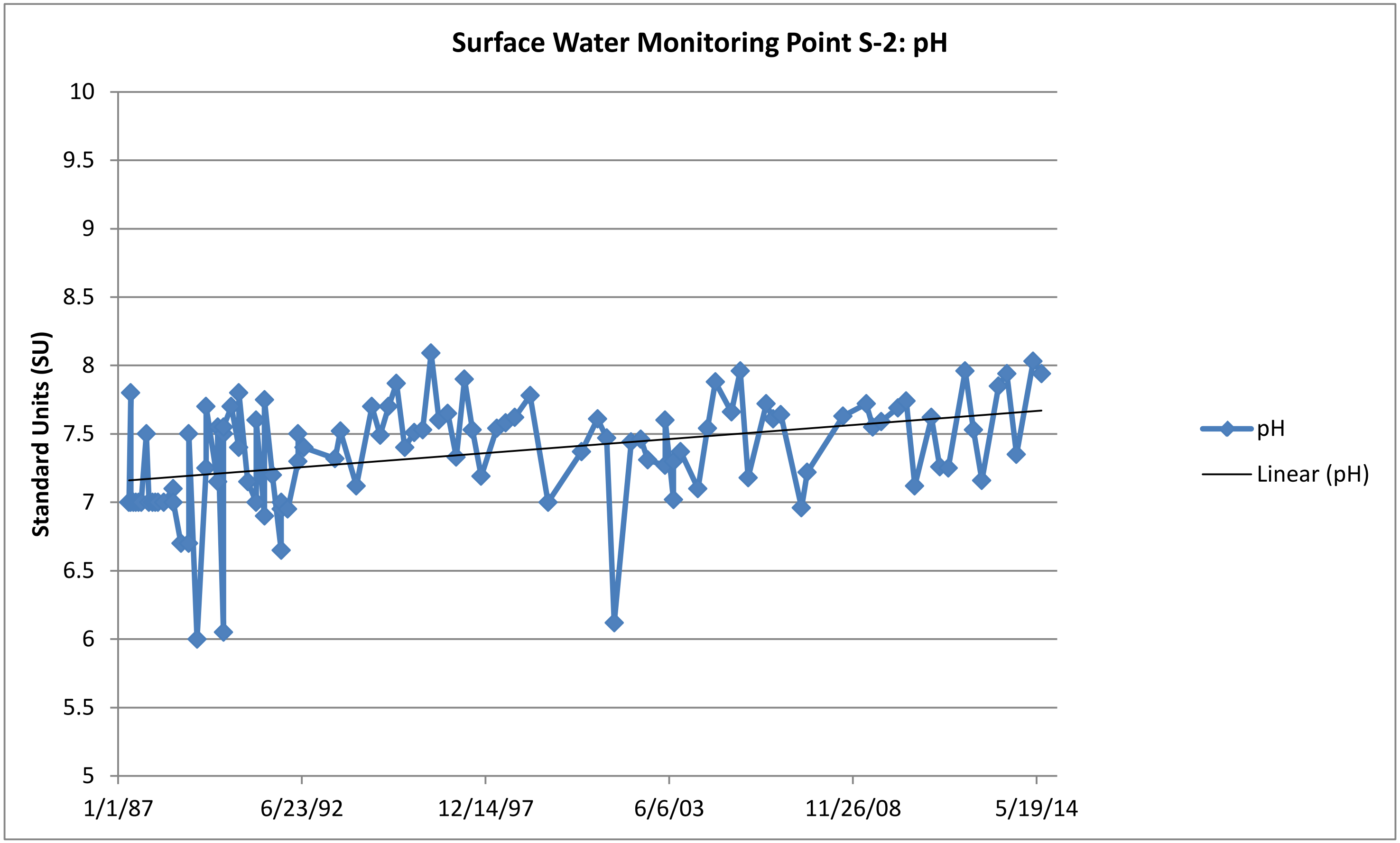

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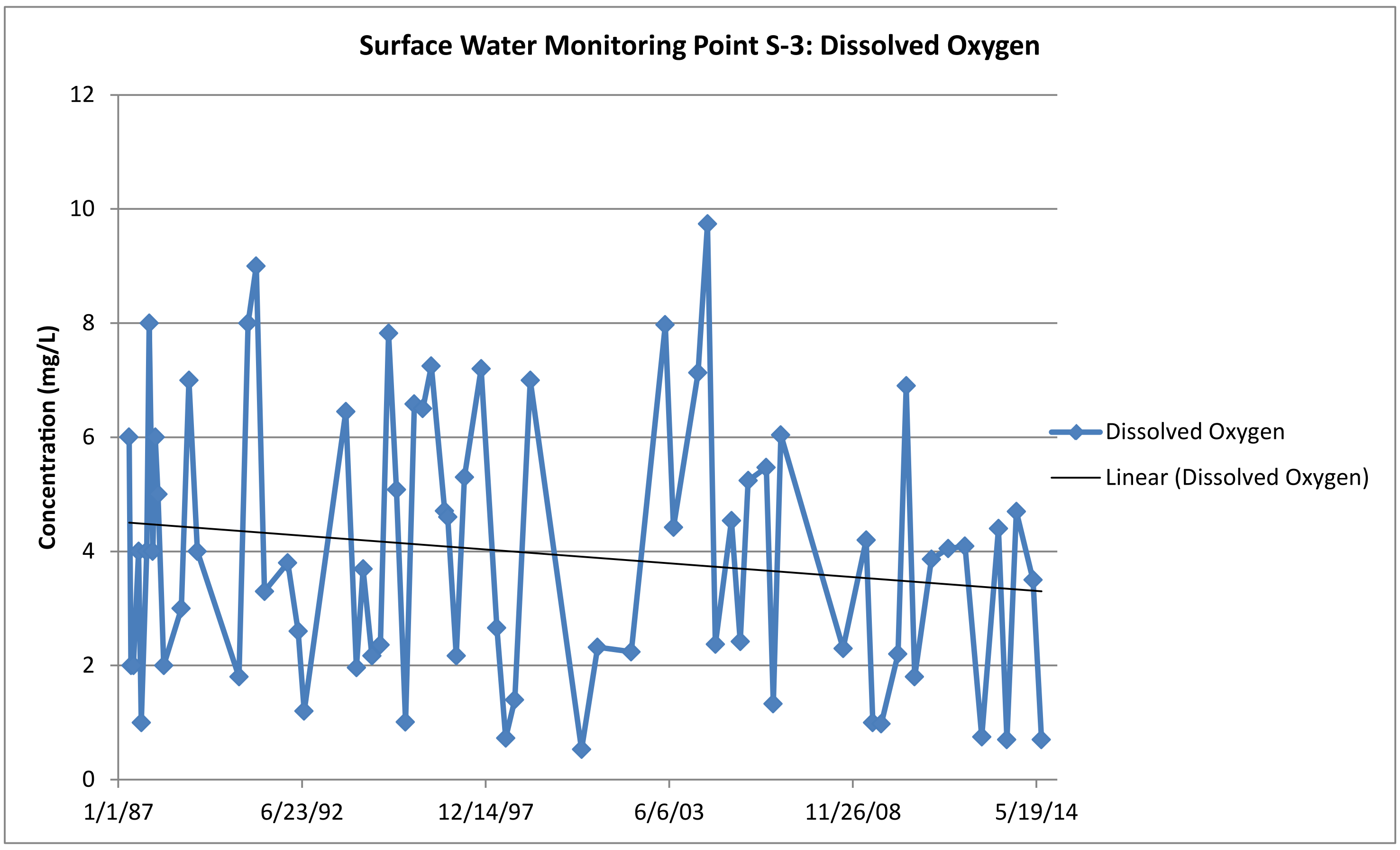

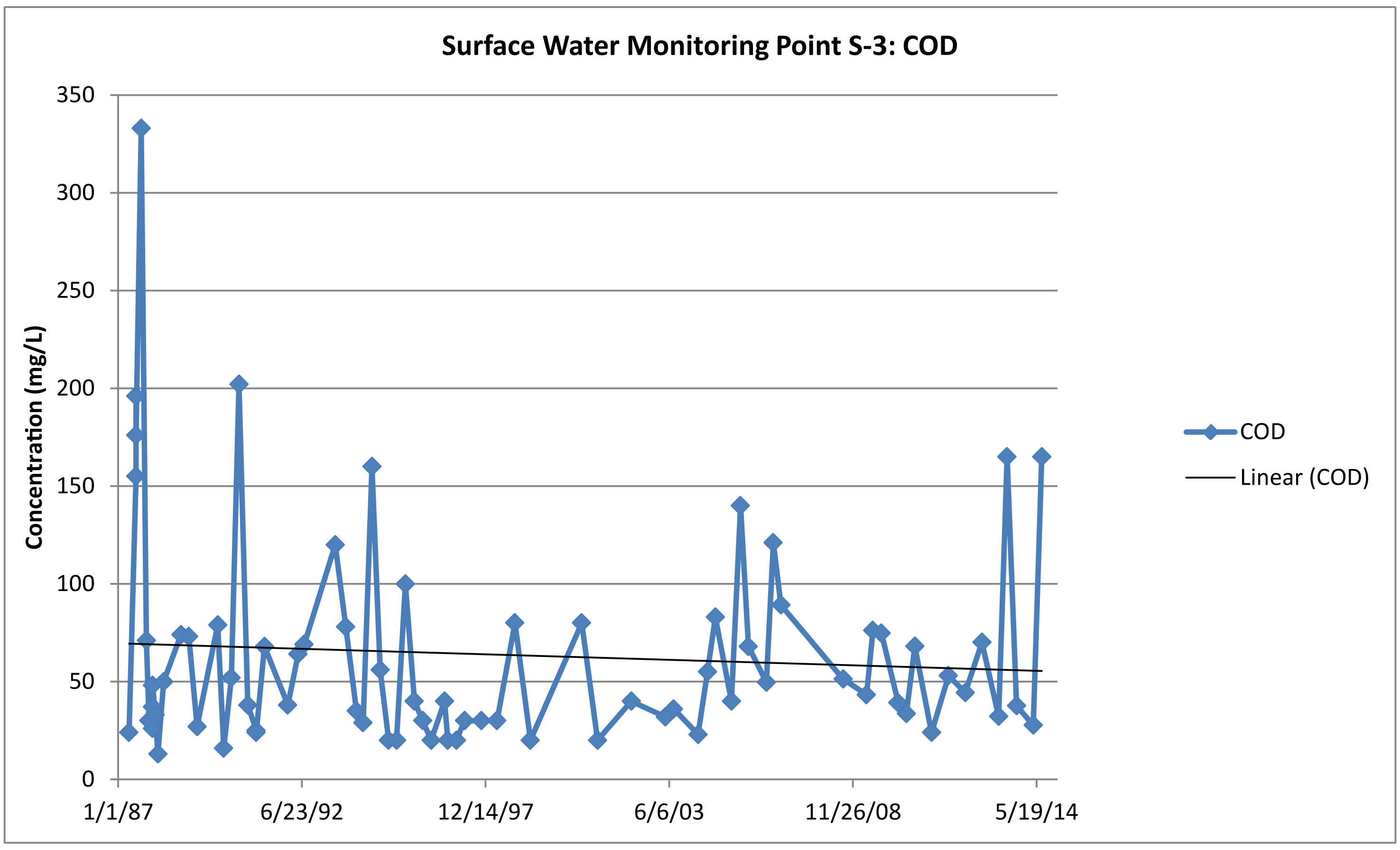

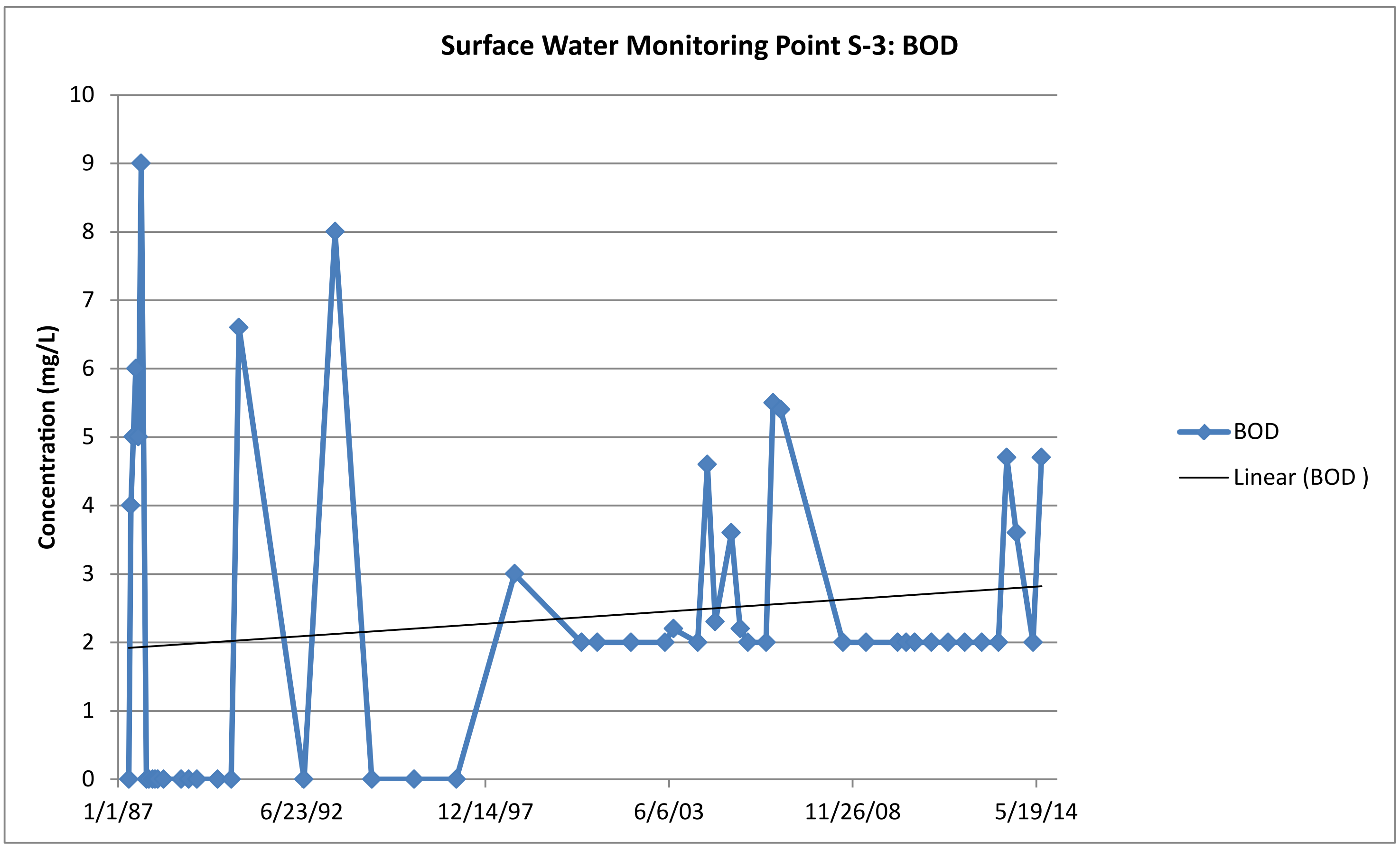

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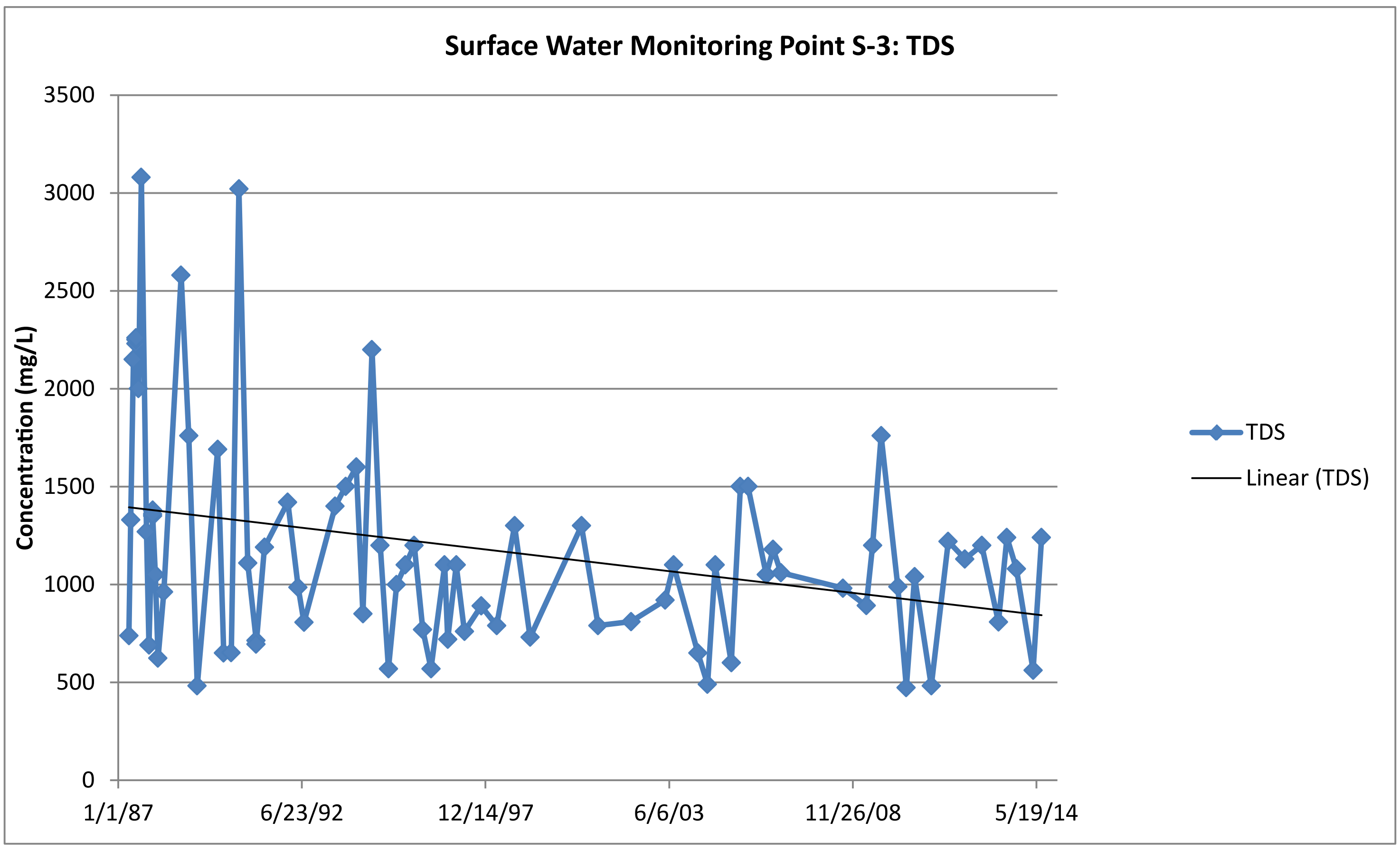
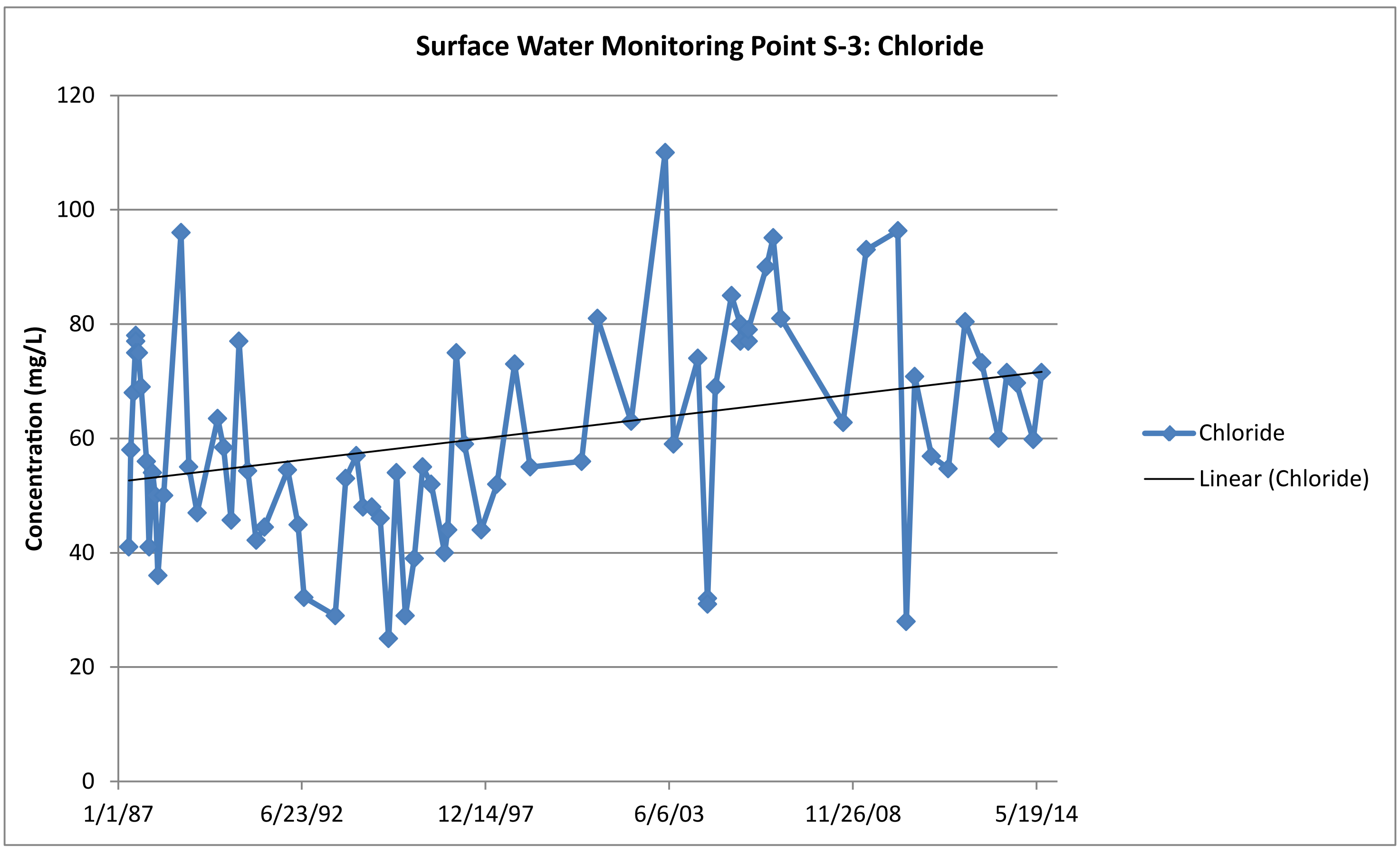
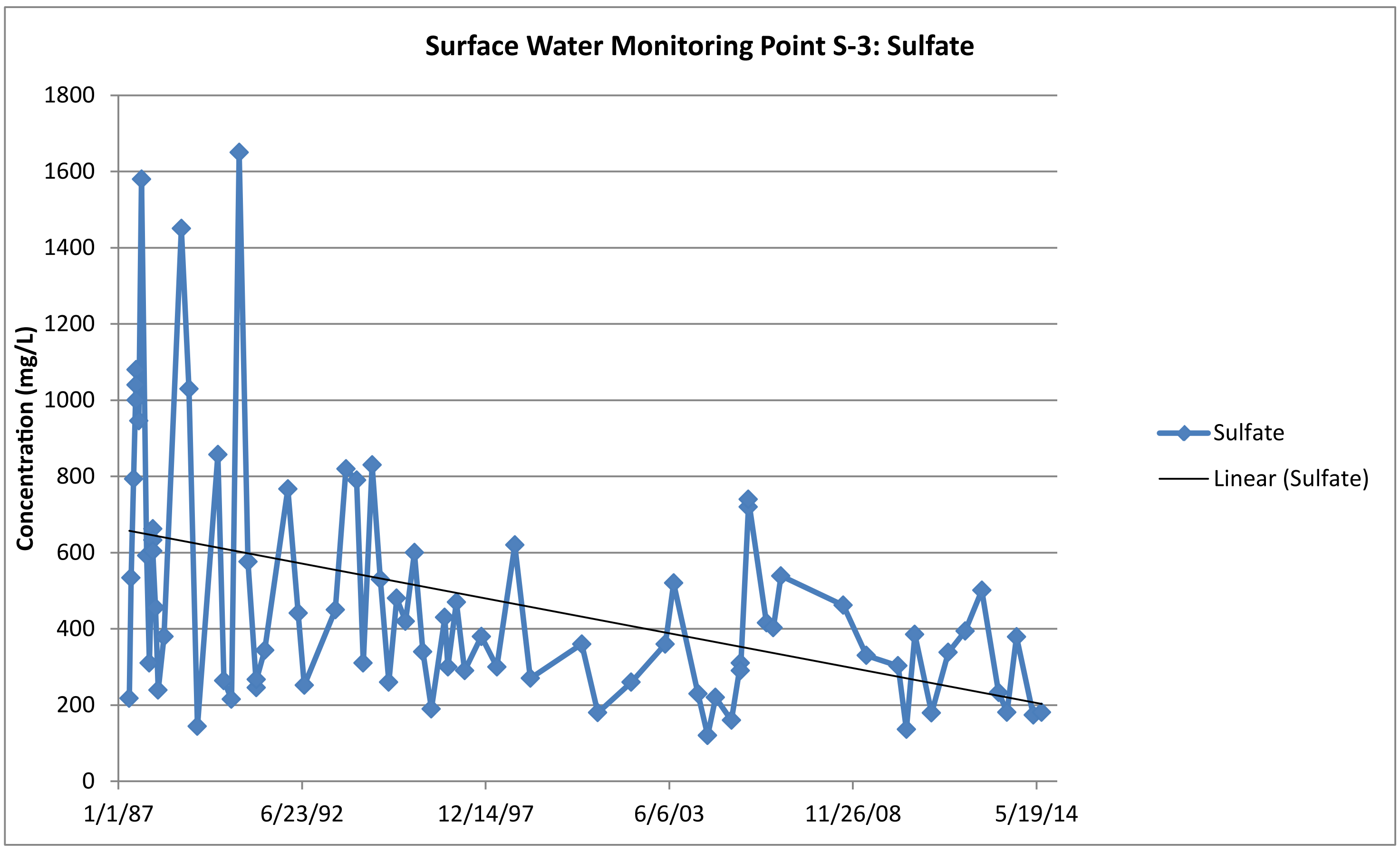

Surface Water Monitoring Point S-3: TDS


Surface Water Monitoring Point S-3: Chloride


Surface Water Monitoring Point S-3: Sulfate

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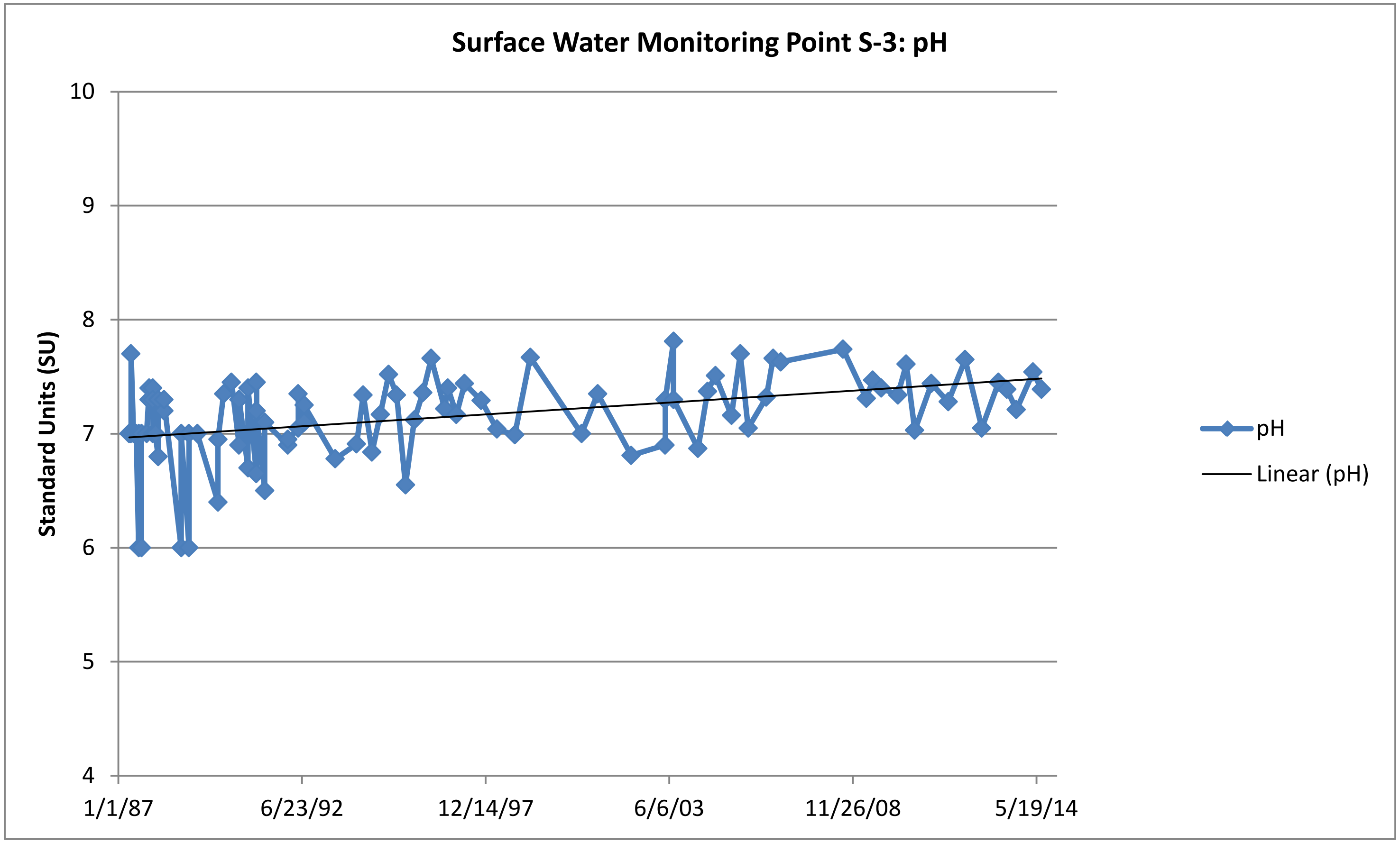

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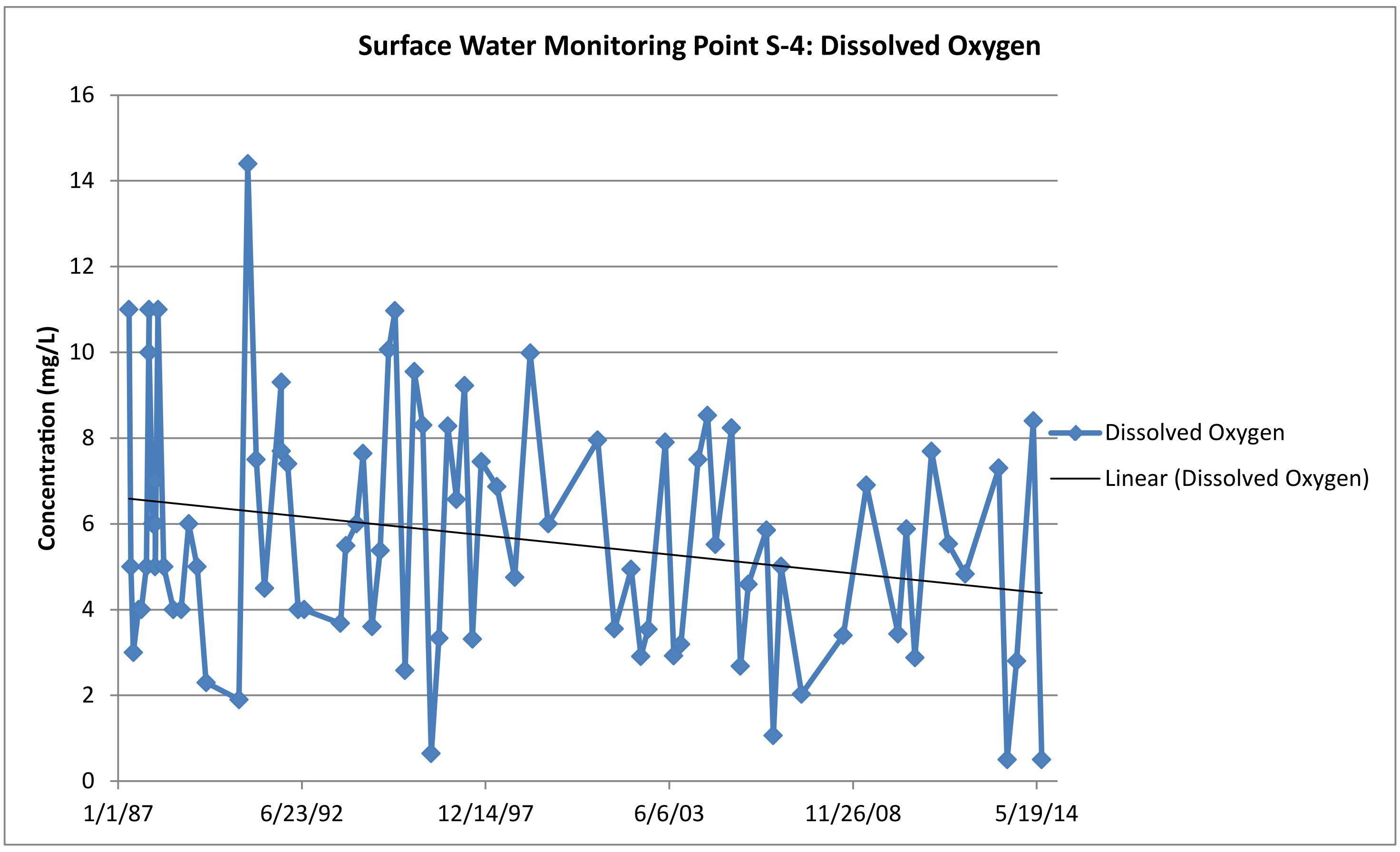

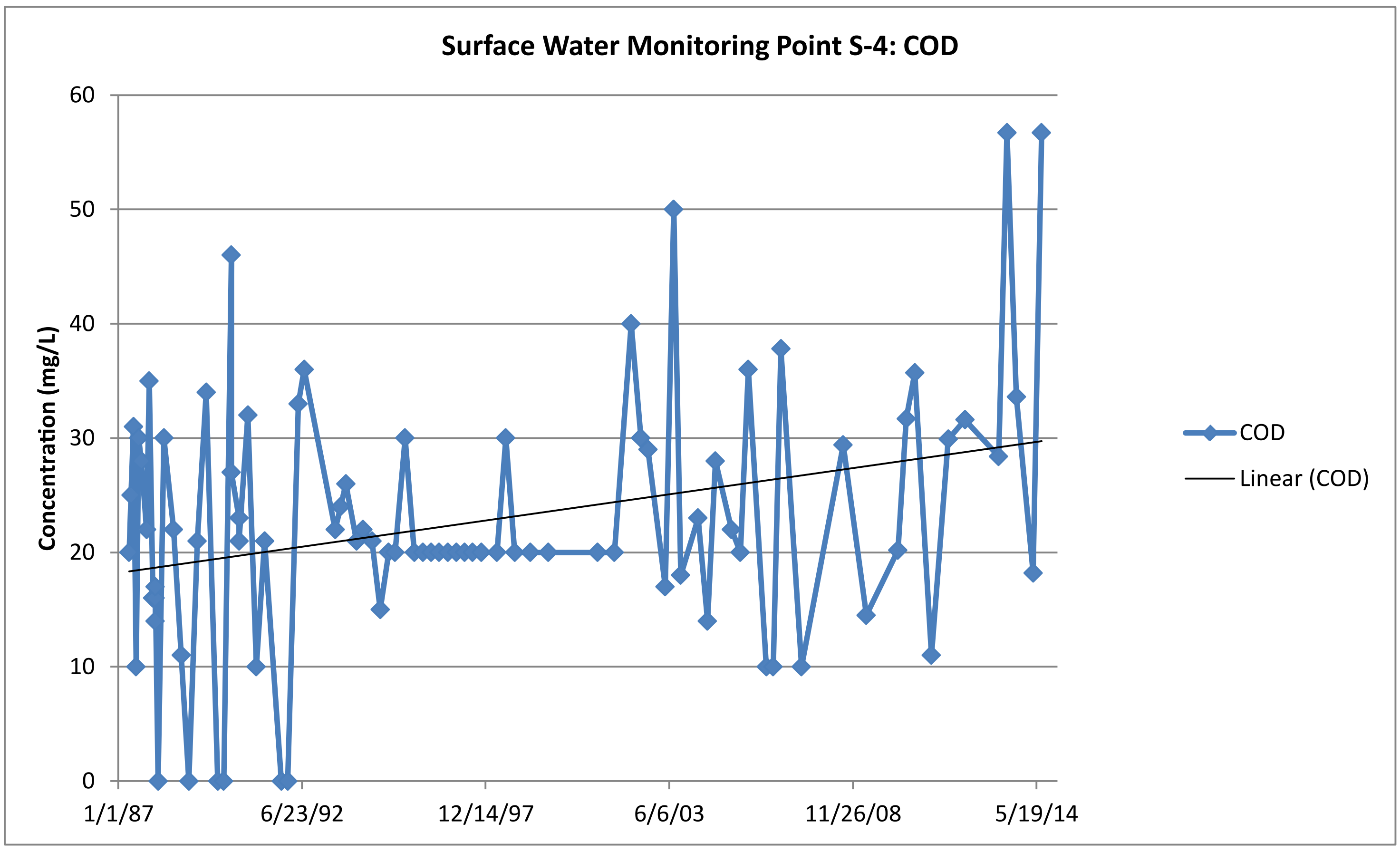

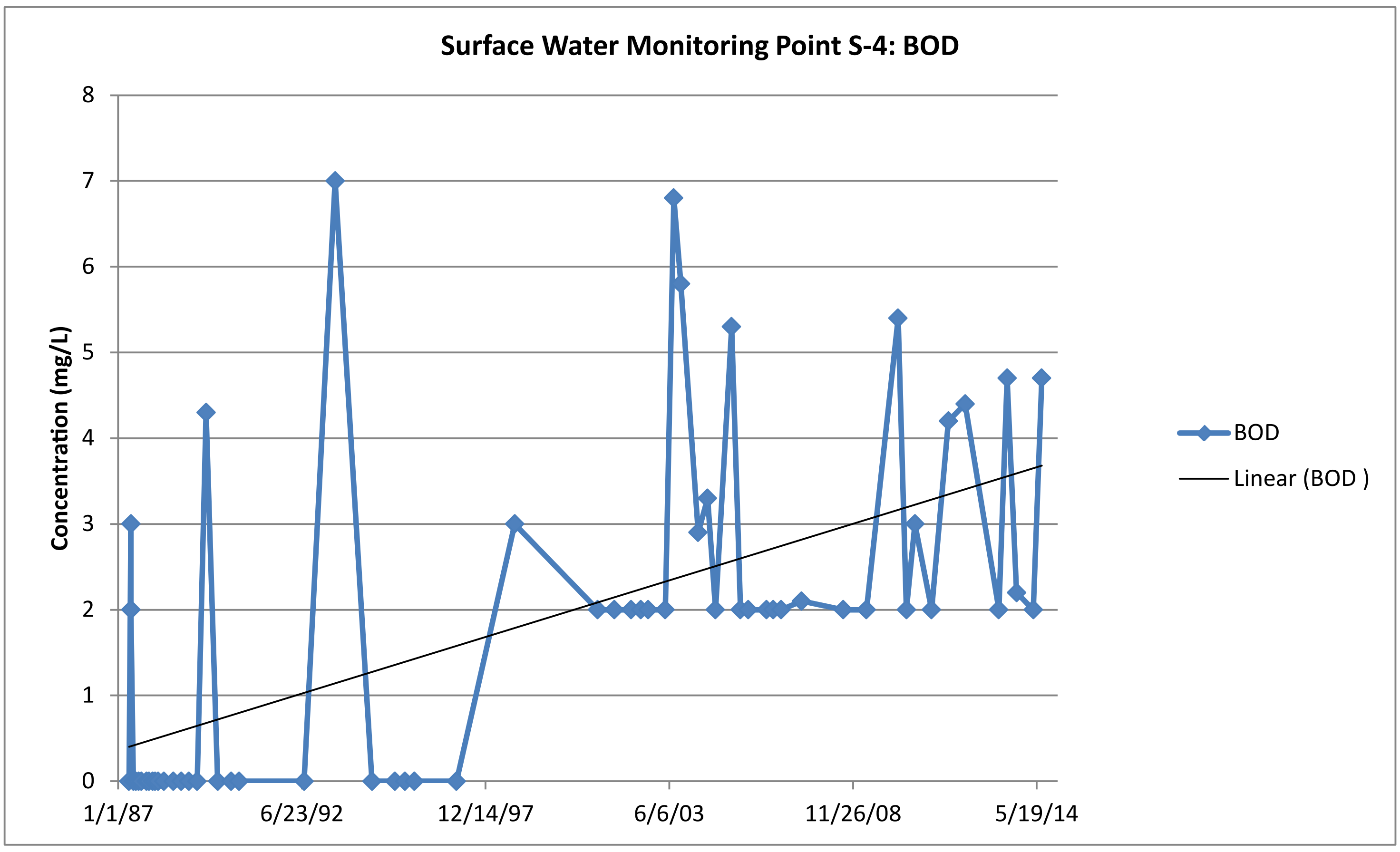

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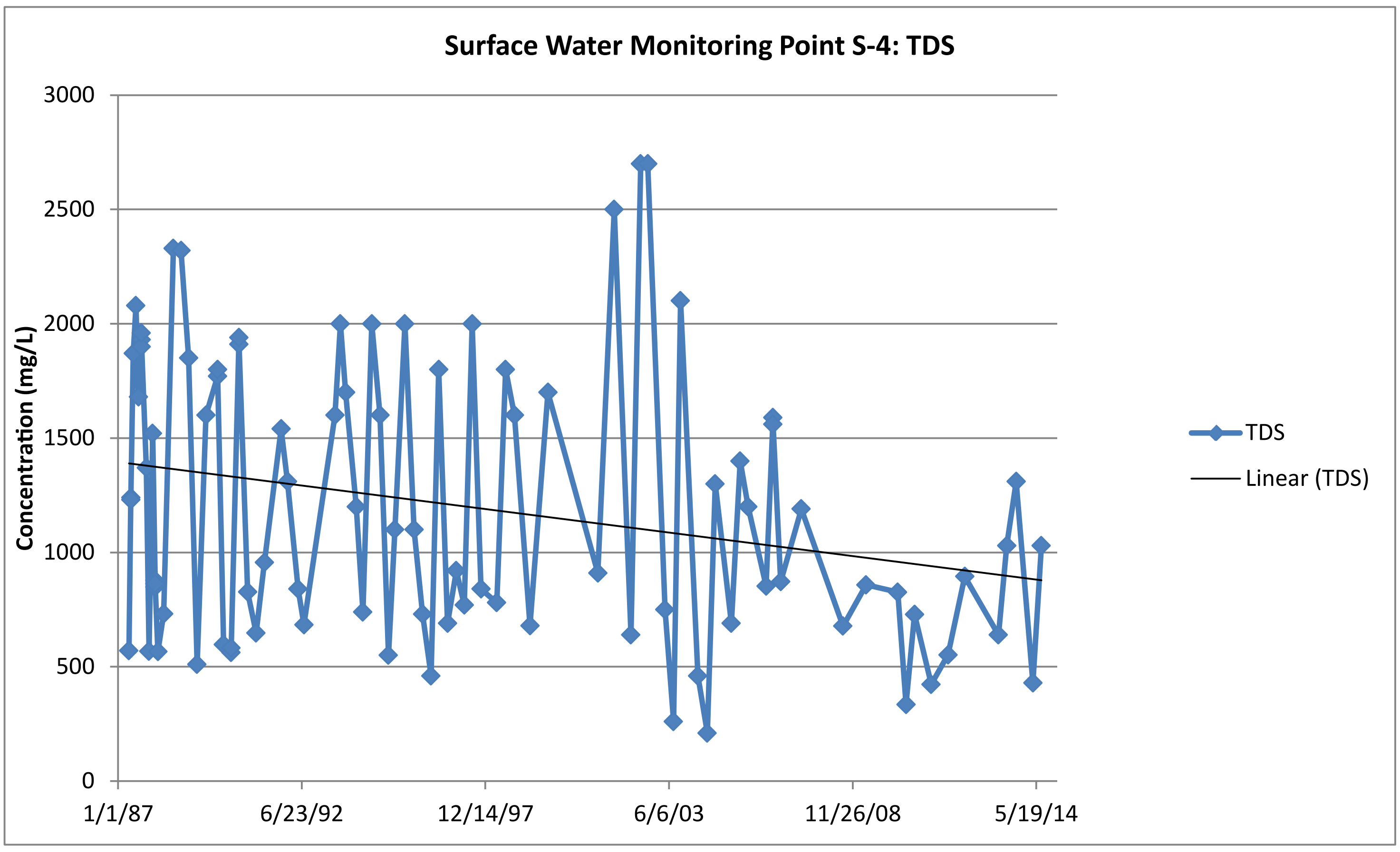
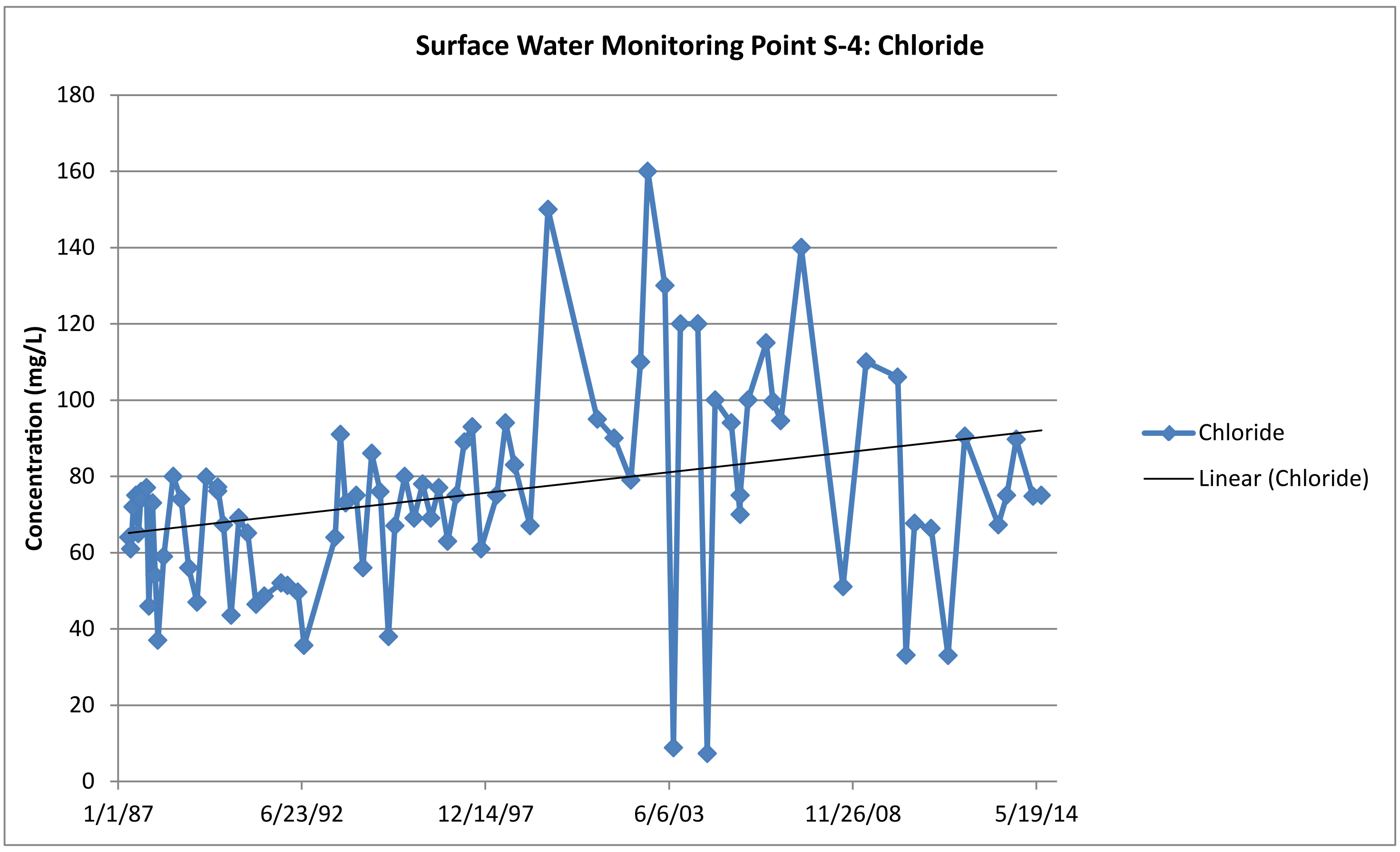
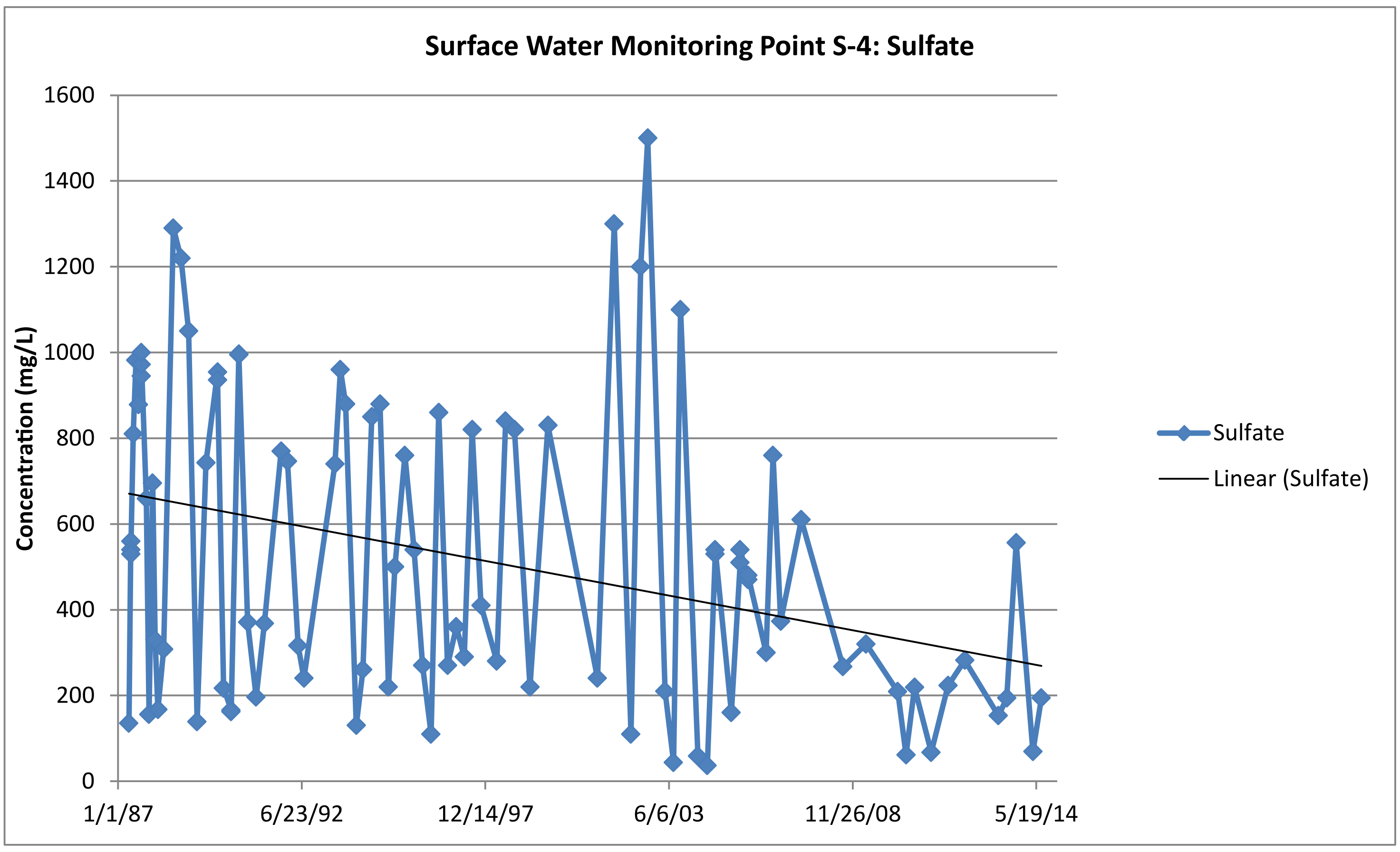


Surface Water Monitoring Point S-4: TDS



Surface Water Monitoring Point S-4: Chloride



Surface Water Monitoring Point S-4: Sulfate

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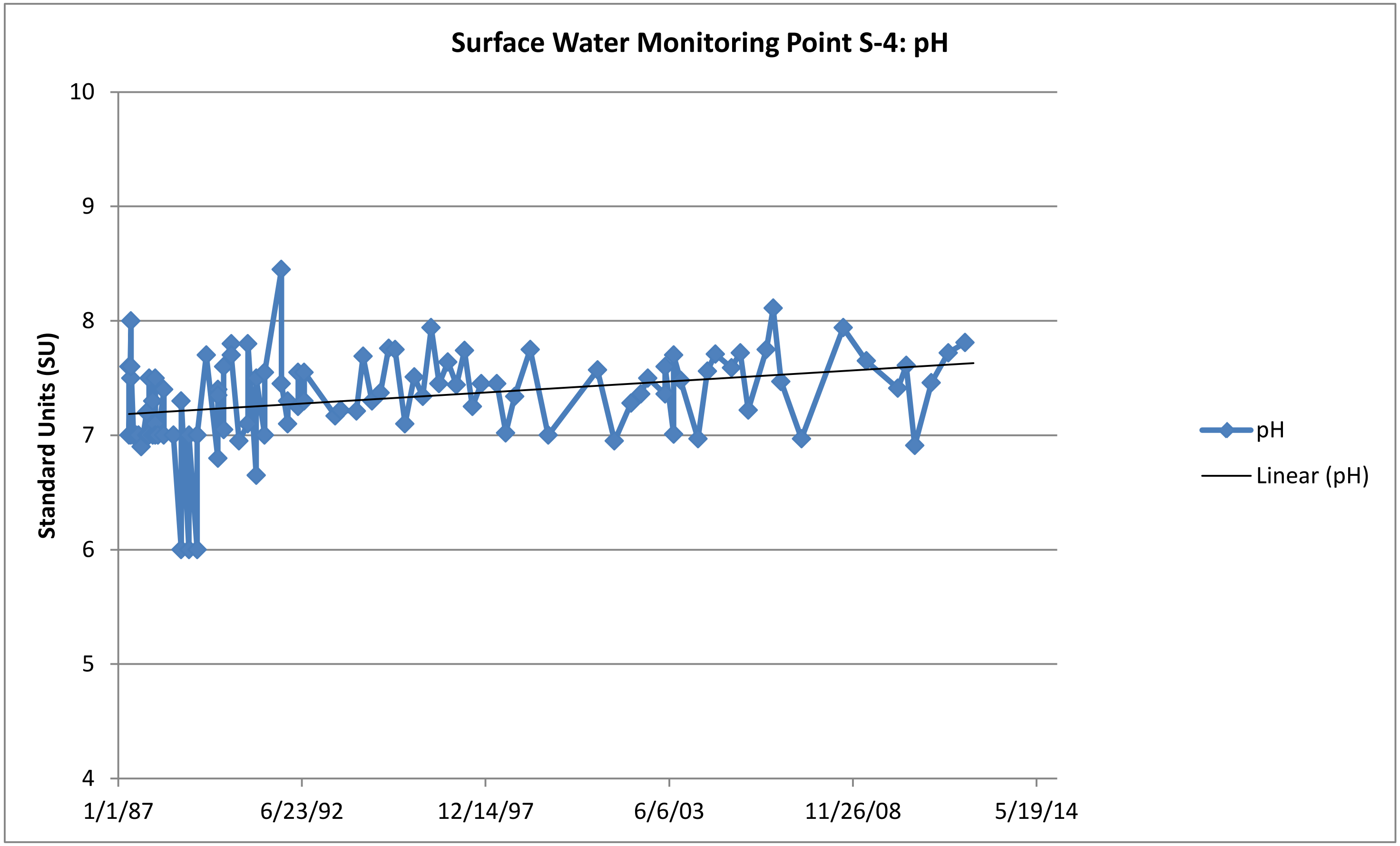

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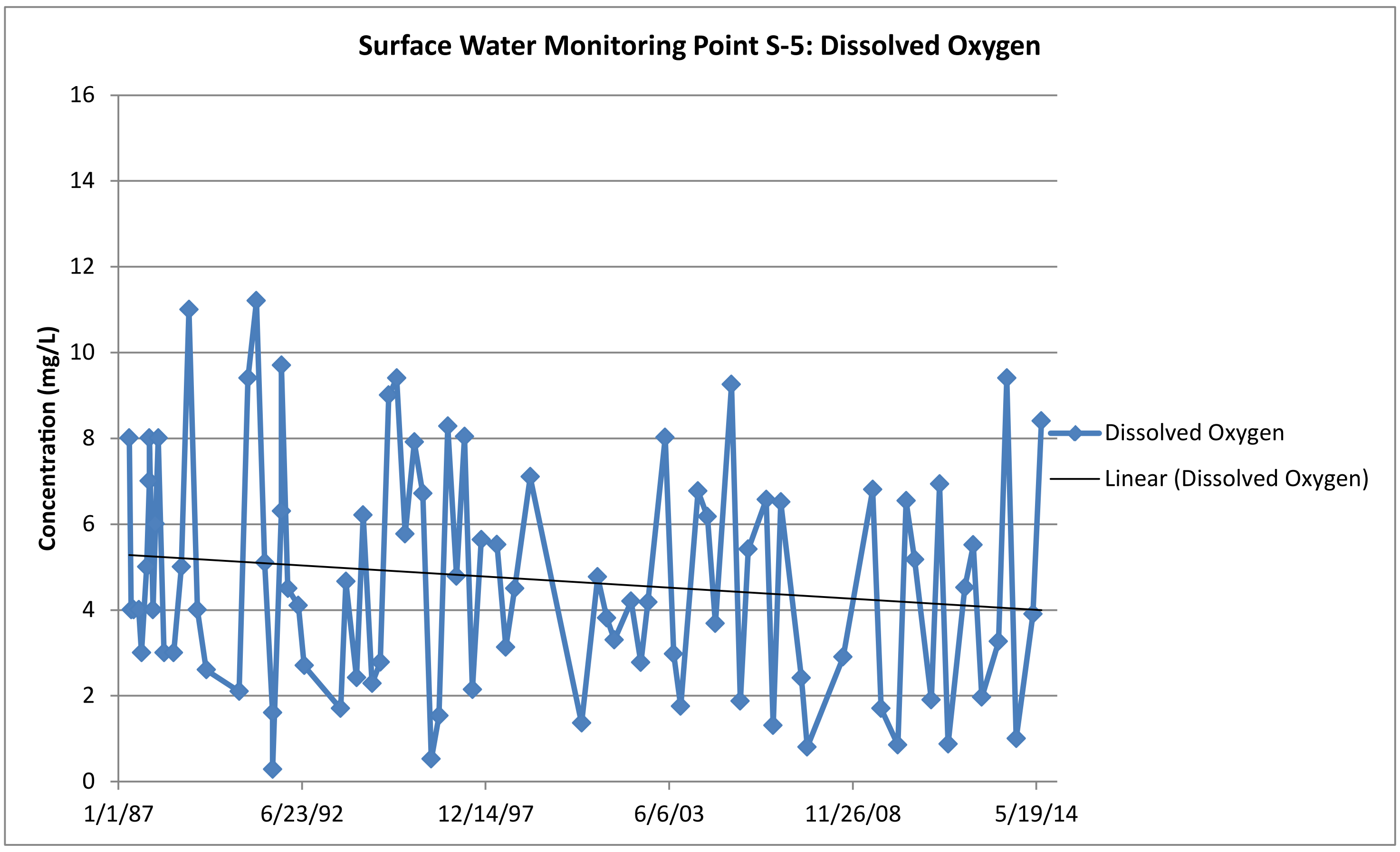
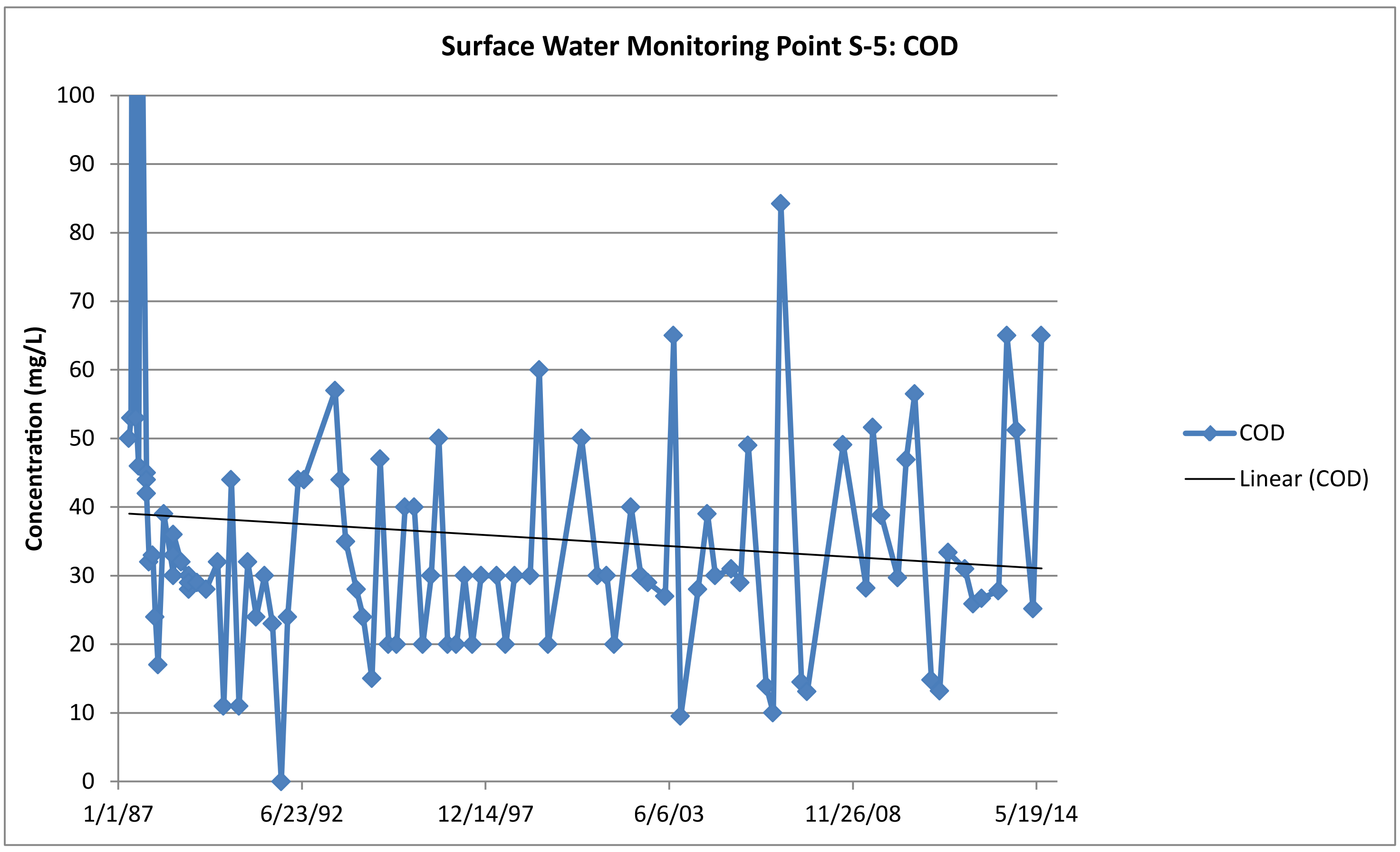
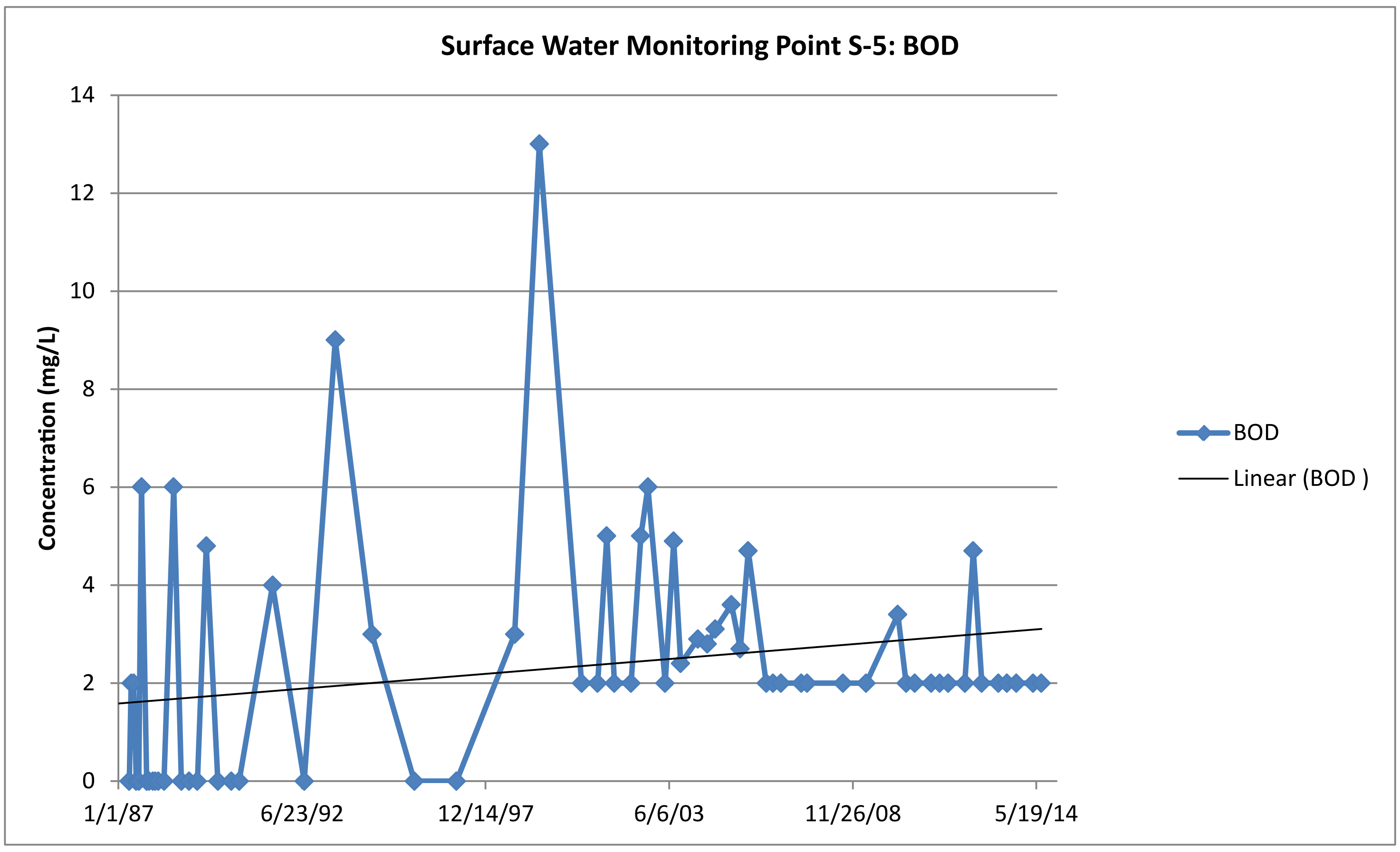

Surface Water Monitoring Point S-5: Dissolved Oxygen


Surface Water Monitoring Point S-5: COD


Surface Water Monitoring Point S-5: BOD

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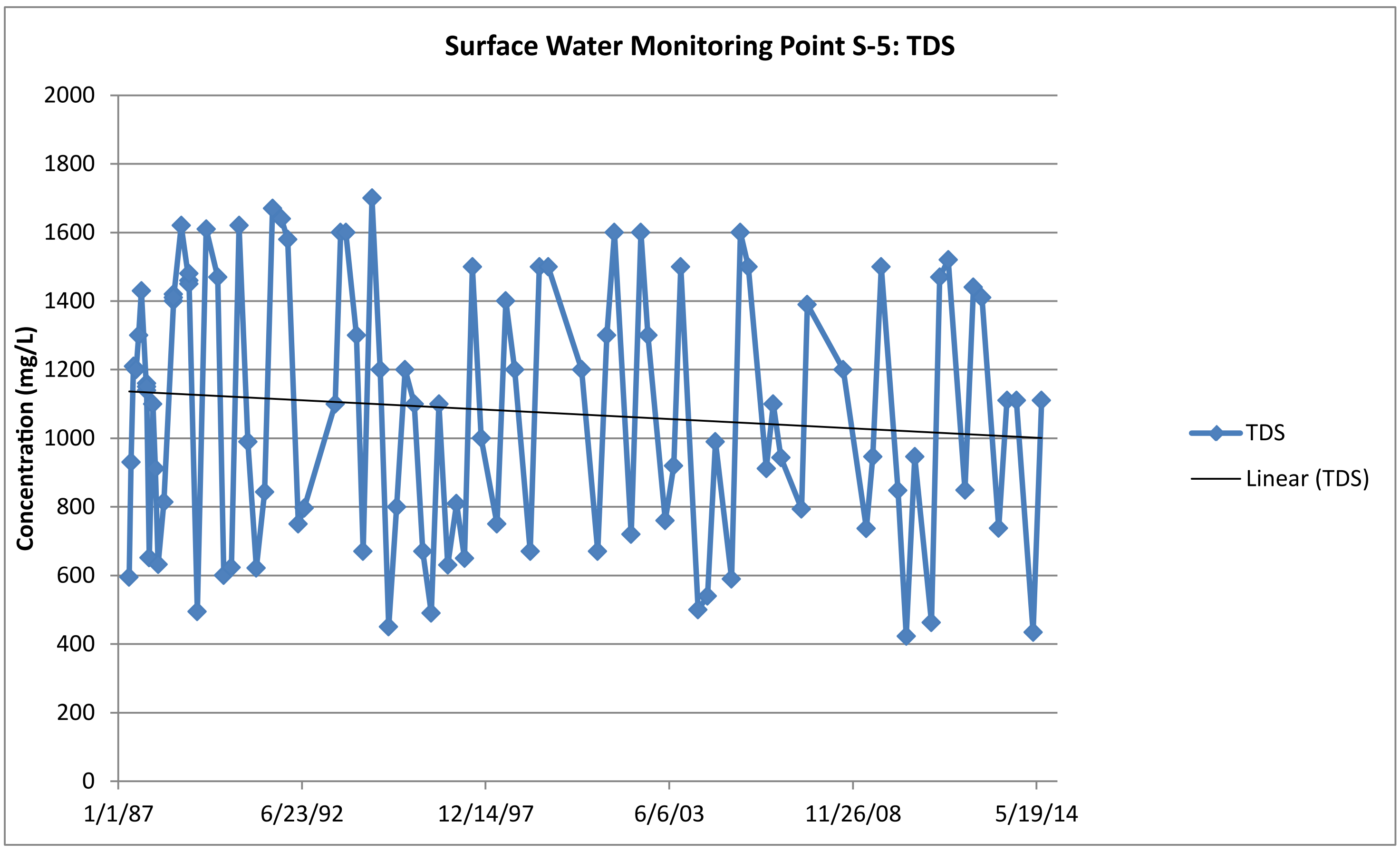
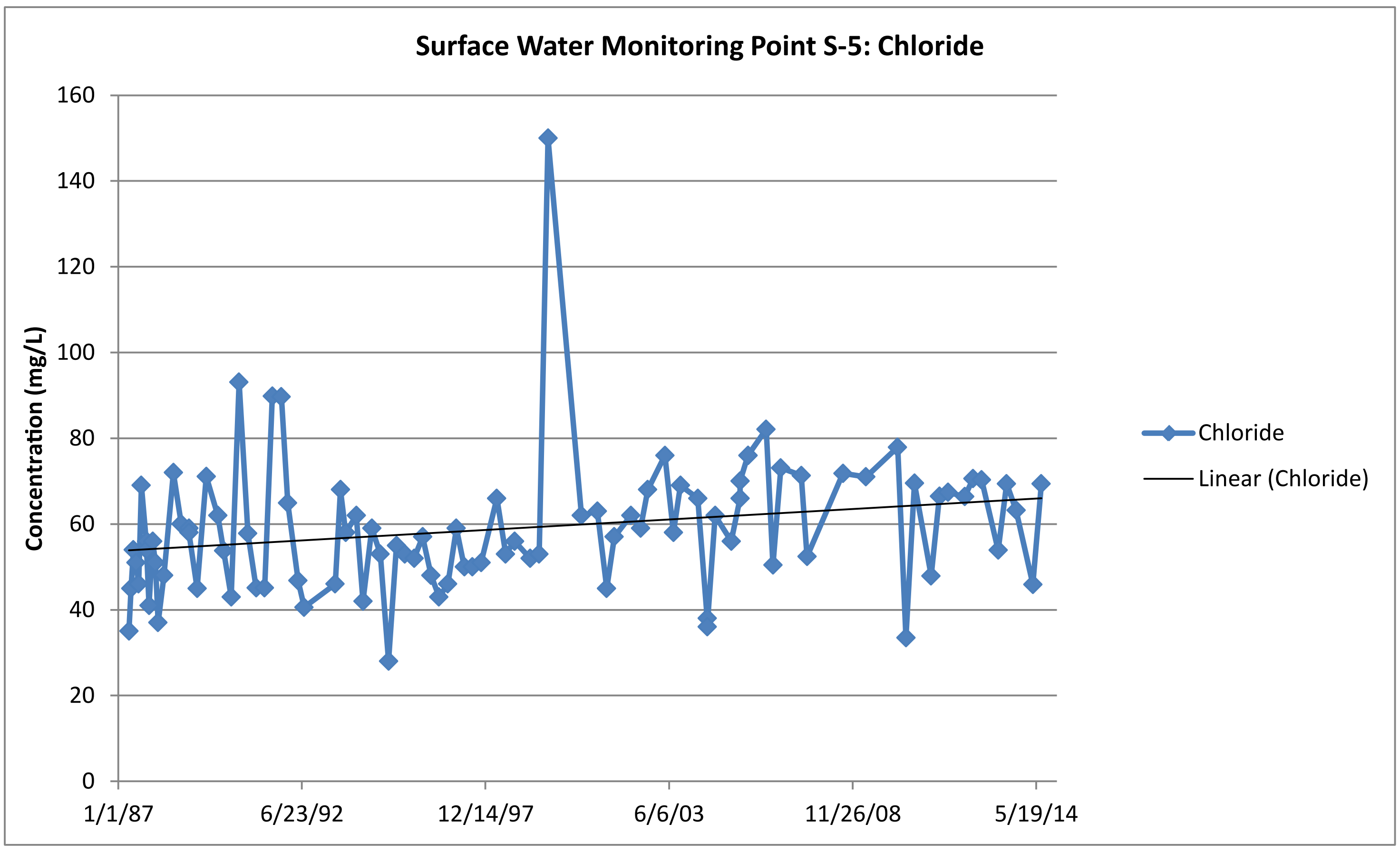
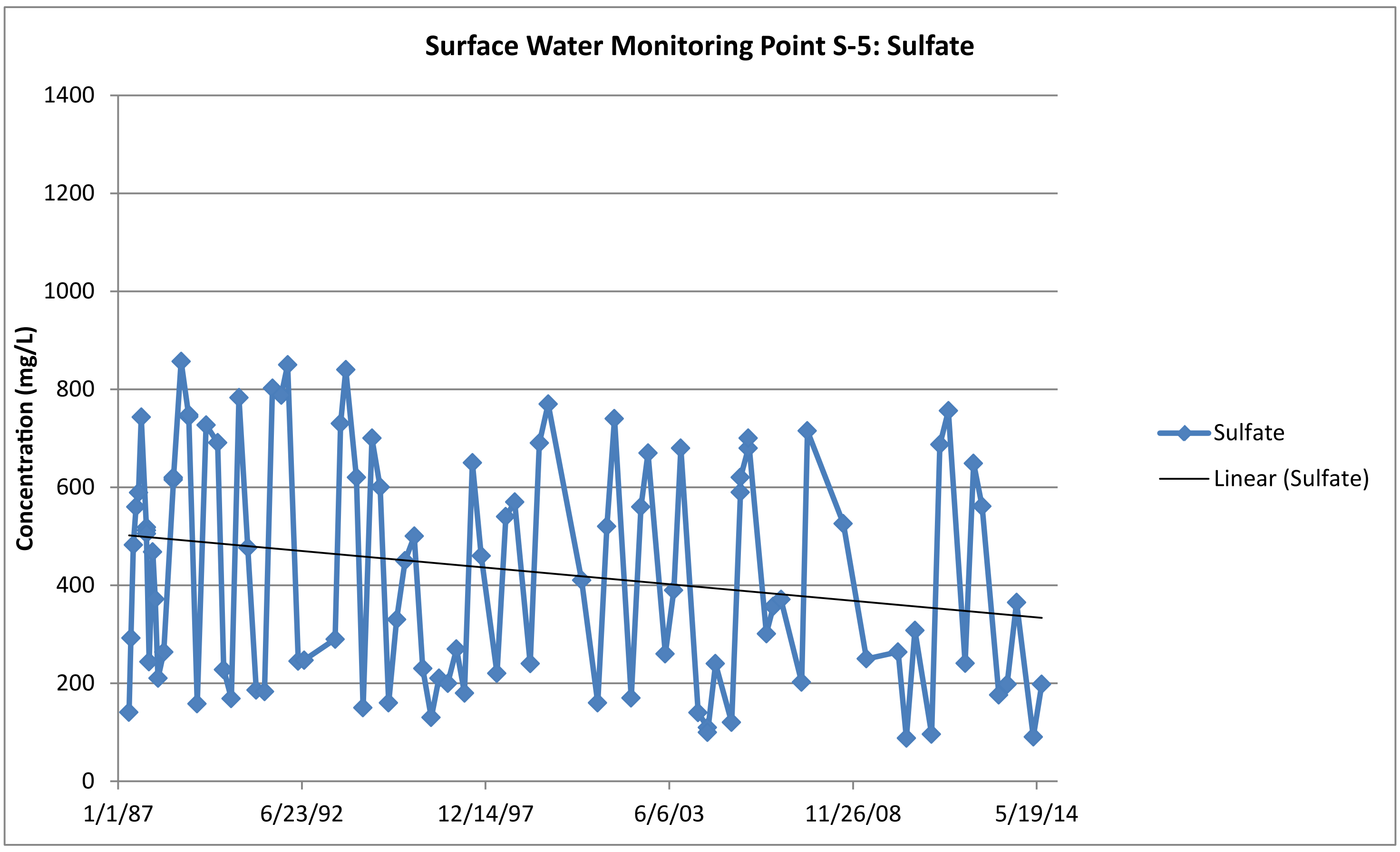

Surface Water Monitoring Point S-5: TDS


Surface Water Monitoring Point S-5: Chloride


Surface Water Monitoring Point S-5: Sulfate

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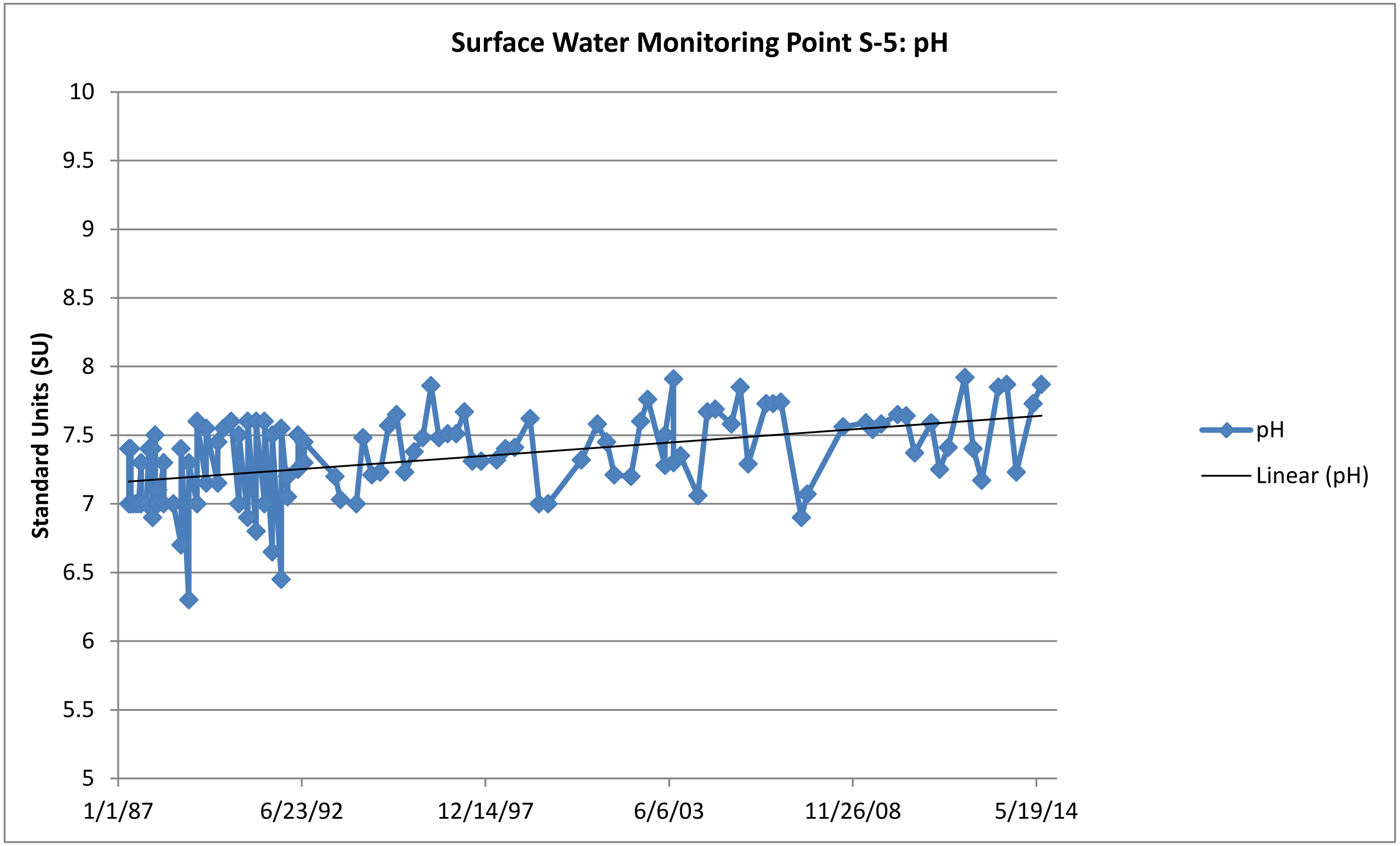

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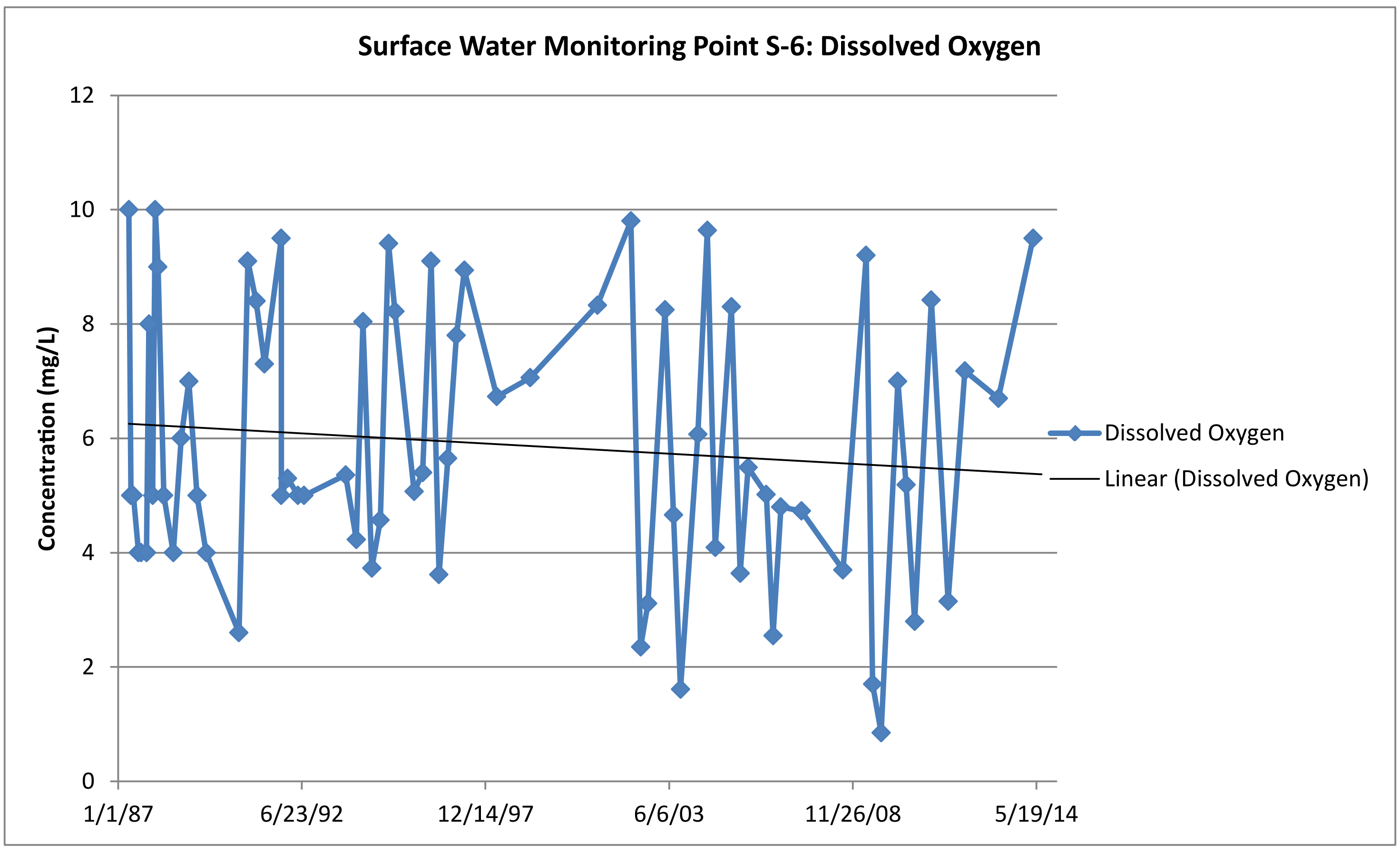
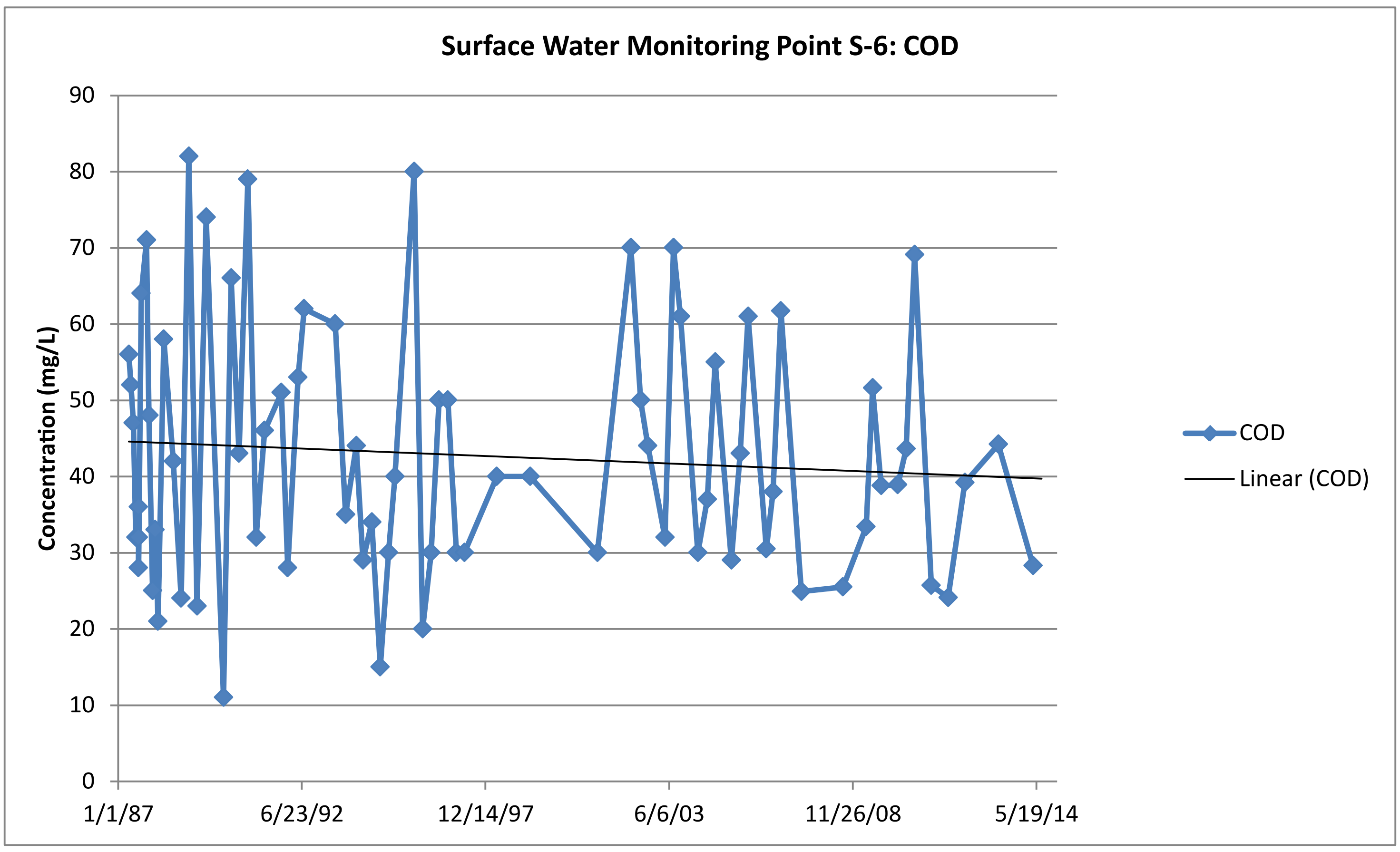
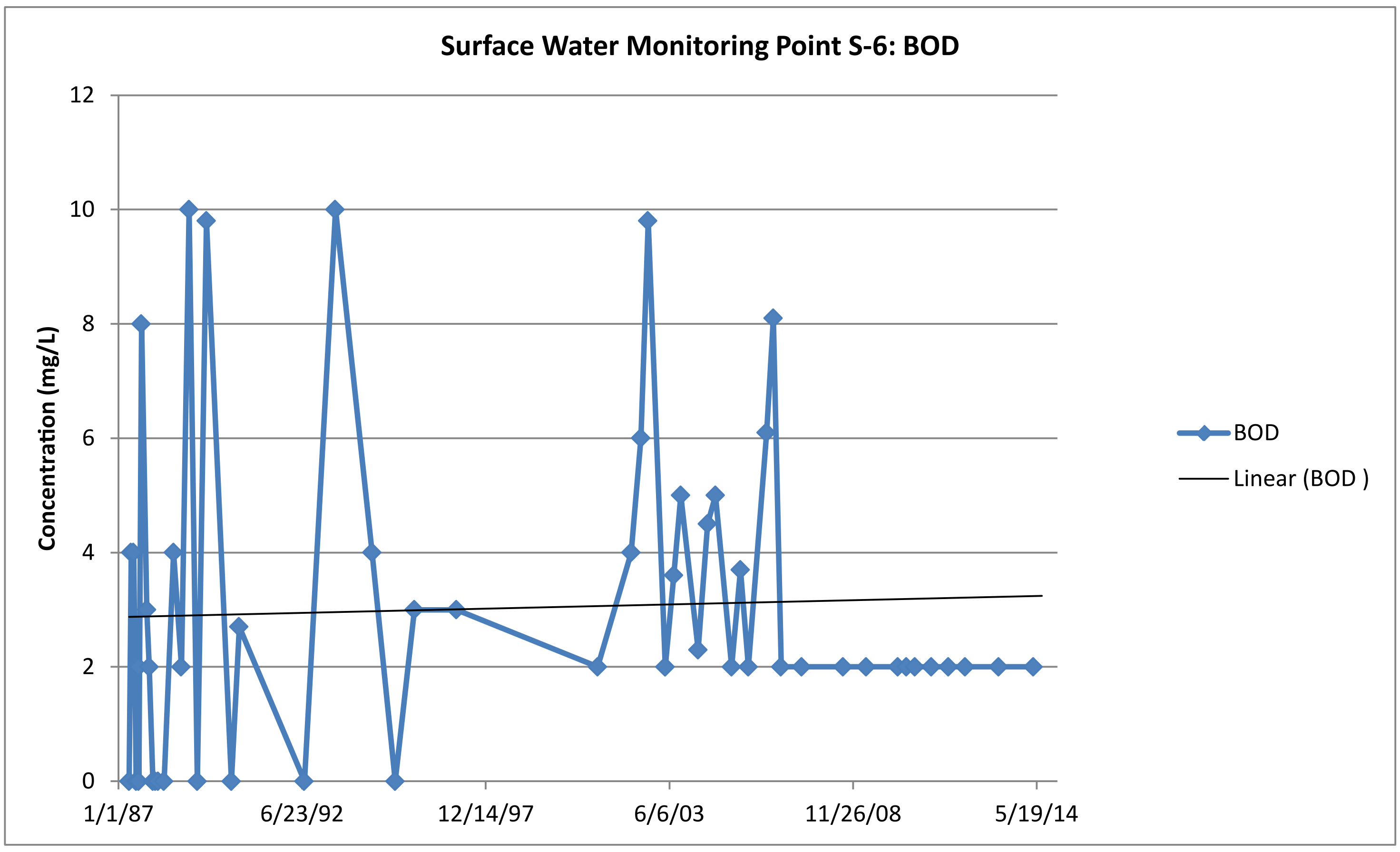

Surface Water Monitoring Point S-6: Dissolved Oxygen


Surface Water Monitoring Point S-6: COD


Surface Water Monitoring Point S-6: BOD

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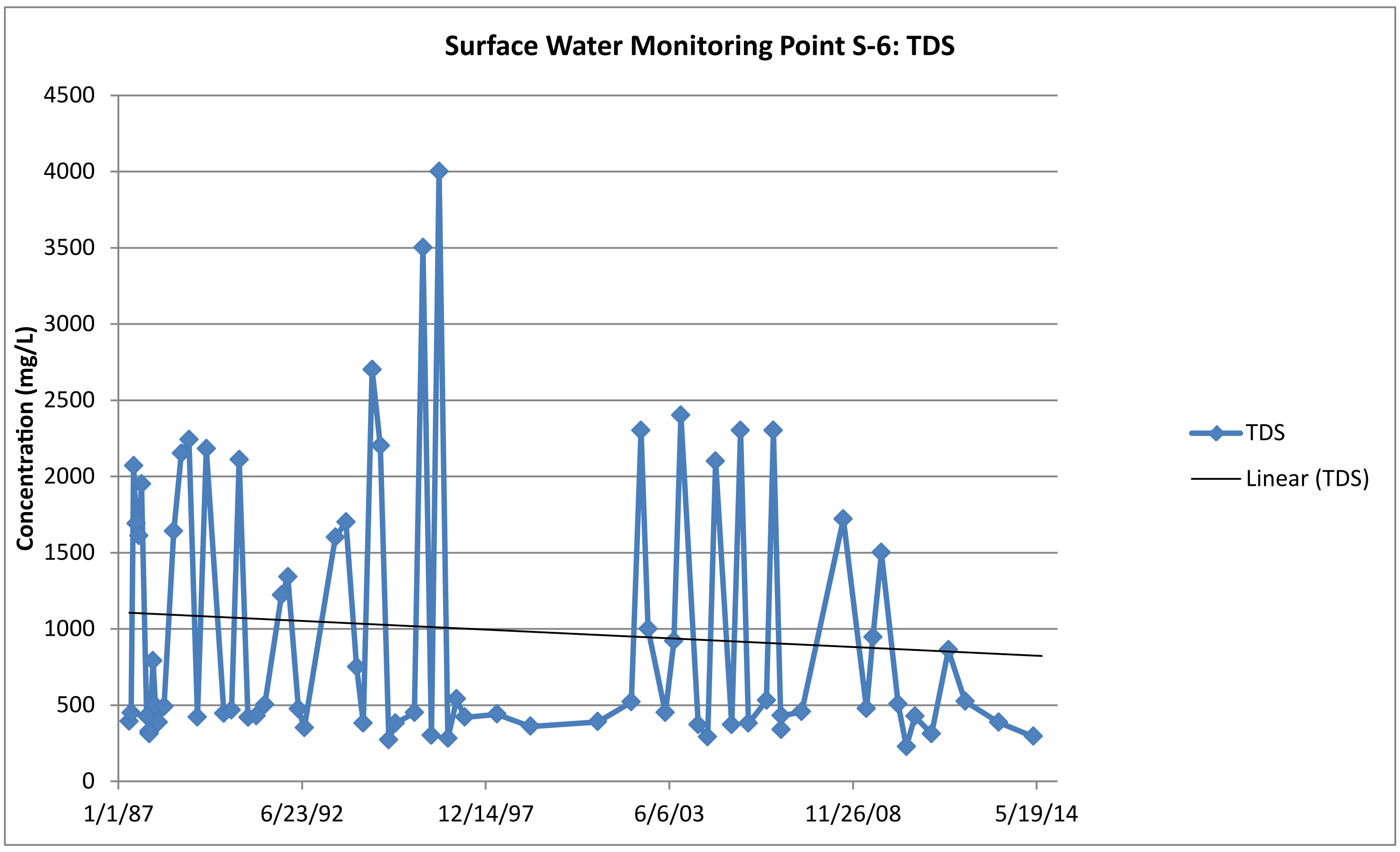

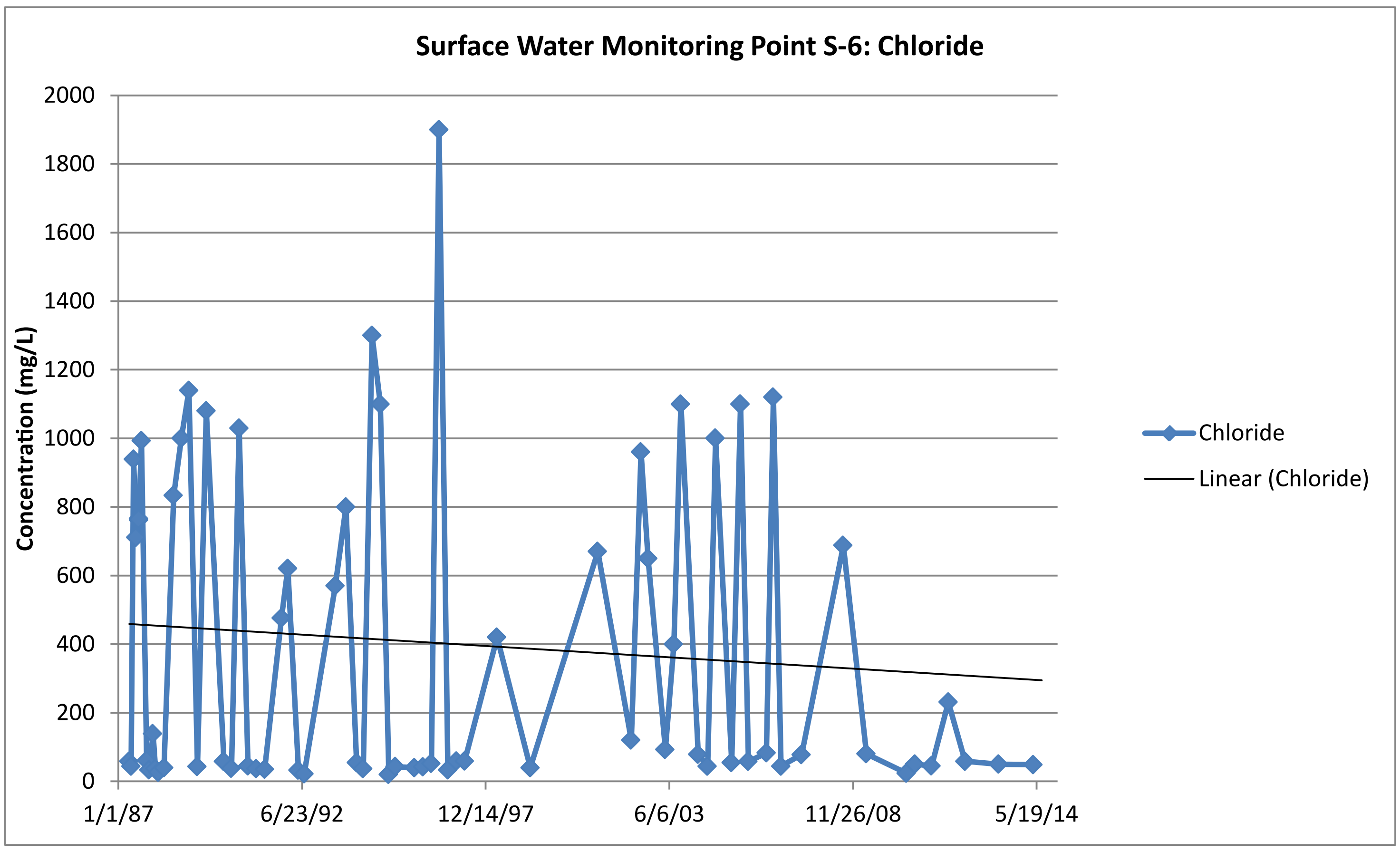

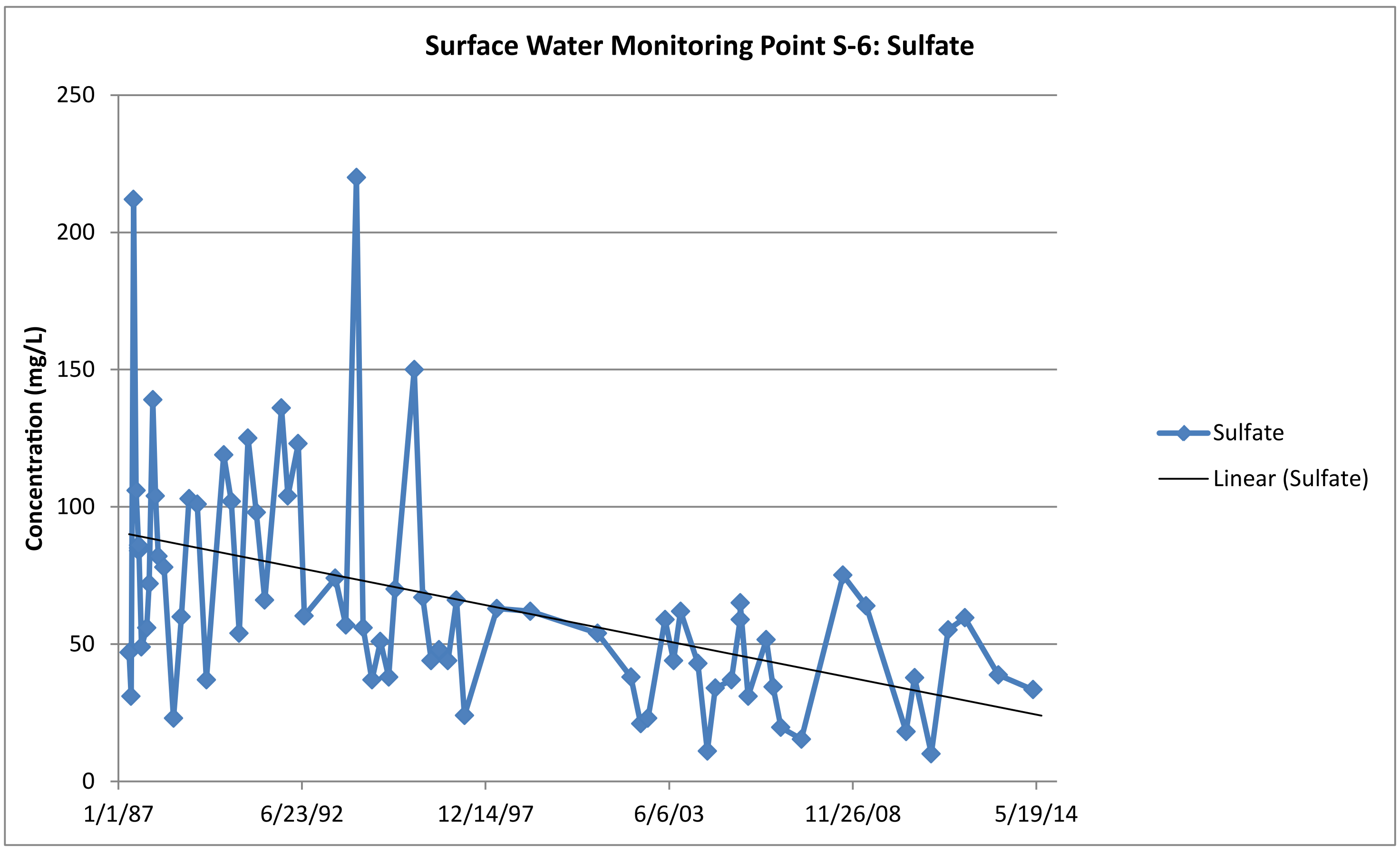

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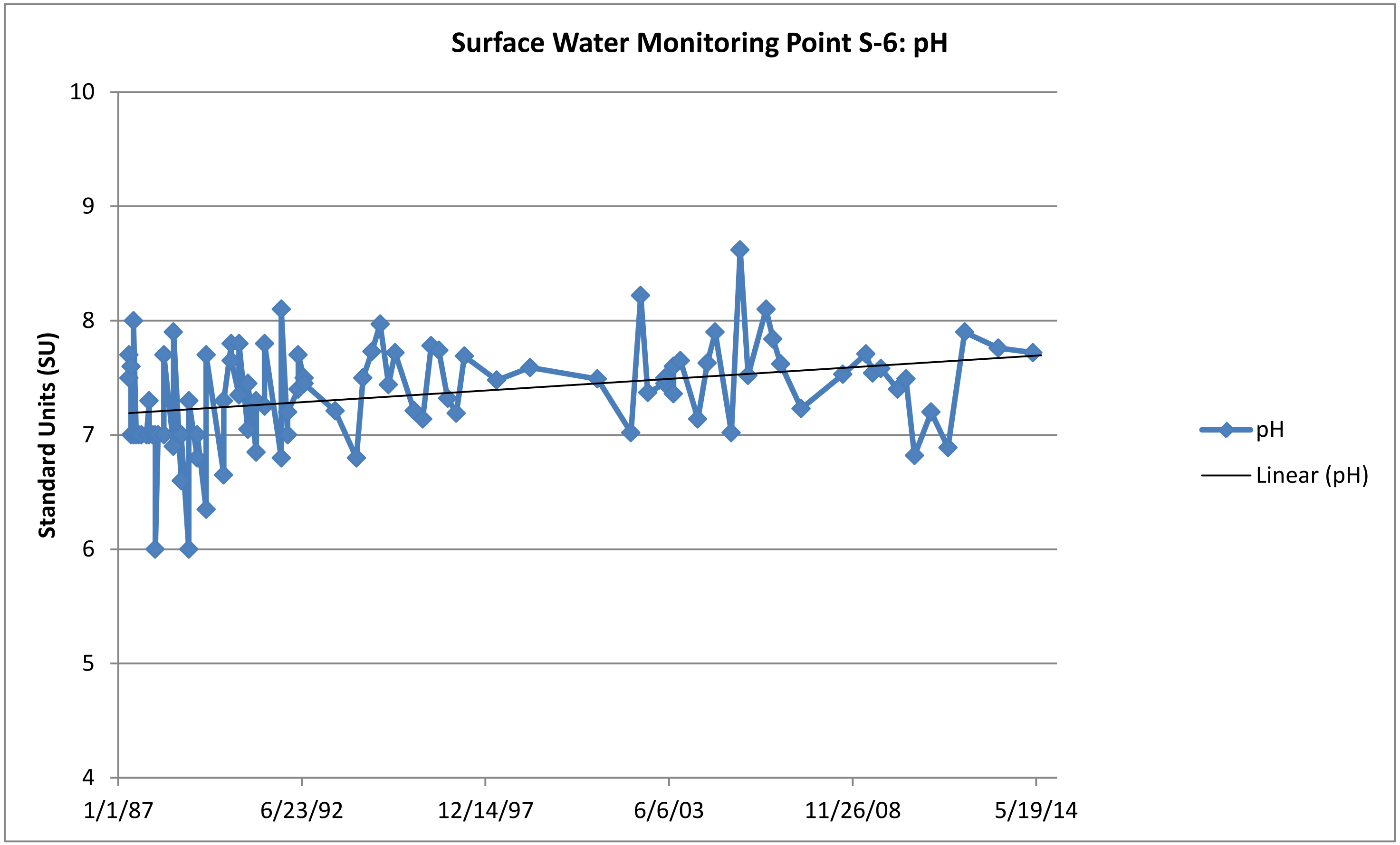

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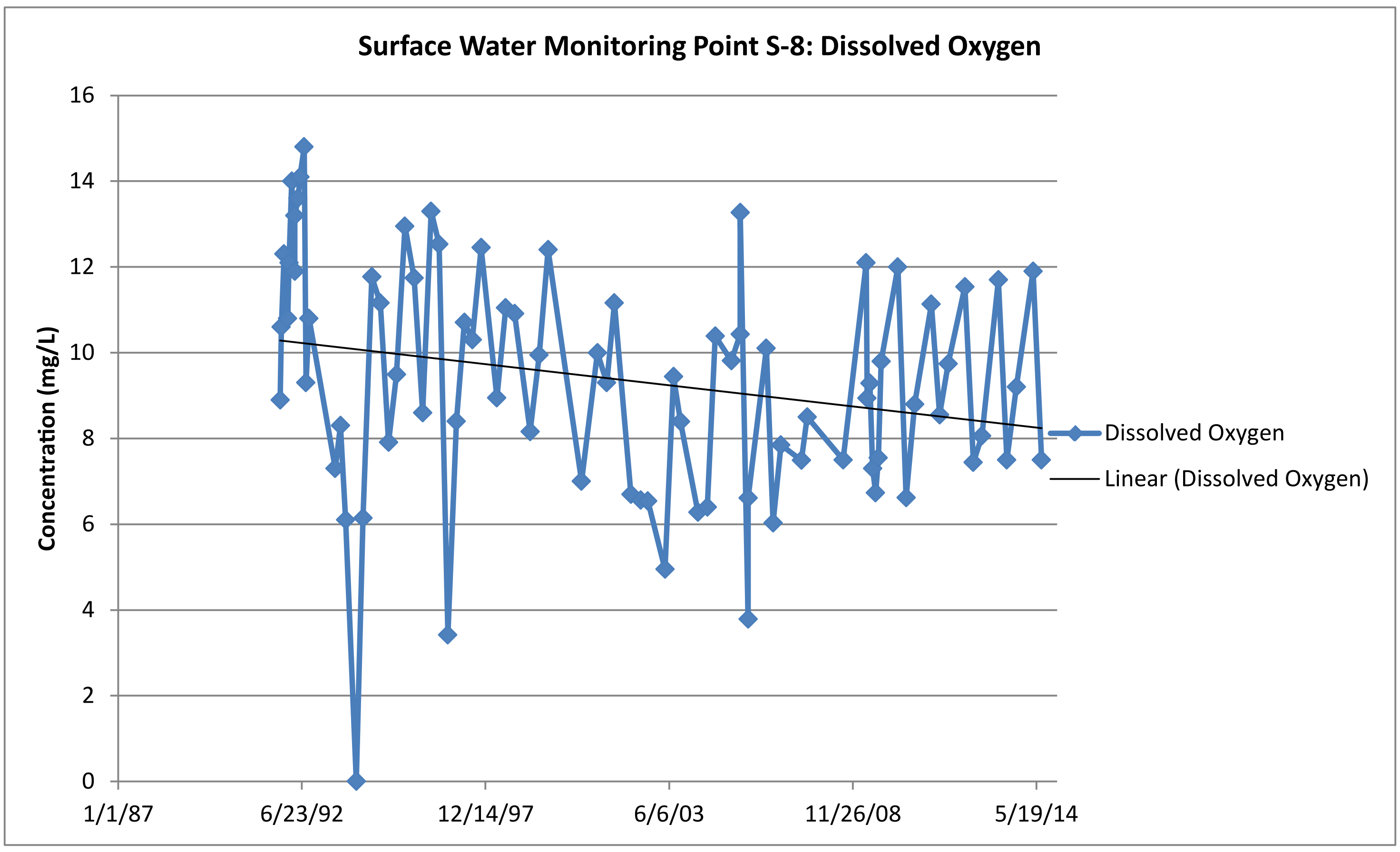

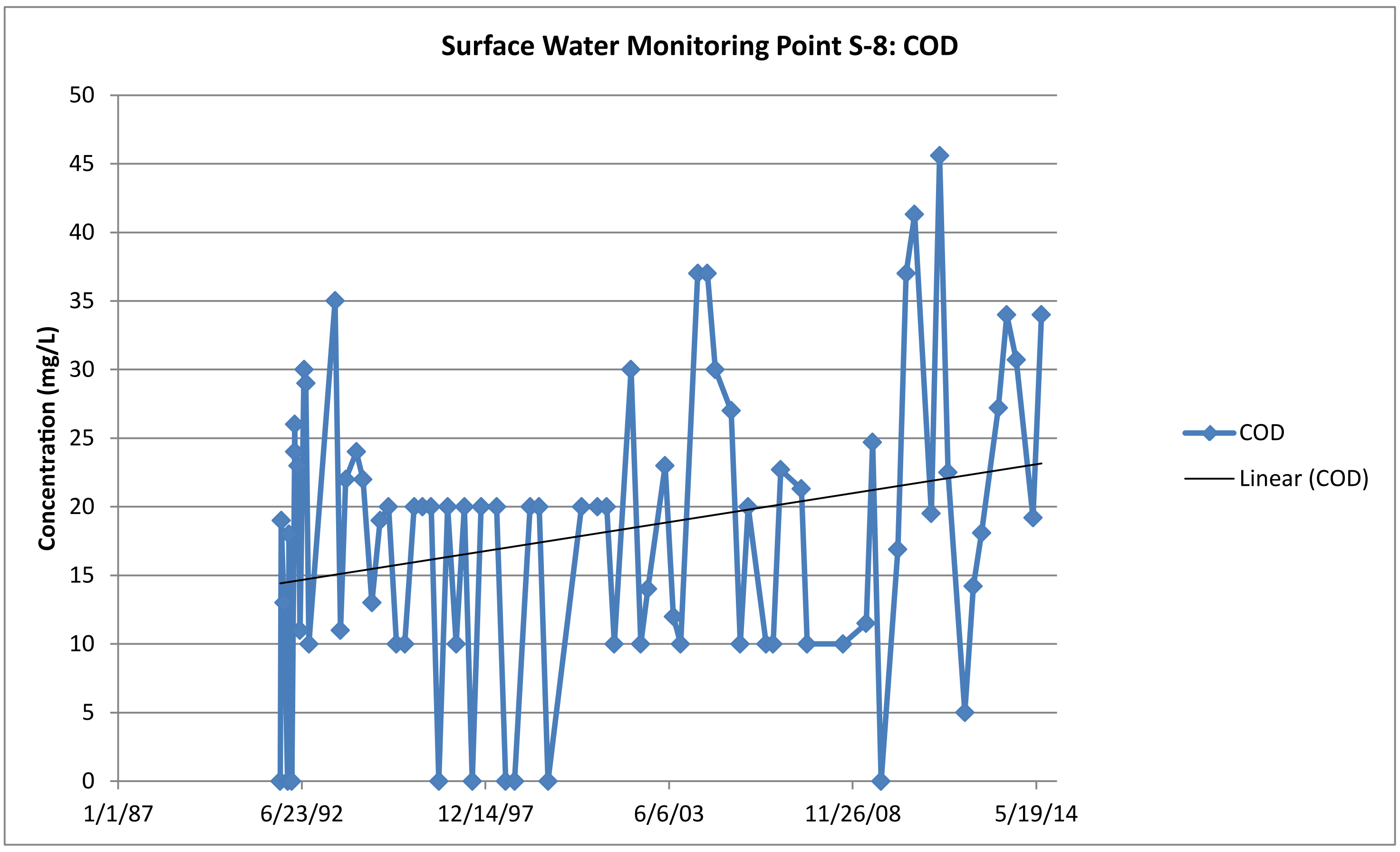

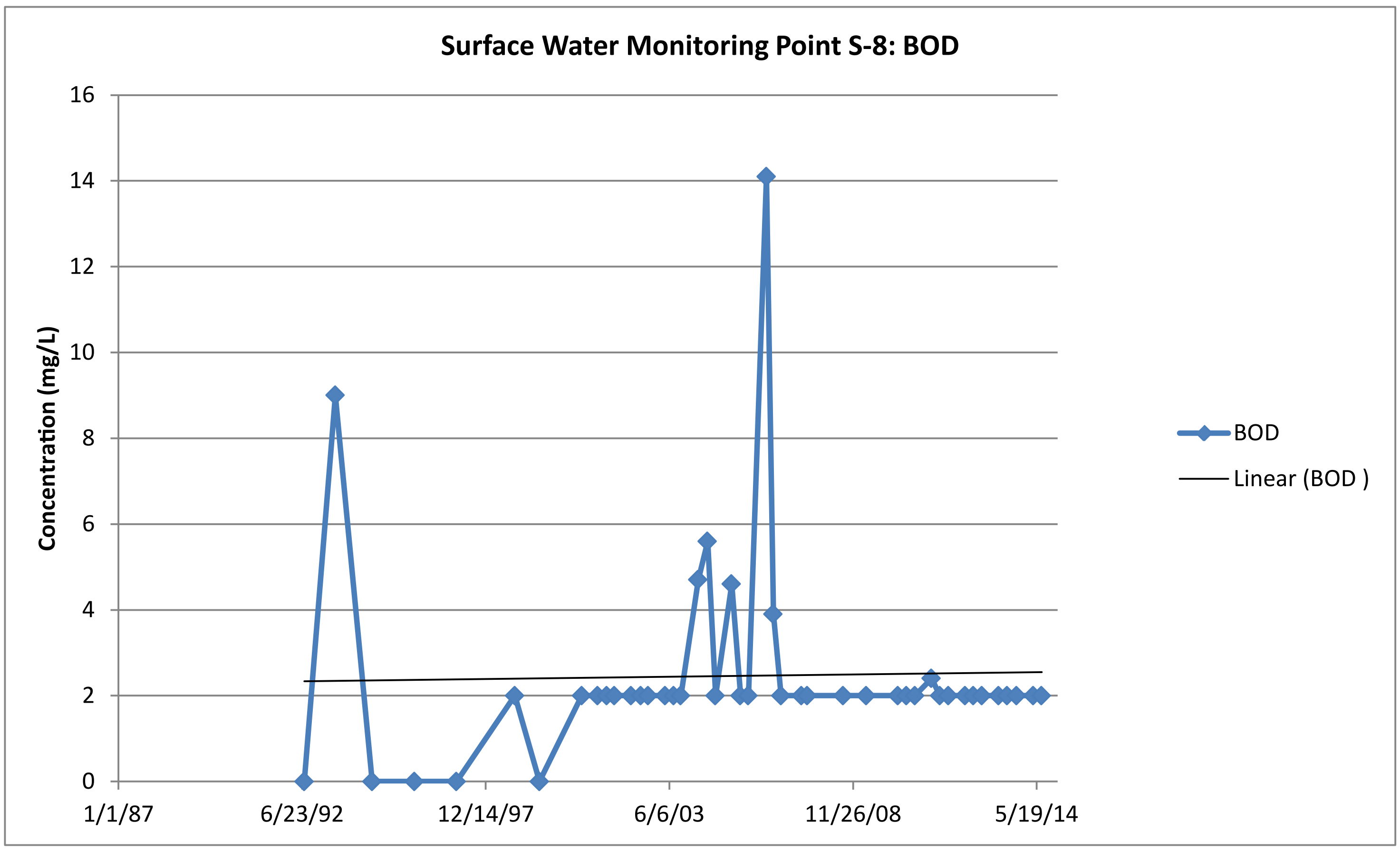

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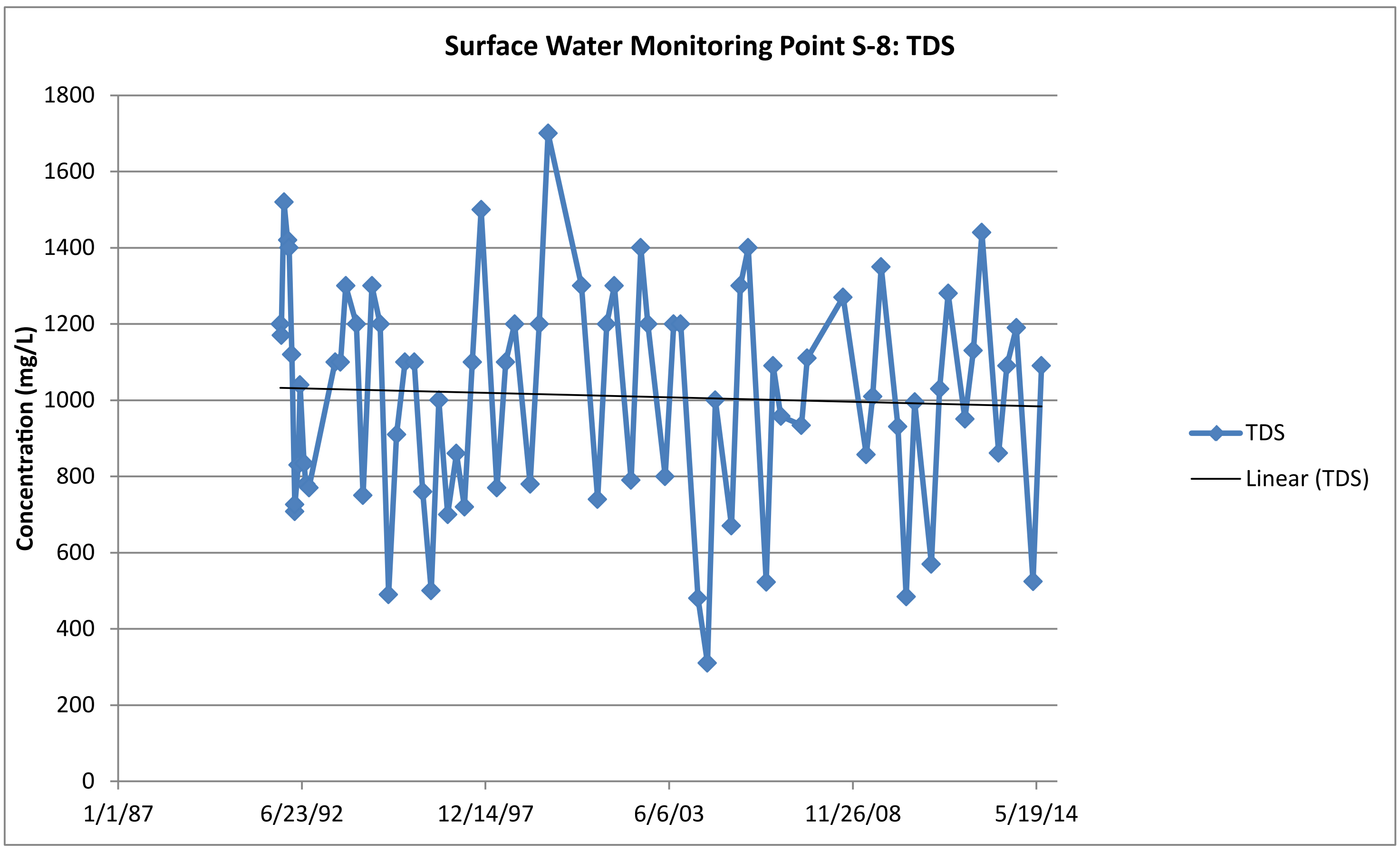
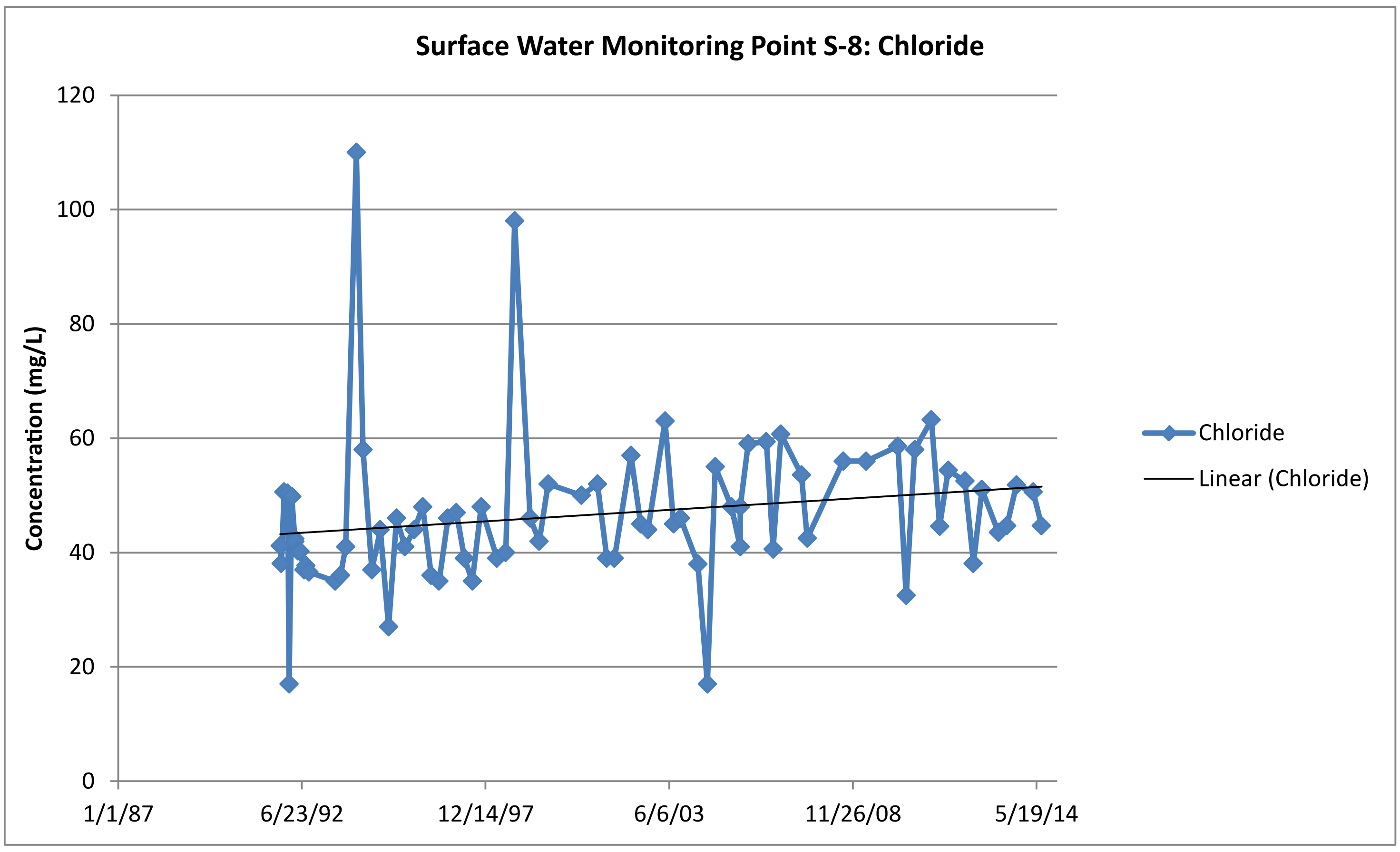
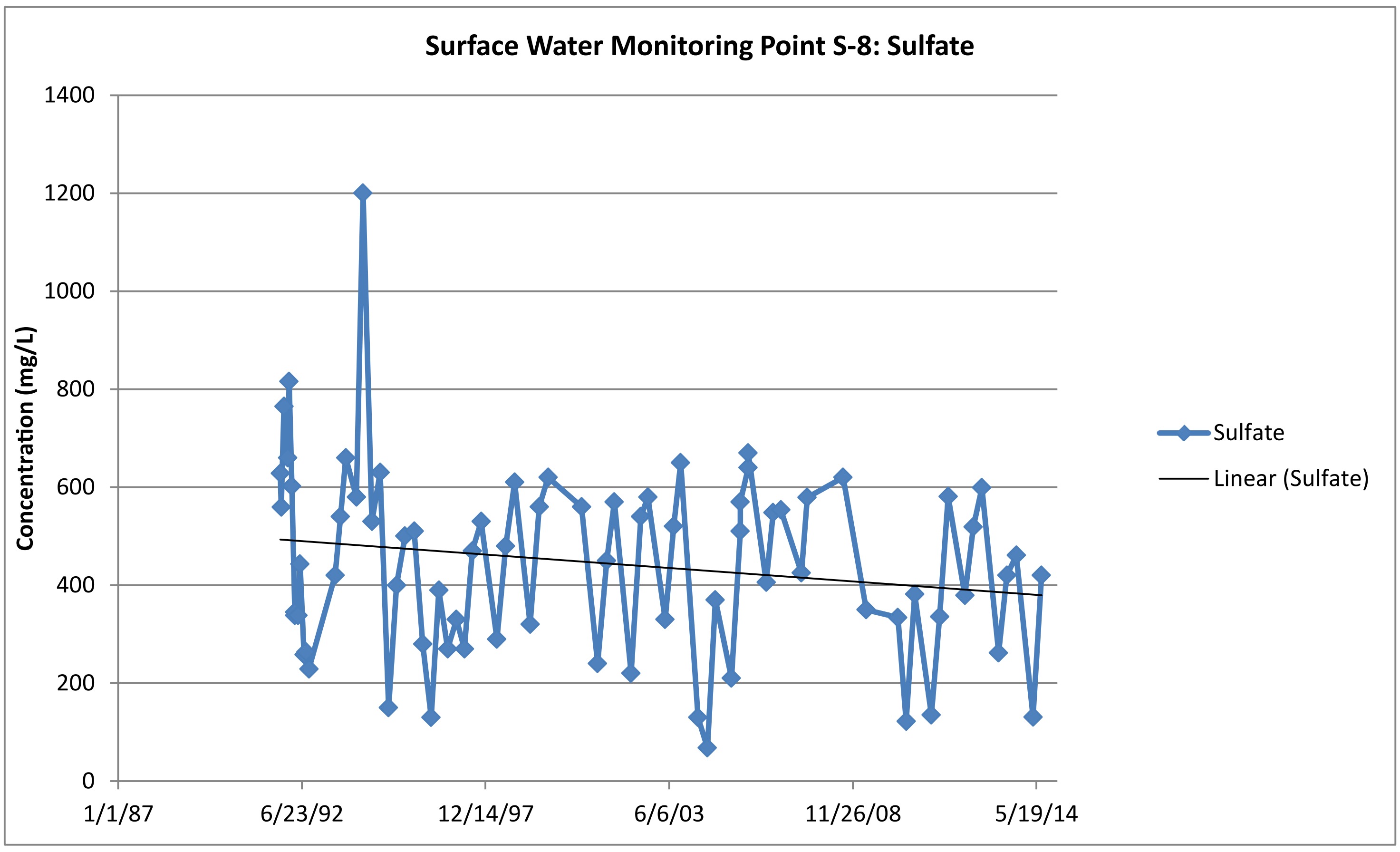


Surface Water Monitoring Point S-8: TDS



Surface Water Monitoring Point S-8: Chloride



Surface Water Monitoring Point S-8: Sulfate

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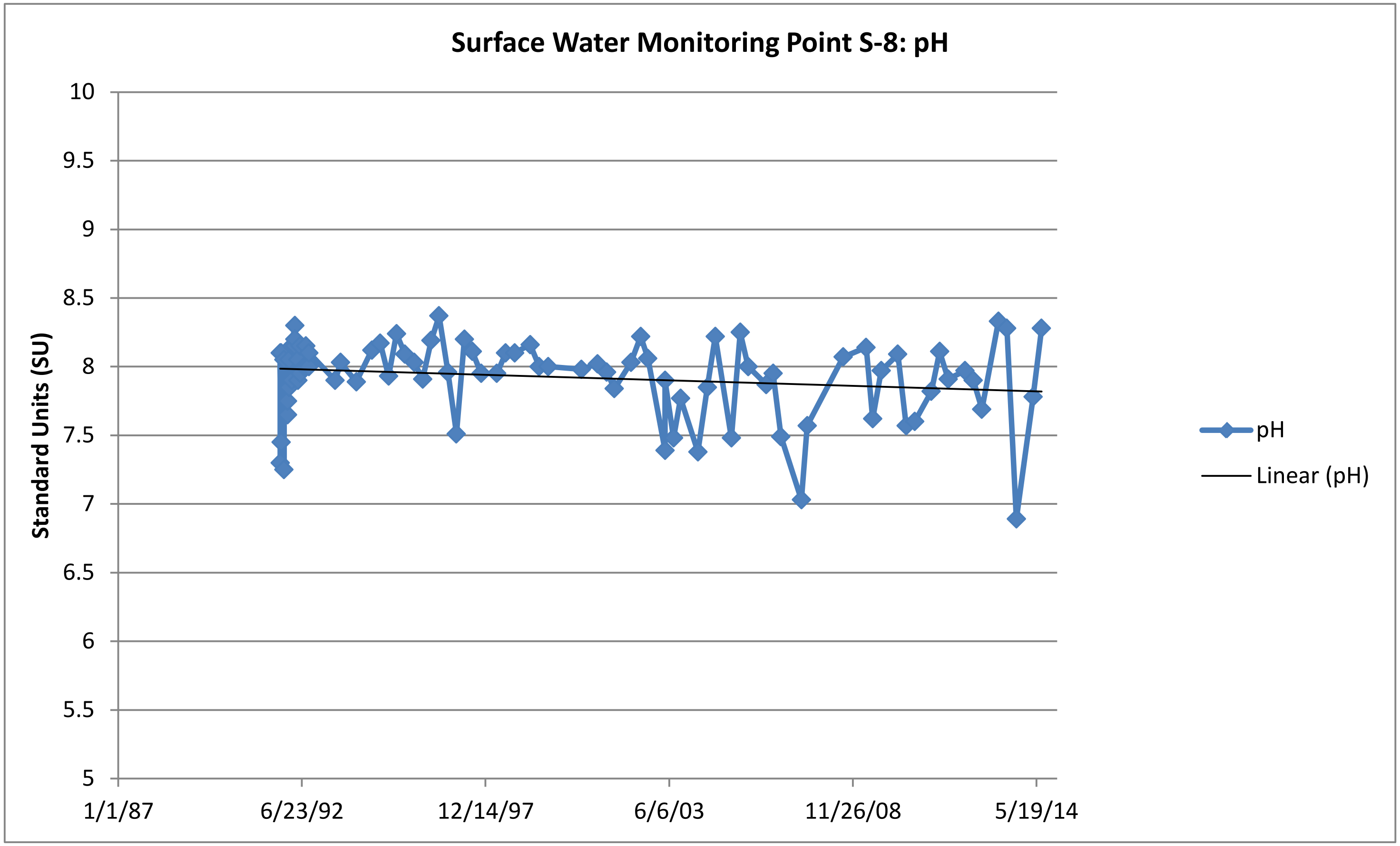
Appendix L



Mill Seat Landfill Proposed Landfill Expansion Hydrogeologic Investigation	GEI Consultants	**SURFACE WATER QUALITY TIME SERIES PLOT MONITORING LOCATION S-8**	
Town of Riga, New York Monroe County	Project 1328270	January 2015	Appendix L

Appendix M

Wetland Areas Recharge Calculations

APPENDIX M

Existing Condition Wetland RG-5 and RG-7 Water Balance

Water balance calculation of annualized recharge to Wetland RG-5 and Wetland RG-7. Recharge is derived from precipitation and runoff with groundwater discharge from the B-zone to the wetland area . This calculation quantifies the approximate volume of recharge contributed by both of these recharge mechanisms. While precipitation is somewhat uniformily distributed over an annual basis, groundwater discharge to the wetland occurs when the groundwater elevations in the area of the wetland are higher than the elevation of surface water in the wetland. It is possible for the wetland to recharge the groundwater when surface water elevations are higher than groundwater elevations. Evaluation of the temporal dynamics of wetland discharge through exfiltration, evapotranspiration, surface water outflow, and change in storage requires more refined inputs and a non-analytical solution (numerical model).

Figures M-1 and M-2 support this calculation.

Wetland RG-5 Recharge Rate = Recharge from Precipitation (QPr) + Recharge from Groundwater (QGw)

Recharge From Precipitation (QPr)

QPr = Volume of Direct Precipitation Falling on Wetland RG-5 (D_Pr) + Volume of Runoff from Precipation that Flows to Wetland (Rf)

D_Pr = Wetland Surface Area (A) X Average Rainfall (P)

A = 4,713,192 sq ft calculated from Figure M-1
P = 33.94 in/yr (ROC Airport)

* assume 50% of precipitation is intercepted by vegatation and does not reach surface water in wetland.

D_Pr = 4,713,192 sq ft X 33.94 in/yr / 12 in/ft X 0.50*
D_Pr = 6,665,239 cubic ft/yr or
D_Pr = 18,261 cubic ft/day

Rf = $P_{ovrf\ lo}$ X (Watershed boundary surface area {sq ft} - Wetland surface area {sq ft})

Watershed area = 14,265,900 sq ft or 327.3 acres
Wetland surface area = 4,713,192 sq ft

*assume 20% of precipitation flows overland and reaches the wetland.

Wtr shed area - Wetld area = 14,265,900 sq ft - 4,713,192 sq ft = 9,552,708 sq ft
P_ovrf lo = 33.94 /12 in/ft X 0.20* = 0.566 ft/year
Rf = 9,552,708 sq/ft X 0.566 ft
Rf = 5,403,648 cubic ft/yr or
Rf = 14,805 cubic ft/day

QPr = D_Pr + Rf

18,261 cubic ft/day + 14,805 cubic ft/day

QPr = 33,065 cubic ft/day

Recharge From Groundwater (QGw)

QGw = Volume of Groundwater Discharge (wetlands lies in area of exposed bedrock - B-zone flow)

QGw = Hydraulic conductivity X Hydaulic Gradient X Saturated Cross-Sectional Area

K = hydraulic conductivity of B-zone
I = hydraulic gradient
A = cross-sectional area

K = B-zone hydraulic conductivity is 3.5 ft/day
I = 0.003 ft/ft
A = 5,535 lin feet from north to south X 30 feet average sat. thickness (A to B zone) = 166050

QGw = K * I * A
QGw = 3.5 ft/day X 0.003 ft/ft X 166050 sq. ft

QGw = 1744 cubic ft/day

Wetland RG-5 Recharge Rate = **QPr** **+** **QGw**

Wetland RG-5 Recharge Rate **=** 33,065 cubic ft/day + 1,744 cubic ft/day

Wetland RG-5 Recharge Rate **=** 34,809 cubic ft/day

5 % recharge from groundwater
95 % recharge from precipitation and overland flow

Additional Recharge to RG-5 and Hotel Creek From RG-6 Outlet flow * 9,900 cubic ft/day

* Value from AMEC Geomatrix Hydrogeologic Investigation of the Soil Borrow Areas (2011) - see attached sheet and figure E-1

TOTAL Wetland RG-5 Recharge Rate with RG-6 Contribution **=** 44,709 cubic ft/day

Wetland RG-7 Recharge Rate = Recharge from Precipitation (QPr) + Recharge from Groundwater (QGw)

Recharge From Precipitation (QPr)

QPr = Volume of Direct Precipitation Falling on Wetland RG-5 (D_Pr) + Volume of Runoff from Precipation that Flows to Wetland (Rf)

D_Pr = Wetland Surface Area (A) X Average Rainfall (P)

A = 4,924,900 sq ft calculated from Figure M-1
P = 33.94 in/yr (ROC Airport)

* assume 50% of precipitation is intercepted by vegatation and does not reach surface water in wetland.

D_Pr = 4,924,900 sq ft X 33.94 in/yr / 12 in/ft X 0.50*
D_Pr = 6,964,629 cubic ft/yr or
D_Pr = 19,081 cubic ft/day

Rf = P$_{\text{\_ovrf lo}}$ X (Watershed boundary surface area {ft} - Wetland surface area {ft})

Watershed area = 16,043,148 sq ft or 368.3 acres
Wetland surface area = 4,924,900 sq ft

*assume 20% of precipitation flows overland and reaches the wetland.

Wtr shed area - Wetld area = 16,043,148 sq ft - 4,924,900 sq ft = 11,118,248 sq ft
P_ovrf lo = 33.94 /12 in/ft X 0.20* = 0.566 ft/year
Rf = 11,118,248 sq/ft X 0.566 ft/year
Rf = 6,289,222 cubic ft/yr or
Rf = 17,231 cubic ft/day

QPr = D_Pr + Rf

19,081 cubic ft/day + 17,231 cubic ft/day

QPr = 36,312 cubic ft/day

Recharge From Groundwater (QGw)

QGw = Volume of Groundwater Discharge (wetlands lies in area of exposed bedrock:- B-zone flow)

QGw = Hydraulic conductivity X Hydaulic Gradient X Saturated Cross-Sectional Area

K = hydraulic conductivity of B-zone
I = hydraulic gradient
A = cross-sectional area

K = ft/day
I = 0.004 ft/ft
A = 4920 lin feet from north to south X 30 feet average sat. thickness (A to B zone) = 147600

QGw = K * I * A
QGw = 3.5 ft/day X 0.004 ft/ft X 147600 sq. ft
QGw = 2066 cubic ft/day

Wetland RG-7 Recharge Rate = QPr + QGw

Wetland RG-7 Recharge Rate = 36,312 cubic ft/day + 2,066 cubic ft/day

Wetland RG-7 Recharge Rate = 38,378 cubic ft/day

5 % recharge from groundwater
95 % recharge from precipitation and overland flow

Calculation of Water Budget Change to RG-5 and RG-7 after Total Landfill Construction

Landfill construction would affect approximately 118 acres of the approximate 750 acres that comprise the collective drainage basins of wetlands RG-5, RG-6, and RG-7. The fully constructed landfill would change the direction of runoff from precipitation that currently falls within the current area of the RG-6 basin. Runoff from precipitation in this area of the proposed expansion area would be redistributed to either the basin of RG-5 or RG-7 based on the surface contours of the constructed landfill cap and the slope of drainage ditches constructed along the landfill perimeter. Surface water captured by these ditches would discharge to storm water retention ponds and discharge to either RG-5/Hotel Creek (via SRP-7) or RG-7 (via SRP-8). Analysis of design drawings indicates approximately 57 acres of land surface situated on the eastern side of the RG-6 basin that currently discharges to RG-5 and Hotel Creek via the RG-6 outlet drainage swale would be redistributed and discharged to RG-7 at SRP-8.

Figure M-2 supports this analysis

Existing Condition

Wetland RG-5 Recharge Rate (incl. RG-6 Outlet discharge) = 44,709 cubic ft/day

Constructed Condition

RG5 Recharge Rate = Flow from RG-5 outside of the landfill footprint + Flow from RG-6 - Diversion of flow from Construction

34,809 cubic ft/day + 9,900 cubic ft/day - Diversion of flow from Construction

The hatched area on Figure M-2 shows the area where existing flow to RG-5 would be diverted to RG-7

Surface Area with diversion of flow from construction = 57 acres or 2482920 sq ft

Runoff from watershed area (Rf) = 2482920 sq ft X 0.566 ft/year runoff

Diversion of flow from construction 1405332.7 cubic ft/yr

or 3850.2266 cubic ft/day

RG5 Recharge Rate = Flow from RG-5 outside of the landfill footprint + Flow from RG-6 - Diversion of flow from Construction

34,809 cubic ft/day + 9,900 cubic ft/day - 3850 cubic ft/day

RG5 Recharge Rate after construction = 40,859 cubic ft/day or 8.6% less recharge

Based on the diversion of flow calculated above:

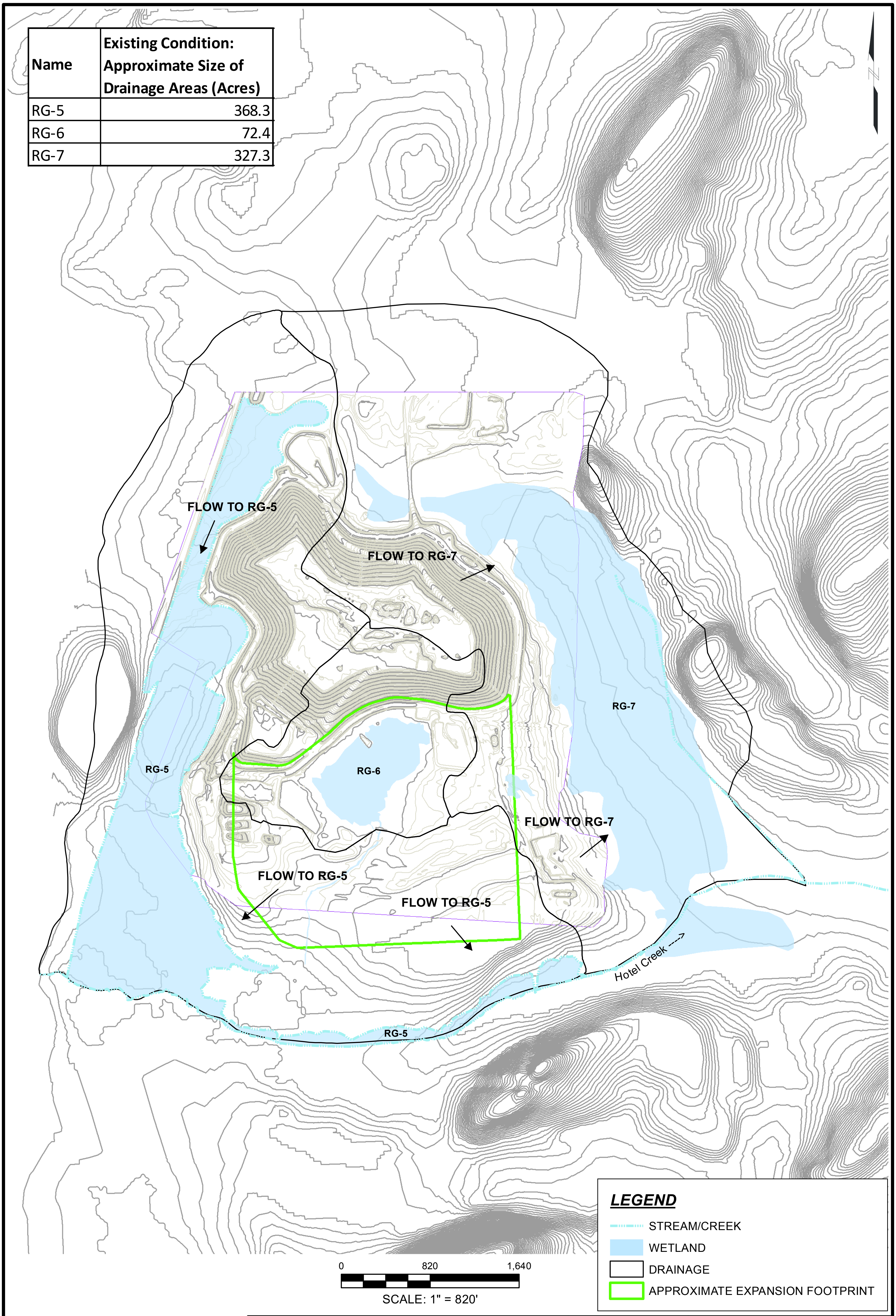
RG7 Recharge Rate = Flow from RG-7 outside of the landfill footprint + Diversion of flow from Construction

38,378 cubic ft/day + Diversion of flow from Construction

38,378 cubic ft/day + 3850 cubic ft/day

RG7 Recharge Rate after construction = 42,229 cubic ft/day or 10% more recharge

Name	Existing Condition: Approximate Size of Drainage Areas (Acres)
RG-5	368.3
RG-6	72.4
RG-7	327.3



SOURCE:
1.Topographic basemap and wetland boundaries provided by Barton and Loguidice, D.P.C.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

SURFACE WATER FLOW
(CURRENT CONDITIONS)

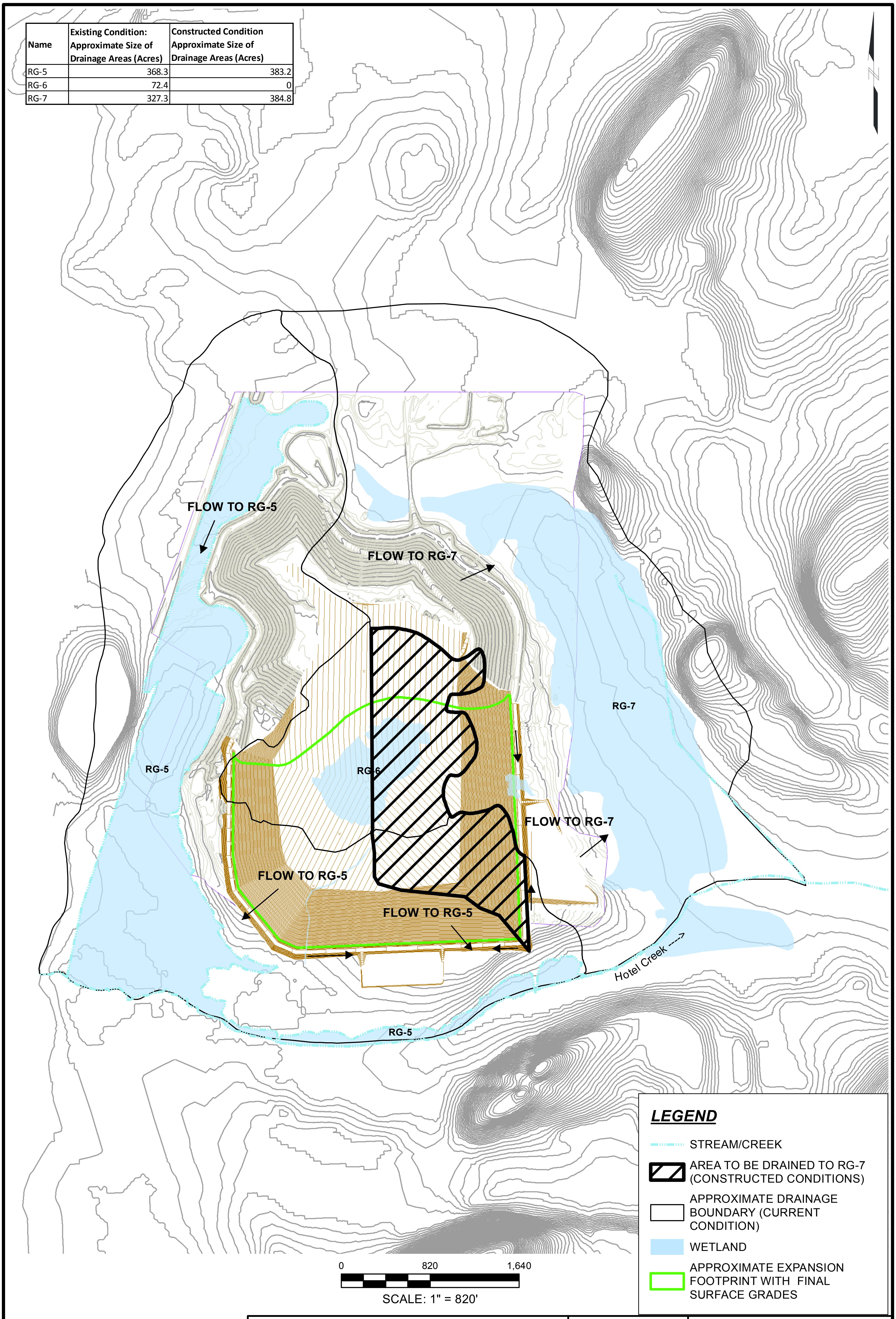
Project 1328270

January 2015

Fig. M-1

J:\Projects\Waste Managment of New York\Mill Seat Landfill\MillSeat-Wetland.mxd

Name	Existing Condition: Approximate Size of Drainage Areas (Acres)	Constructed Condition Approximate Size of Drainage Areas (Acres)
RG-5	368.3	383.2
RG-6	72.4	0
RG-7	327.3	384.8



LEGEND

- ┅ STREAM/CREEK
- ▨ AREA TO BE DRAINED TO RG-7 (CONSTRUCTED CONDITIONS)
- ☐ APPROXIMATE DRAINAGE BOUNDARY (CURRENT CONDITION)
- 🟦 WETLAND
- 🟩 APPROXIMATE EXPANSION FOOTPRINT WITH FINAL SURFACE GRADES

SOURCE:
1.Topographic basemap and wetland boundaries provided by Barton and Loguidice, D.P.C.

Mill Seat Landfill
Proposed Landfill Expansion
Hydrogeologic Investigation

Town of Riga, New York
Monroe County

GEI Consultants

SURFACE WATER FLOW
(CONSTRUCTED
CONDITIONS)

Project 1328270

January 2015

Fig. M-2

J:\Projects\Waste Managment of New York\Mill Seat Landfill\MillSeat-Wetland Final Grade.mxd

Comparison of Wetland RG-6 Recharge Rates

Recharge to Wetland RG-6 is primarily surface water runoff from precipitation that falls on the south side of the active landfill area and the discharge of groundwater from the Upper Water-Bearing Zone and the B-zone. This calculation quantifies the approximate volume of recharge contributed by both of these recharge mechanisms. While precipitation is somewhat uniformily distributed over an annual basis, groundwater discharge to the wetland occurs when the groundwater elevations in the area of the wetland are higher than the elevation of surface water in the wetland. It is possible for the wetland to recharge the groundwater when surface water elevations are higher than groundwater elevations. Evaluation of the temporal dynamics of wetland discharge through exfiltration, evapotranspiration, surface water outflow, and change in storage requires more refined inputs and a non-analytical solution (numerical model).
Figure E-1 supports this calculation.

Wetland RG-6 Recharge Rate = Recharge from Precipitation (QPr) + Recharge from Groundwater (QGw)

Recharge From Precipitation (QPr)

QPr = Volume of Direct Precipitation Falling on Wetland RG-6 (D_Pr) + Volume of Runoff from Precipation that Flows to Wetland (Rf)

D_Pr = Wetland Surface Area (A) X Average Rainfall (P)

A = 882,000 sq ft calculated from Figure E-1
P = 33.94 in/yr (ROC Airport)

assume 20% of precipitation is intercepted by vegatation and does not reach surface water in wetland.

D_Pr = 882,000 sq ft X 33.94 in/yr / 12 in/ft X 0.80
D_Pr = 1,995,672 cubic ft/yr or
D_Pr = 5,468 cubic ft/day

Rf = P X Overland flow from Area 2, Area 4, and south side of landfill the flows to retention pond

Area 2 = 460,450 sq ft calculated from Figure E-1
Area 4 = 267,500 sq ft calculated from Figure E-1
South Side of Landfill = 1,551,700 sq ft calculated from Figure E-1

*assume 25% of precipitation flows overland and reaches the wetland.

Rf = 460,450 + 267,500 + 1,551,700 sq ft
Rf = 33.94 /12 in/ft X 0.25* X 2,279,650 sq ft or 52.4 acres
Rf = 1,611,903 cubic ft/yr or
Rf = 4,416 cubic ft/day

QPr = D_Pr + Rf

Pr = 5,468 cubic ft/day + 4,416 cubic ft/day
Pr = 9,884 cubic ft/day

From: AMEC Geomatrix Hydrogeologic Investigaiton Soil Borrow Areas, January 2011

Recharge From Groundwater (QGw)
QGw = Volume of Groundwater Discharge

QGw = Hydraulic conductivity X Hydaulic Gradient X Saturated Cross-Sectional Area

K = hydraulic conductivity of till
I = hydraulic gradient
A = cross-sectional area

K = 1.6E-7 cm/s (SB-7) to 7.9E-6 cm/s (MW06-1S); say 1 E-5 cm/s or 0.028 ft/day to be highly conservative
I = 0.03 ft/ft - PZ-2 to SW in RG-6
A = 2000 lin feet along south, west, and north side of RG-6 X 12 feet average sat. thickness = 24,000

QGw = K * I * A
QGw = 0.028 ft/day X 0.03 ft/ft X 24000 sq. ft
QGw = 20 cubic ft/day

Wetland RG-6 Recharge Rate = QPr + QGw

Wetland RG-6 Recharge Rate **=** 9,884 cubic ft/day + 20 cubic ft/day

Wetland RG-6 Recharge Rate **=** 9,904 cubic ft/day

LEGEND

- - 670 - - EXISTING CONTOURS (SEE NOTE 1)

⌒⌒⌒ EXISTING VEGETATION (SEE NOTE 1)

— — — PROPERTY LINE (SEE NOTE 2)

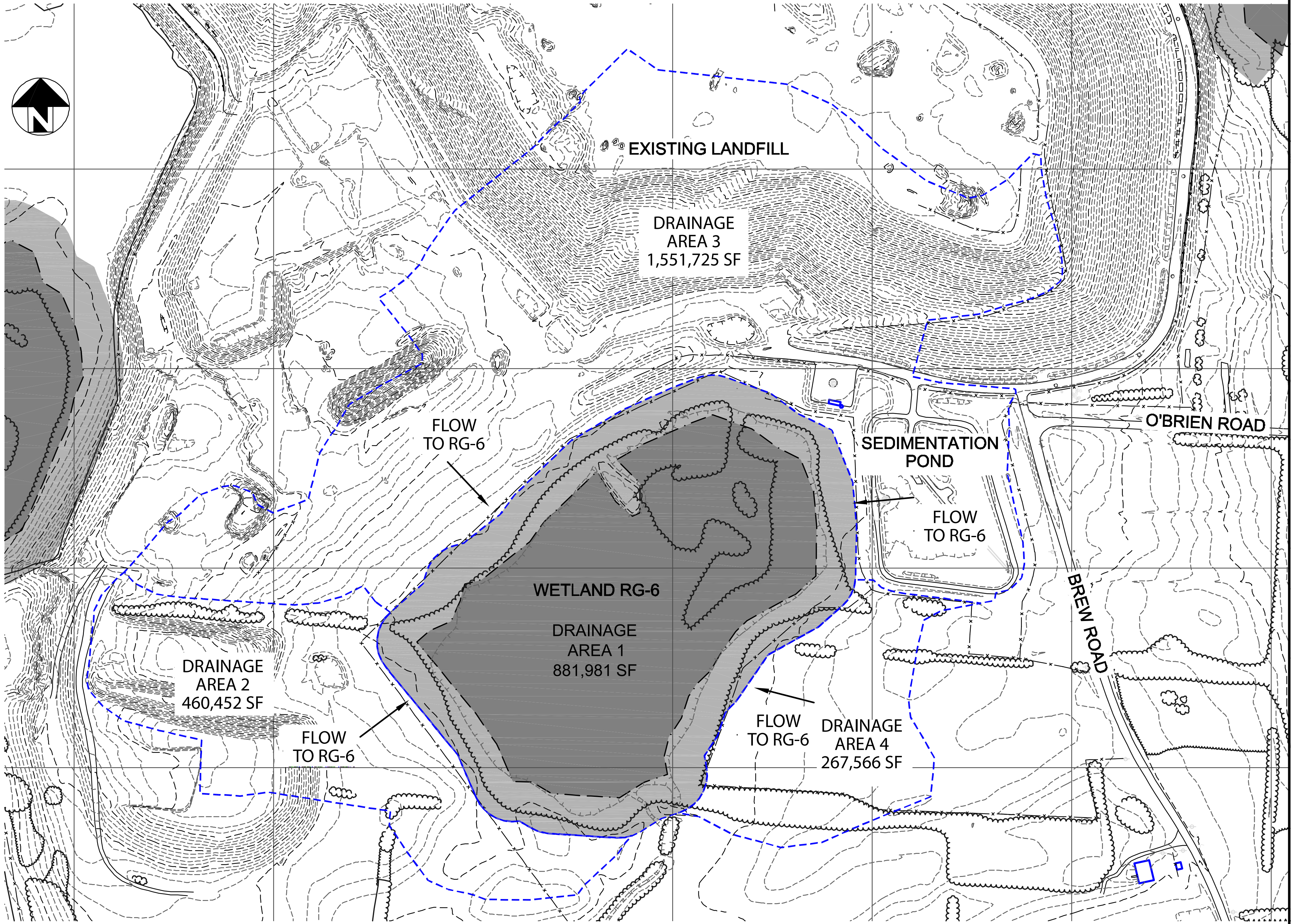
▨ DELINEATED WETLANDS (SEE NOTE 3)

▨ 100' WETLAND BUFFER (SEE NOTE 3)

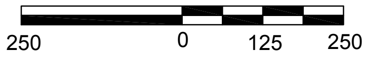
- - - - EXISTING DRAINAGE AREAS

NOTES:

1. Existing site topography and features are based on aerial photography dated July 12, 2008 compiled by Air Survey Corp.
2. Property lines were provided by Golder Associates from drawing file X07386309A-Property Line.
3. Wetland boundaries and buffers are based on record drawings prepared by Clark Engineers & Associates titled "Site Plan 1 of 5 to Site Plan 5 of 5" dated 1994.
4. Figure reproduced from a drawing by McMahon & Mann Consulting Engineers, P.C.



EXISTING CONDITIONS PLAN



Scale in feet

From AMEC Geomatrix (2011) Soil Borrow Area Hydrogeologic Investigation Report Appendix E

SURFACE WATER FLOW DIRECTIONS:
BOVEE ROAD PROPERTY
Mill Seat Landfill
Bovee Road Property Hydrogeologic Investigation
Town of Riga, New York

By: DMH	Date: Nov. 2008	Project No. 12625
AMEC Geomatrix		Figure E-1

Appendix N

Environmental Monitoring Plan

Mill Seat Landfill Expansion
Facility ID No. 8-2648-00014

Town of Riga, New York

COUNTY OF MONROE
STATE OF NEW YORK

APPENDIX N
Environmental Monitoring Plan

WASTE MANAGEMENT

February 2015

GEI Consultants

6 NYCRR Part 360 Permit Application

For the Proposed Mill Seat Landfill Expansion
303 Brew Road
Town of Riga, Monroe County, New York
Facility ID No. 8-2648-0014

Hydrogeologic Report

APPENDIX N
Environmental Monitoring Plan

Prepared For:

Monroe County
39 West Main Street
Rochester, New York 14614

Prepared By:

Waste Management of New York, LLC
303 Brew Road
Bergen, New York 14416

and

GEI Consultants, Inc., P.C.
90B John Muir Drive, Suite 104
Amherst, New York 14228

February 2015

Table of Contents

Tables

Figures

Attachments

Glossary of Terms and Acronyms

6 NYCRR Part 360 Permit Application – In order to modify, the County must demonstrate compliance with the design, construction, operation, and closure requirements of 6 NYCRR Part 360 to demonstrate the expansion's compliance with current regulations.

6 NYCRR Part 360 – NYSDEC's solid waste management regulations, codified at 6 NYCRR Part 360 (Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York), effective May 12, 2006.

AMSL – Above Mean Sea Level

***ASP* –** Analytical Services Protocol

B&L – Barton & Loguidice, D.P.C.

County – Monroe County, New York.

CMP – Contingency Monitoring Plan

***CSS* –** Critical Stratigraphic Section

***dB* –** decibel

***DO* –** Dissolved Oxygen

***DQO* –** Data Quality Objective

***DQR* –** Data Quality Reviews

***ELAP* –** Environmental Laboratory Approval Program

EMP – Environmental Monitoring Plan

***fasl* --** feet above sea level

***fbgs* --** feet below ground surface

FEIS -- Final Environmental Impact Statement

***FIDs* --** fracture intensification domains

***ft/day* –** feet per day

GEI - GEI Consultants, Inc. (P.C.)

GWSS – Groundwater suppression system

Hydrogeologic Investigation Area – The area studied for bedrock and groundwater characteristics for siting the Proposed Landfill Expansion. This area stretches across the Proposed Site over the existing monitoring well network and various borings, test pits, and piezometers installed as part of previous and current hydrogeologic investigations. This area stretches north to the existing landfill infrastructure, south across Bovee Road to the Proposed Wetland Mitigation Area, and is bounded to the east and west by Wetlands RG-7 and RG-5, respectively and the Proposed Wetland Mitigation Area property boundaries.

LEL – Lower explosive limit

Leq – Equivalent continuous sound pressure level

LFG – Landfill gas

LFGTE Facility – Landfill gas to energy facility

mg/L – milligram per liter

MCDES – Monroe County Department of Environmental Services

MCDOH – Monroe County Department of Health

MCDPW – Monroe County Department of Public Works

Mill Seat Landfill – Currently permitted landfill and associated operations.

MS/MSD – Matrix Spike/Matrix Spike Duplicate

MSW – Municipal solid waste

NAPLs – Non-Aqueous Phase Liquids

NELAC – National Environmental Laboratory Accrediting Council

NIST – National Institute of Standards and Technology

NYCRR – New York Official Compilation of Codes, Rules and Regulations

***NYGWQS* –** New York Groundwater Quality Standards as provided in Technical and Operational Guidance Series (TOGS) 1.1.1 and in 6 NYCRR Part 703

***NYSDEC* –** New York State Department of Environmental Conservation

***NYSDOH* –** New York State Department of Health

***Permitted Footprint* –** The existing 98.6 acres of the Permitted Site allocated for solid waste disposal within a double composite liner system.

***Permitted Site* –** The land on which the Permitted Footprint and associated support features (including buildings and structures, stormwater ponds, access roads, and borrow areas) is located, and the land included as part of the Landfill Lease Agreement. The Permitted Site totals 485 acres.

***PM10* –** Particulate matter 10 microns

PQL – Practical Quantitation Limit

***Proposed Footprint* –** The 118.3 acres allocated for solid waste disposal within the proposed double composite liner system in addition to and directly adjacent to the Permitted Footprint.

***Proposed Landfill Expansion* –** The addition of a contiguous footprint to the south of the Permitted Footprint. This defined term is specific to the Proposed Footprint of an additional 118.3 acres, 39.2 acres of overlay onto the Permitted Footprint, and any support features (stormwater management structures, access roads, LFG collection and control infrastructure, and leachate conveyance infrastructure).

QA/QC – Quality Assurance/Quality Control

***QAPP* –** Quality Assurance Project Plan

RQD – Rock Quality Designation

RPD – Relative Percent Difference

***S* –** Surface water monitoring locations

***SAP* –** Site Analytical Plan

SED – Sediment monitoring locations

SOPs– Standard Operating Procedures

SPDES – New York State Pollutant Discharge Elimination System

***SRP* –** Stormwater Retention Pond

***SWMF* –** Solid Waste Management Facility

***TSP* –** Total suspended particulate matter

***ug/L* –** microgram per liter

USEPA – United States Environmental Protection Agency

***WMNY* –** Waste Management of New York, LLC operates the Mill Seat Landfill under a lease agreement with Monroe County.

***WQAV* –** Water Quality Action Value

1. Introduction

This document presents the updated EMP for the Mill Seat Landfill and Proposed Landfill Expansion and is submitted with a 6 NYCRR Part 360 Permit Application for lateral expansion of the Mill Seat Landfill. The EMP provides information necessary to monitor the environmental conditions for the Mill Seat Landfill and the Proposed Landfill Expansion. The development of this EMP is based on a detailed understanding of site conditions obtained from several hydrogeologic studies completed at the Mill Seat Landfill and environmental monitoring data gathered from over 15 years of routine monitoring of landfill systems and environmental media including groundwater, surface water, liquids in landfill systems, ambient air, and noise, performed in accordance with regulatory requirements. The EMP is a stand-alone document but should be read in context with the Hydrogeologic Report (GEI, 2015) for which this document is a component of (i.e., referred to as Appendix N in the Hydrogeologic Report). The EMP was prepared to be consistent with regulations in 6 NYCRR Part 360-2.11(c).

1.1 EMP Organization

Section 1.0 provides general background information for the Mill Seat Landfill and the Proposed Landfill Expansion. Section 2.0 summarizes geologic and hydrogeologic conditions and describes the CSS for the Mill Seat Landfill and Proposed Landfill Expansion. Section 3.0 describes the environmental monitoring program for groundwater, surface water/sediment, landfill systems (including leachate, groundwater suppression, and storm water), ambient air and noise. Section 4.0 presents procedures to evaluate data obtained by the monitoring program. Section 5.0 presents the SAP. Section 6.0 describes laboratory QA/QC and Section 7.0 discusses the data quality review, reporting and recordkeeping procedures.

1.2 Site Background

The Permitted Site is located on 485 acres of land on Brew Road in the Town of Riga, Monroe County, New York (Figure 1) and is owned by the County but operated by WMNY under the landfill’s SWMF Permit I.D. 8-2648-0014. The Permitted Footprint is centrally located on approximately 100 acres, with the remaining acreage used for internal roadways, buffer areas, and support facilities (Administration and Maintenance Buildings, retention ponds, leachate collection and pump stations, a Scale House, LFGTE Facility). The Mill Seat Landfill is a state-of-the-art SWMF that is comprised of a double composite liner system with a primary and secondary leachate collection system. The Mill Seat Landfill is receiving MSW, non-hazardous industrial solid waste, and biosolids. The Proposed Footprint is shown on Figure 2 with soil borings, test pits, piezometers, and monitoring wells used to characterize the area.

The remainder of this section summarizes landfill construction of the Permitted Footprint and environmental monitoring performed to comply with regulations in 6 NYCRR Part 360-2.11(c). This section also describes construction, fill progression and environmental monitoring for the Proposed Landfill Expansion.

Permitted Footprint

The Permitted Footprint was developed in a series of Stages, Stage I through Stage IV. Stage IV, located southwest of the pre-existing Stages, is the final remaining landfill Stage to receive waste. All Stages are constructed of multiple double-lined subcells, which are configured to generally drain outwards from the center of the perimeter of the Permitted Footprint. All subcells are gravity drained to perimeter manholes and leachate conveyance piping with the exception of Stage IV. Leachate from Stage IV drains into a common sump and utilize a shared side riser pumping station that removes leachate into the gravity conveyance header along the perimeter of the Permitted Footprint. The leachate is conveyed by the header piping system to pump stations which pump the leachate to the leachate control building for storage in the leachate storage tanks or transfer to the Mill Seat Pump Station. The Mill Seat Pump Station then pumps the leachate to the County’s Pure Waters District for final treatment and disposal.

Environmental Monitoring for the Permitted Footprint

In October 1989, the MCDPW prepared an EMP for the Mill Seat Landfill to provide the framework for compliance with the conditions of 6 NYCRR Part 360-2.11(c). The EMP is a resource and a reference document that identifies the specific solid waste management requirements for the Mill Seat Landfill. Prior to the operation of the Mill Seat Landfill in April 1993, the MCDPW revised the October 1989 EMP in November 1989 and September 1990. The EMP was subsequently modified in 2000 and 2003 by O’Brien & Gere and by AMEC Geomatrix in 2011 to achieve environmental monitoring objectives during landfill operations. The 2011 EMP included monitoring of the following:

- Groundwater on-site and off-site;
- Surface water and sediment in adjacent wetlands;
- Hotel Creek surface water and sediment;
- Noise;
- LFG;
- Airborne particulates; and
- Landfill systems including leachate in the primary and liquid in the secondary leachate collection systems, groundwater suppression system {GWSS} drains, and discharge from storm water retention ponds

The environmental monitoring program is implemented on a quarterly basis; however, the first quarter (winter months from January through March) is excluded with an EMP modification and NYSDEC approval in correspondence to the County in 1997 and 1998.

Proposed Landfill Expansion

Construction of the Proposed Landfill Expansion will proceed in a southward progressive manner with the first Stages (designated Stage V) constructed adjacent to the southern boundary of the Permitted Footprint. Portions of Stage V construction will overlap onto the existing Permitted Footprint and will require relocation of the storm water retention pond DP-2 and mitigation of Wetland RG-6. The progression of various Stages of the Proposed Landfill Expansion is shown on Figure 3. The volume of each Stage and/or Subcell and the corresponding estimated site life is shown in the table below.

Stage Development	Acreage	Capacity (CY)	Projected Site Life (Years)*
V-A and VI-A	12.6	1,300,031	1.3
V-B	8.6	2,745,316	2.8
VI-B	13.4	3,940,766	4.1
VII	20.8	4,918,311	5.1
VIII	21.5	5,355,175	5.5
IX-A	21.6	5,769,094	5.9
IX-B	19.8	5,859,366	6.0
Totals	**118.3**	**29,900,000**	**30.7**

* Based on a waste acceptance rate of 776,000 tons per year at a density of 0.80 tons/CY

The initial Proposed Landfill Expansion construction will consist of developing Stages V-A and VI-A located off the southeast corner of the Mill Seat Landfill. It is estimated that construction of the first double composite liner system extension will commence in 2016. Leachate collected from individual Stages of the Proposed Landfill Expansion will be conveyed to Pump Station No. 4 which will be constructed on the north side of the Permitted Footprint. A GWSS will be constructed beneath each stage of the double composite liner system to ensure that the maximum elevation of groundwater is not less than five (5) feet from below the double composite liner system. Pore water drainage will flow via gravity to the side riser building where it will be pumped to the storm water retention ponds. Storm water for the Proposed Landfill Expansion will be collected in two (2) storm water retention ponds (SRP-7 and SRP-8) constructed on the east and south side of the Proposed Footprint.

Environmental Monitoring for the Proposed Landfill Expansion

The Proposed Landfill Expansion will require modification of the 2011 EMP. Additional groundwater monitoring and landfill system monitoring will be required to adequately monitor the Mill Seat Landfill and Proposed Landfill Expansion to comply with 6NYCRR Part 360. The remainder of this EMP will address monitoring needs for monitoring the Proposed Landfill Expansion and Mill Seat Landfill. It is important to note that fill progression as described above will occur over a period of decades. As a result, the monitoring well network described in Section 3.0 will be installed in phases as fill progression occurs south of the Permitted Footprint to monitor the Proposed Landfill Expansion.

2. Hydrogeologic Setting

The geologic and hydrogeologic discussions presented in this EMP provide a brief description of regional and site conditions. Detailed discussions of the geological conditions are presented in the Hydrogeologic Report for Proposed Landfill Expansion (February, 2015) and in earlier hydrogeologic studies conducted in support of the Mill Seat Landfill.

2.1 Regional Geology and Hydrogeology

The Mill Seat Landfill is situated within the Erie-Ontario Lowlands physiographic province. The region consists of broad plains of relatively low relief, underlain by gently south-southwestward dipping sedimentary bedrock of the early Paleozoic age. The regional bedrock is covered by a veneer of glacially derived sediments that exhibit four (4) distinct glacial successions during the Pleistocene Era. The most visible landforms produced by glacial advances and retreat in the northern portion of central New York State are drumlins. Drumlins shape the topographic landscape in the southern portion of the County as elongated hills. Geologic deposits from drumlin formation occur in the area of the Permitted Footprint and Proposed Footprint.

Bedrock units in western New York strike east-west and dip south-southwest at an angle of 1^0 to 2^0 (50 to 80 ft./ mile). Bedrock in the southern portion of the County consists of rock units of the Upper Silurian Salina Group. The bedrock formations contain evaporite lithology (gypsum and halite {salt}) with interbedded dolomite, shale, and mudstone. The Syracuse and Vernon Formations of the Salina Group outcrop in southern Monroe County. Bedrock surface exposures are limited to areas where excavations and streams and creeks have cut through glacial sediment to expose bedrock surfaces.

The bedrock underlying the Permitted Footprint and Proposed Footprint consists of the Vernon Formation. The Vernon Formation is typically a dolomitic shale with dolostone interbeds and has been further subdivided into three (3) units as follows:

- Vernon C Unit (includes a dolostone marker bed known as the CB Horizon)
- Vernon B Unit
- Vernon A Unit

Historic study of the Mill Seat Landfill area prior to site development (H&A, 1989) correlated the site bedrock strata to regional bedrock formations outcropping and subcropping in Monroe, Genesee and Livingston Counties within 15 miles of the Mill Seat Landfill. This was accomplished using correlated salt bed mapping cross-sectional data from Rickard (1969) with rock core description information and litho-density gamma ray logs from deep exploratory well P8S (previously abandoned by H&A) located beneath the Permitted Footprint. This work correlated the upper 100 feet of bedrock beneath the Permitted Site to regional correlative members within the Vernon Formation. Based on rock core descriptions and gamma ray log information, it was determined that the Proposed Site, including the Proposed Landfill Expansion, overlies the Vernon C Unit of the Vernon Formation.

2.2 Local Geology and Hydrogeology

Glacially-derived materials cover sedimentary bedrock in the Proposed Landfill Expansion and the area surrounding the Mill Seat Landfill. Principal geologic units encountered within the limits of the Mill Seat Landfill and Proposed Landfill Expansion include:

- Isolated surficial sand and gravel deposits
- Coarser grained till
- Dense lodgment till
- Shale and limestone/dolostone bedrock

The greatest natural thickness of unconsolidated materials occurs in the central eastern portion of the Proposed Footprint near Brew Road. Science Hill, located outside the Proposed Footprint near the intersection of Brew and Bovee Roads south of the Proposed Landfill Expansion, is a drumlin with over 40 feet of unconsolidated material. Areas having no or a thin cover of unconsolidated material occur in the southwestern portion of the investigation area in the wetland area of Hotel Creek and along Bovee Road west of the Science Hill drumlin.

The surficial bedrock in the area of the Mill Seat Landfill is the Vernon Formation (C-Horizon). The bedrock is composed of an interbedded shale and limestone/dolostone that frequently exhibits a high degree of weathering near its top and where shale is more prevalent than limestone. In most areas, the weathered bedrock is sufficiently soft to be recovered by a split-spoon sampler and was excavated during test pit excavation. The weathered bedrock is described as a gray to olive brown shale with interbedded clay and resistant layers of limestone. The weathered bedrock zone was typically one (1) to three (3) feet thick and as much as ten (10) feet thick in the south central portion of the Proposed Footprint.

The hydrogeology of the Permitted Footprint and the Proposed Footprint has been characterized as consisting of four (4) designated flow zones and include the following:

- ***Water Table:*** occurring in the shallow unconsolidated materials generally within seven (7) to ten (10) feet of the ground surface.

- ***B Zone***: consisting of the lowermost portions of the unconsolidated overburden and a portion of the upper weathered bedrock.

- ***A Zone:*** consisting of unweathered portions of the Vernon Shale bedrock generally between 15 and 30 feet below the top of bedrock.

- ***Z Zone:*** consisting of deeper bedrock intervals generally between 30 and 80 feet below the top of bedrock.

Water Table - Unconfined groundwater conditions are present in the Proposed Landfill Expansion area. When compared to the Mill Seat Landfill, the thicker section of low permeability glacial material in the Proposed Landfill Expansion area allows water table conditions to occur. The geometric mean hydraulic conductivity of the unconsolidated deposits beneath the Proposed Landfill Expansion area is 3.7×10^{-6} cm/s. Below the existing Permitted Footprint, the water table was generally eliminated during the excavation of overburden materials for base grade construction and installation of the GWSS. As landfill development extends into the Proposed Footprint, the relocation of Wetland RG-6, removal of overburden material, and construction of the double composite liner system will eliminate vertical recharge. As a result, the water table in the Proposed Footprint will be lowered to levels corresponding to the B-Zone.

B-Zone – Refers to groundwater occurring in the lower till and shallow weathered bedrock that flows laterally away from the Permitted Footprint and the Proposed Footprint. The saturated thickness of the B-Zone is variable ranging from approximately 15 to 20 feet within the low hydraulically conductive soil located in the central portion of the Proposed Footprint and thins to the south. The B-Zone groundwater flow direction, as shown on Figure 4, is to the northeast and east beneath the Permitted Footprint, east across much of the Proposed Footprint, and southerly toward Wetland RG-5 and Hotel Creek in the extreme southernmost portion of Proposed Landfill Expansion area. Flow is generally horizontal. A geometric mean hydraulic conductivity value of 1.06×10^{-3} cm/s was calculated for wells screening the B-Zone.

A-Zone – Refers to groundwater occurring in bedding plane fractures and vertical and high angle joint sets in the upper 30 feet of bedrock (Vernon Formation). The A-Zone is characterized as the approximate upper 30 to 40 feet of bedrock in the Permitted Footprint and Proposed Footprint. The groundwater flow direction in the A-Zone is shown on Figure 5. A-Zone groundwater elevations are highest in the west-central portion of the Proposed Footprint near monitoring well MW-SEA-1A. From this groundwater high, A-zone groundwater flow is northeasterly beneath the Permitted Footprint and easterly to south easterly across the Proposed Footprint. No definitive vertical groundwater flow direction was observed in bedrock below the Proposed Footprint and flow is generally horizontal. The geometric mean hydraulic conductivity of the A-Zone is 1.0×10^{-3} cm/s.

Z-Zone – Refers to groundwater occurring in deeper, generally unweathered, competent bedrock having lower fracture frequency. Z-Zone groundwater is designated as groundwater flowing in bedrock 40 feet or deeper below the top of bedrock beneath the Permitted Footprint and the

Proposed Footprint. The groundwater flow direction in the Z-Zone is northeasterly beneath the Mill Seat Landfill and easterly beneath the Proposed Footprint as shown on Figure 6. A geometric mean hydraulic conductivity value of $2.09\text{x}10^{-4}$ cm/s was calculated for Z-Zone wells at the Permitted Footprint and the Proposed Footprint. The water chemistry data for the Z-Zone wells show that background groundwater quality in the deeper bedrock contains higher levels of naturally occurring constituents (i.e., primarily bromide, boron, potassium, sodium, chloride and sulfate) than B-Zone and A-Zone groundwater.

Groundwater Usage

The area near the Permitted Site is now serviced with municipal water provided by Monroe County Water Authority. Water lines were constructed in the area during the early 1990s and most of the domestic wells in the area were either decommissioned or are unused. The Monroe County Water Authority conducts inspections once every five (5) years at residential properties where groundwater wells are used for residential irrigation.

Three (3) off-site domestic wells were historically monitored as part of the overall environmental monitoring plan for the Mill Seat Landfill. The current environmental monitoring program has demonstrated that the double composite liner system design incorporated into the Mill Seat Landfill from original construction has been protective of groundwater quality. Based on the distance the domestic wells are from the Mill Seat Landfill, the demonstrated performance of the engineered landfill using double composite liner systems, and comprehensive monitoring network indicating no adverse impacts to groundwater quality at the Mill Seat Landfill, the monitoring of off-site domestic wells will only be needed as a contingency should impacted water quality occur at the Mill Seat Landfill Facility.

2.3 Critical Stratigraphic Section

The CSS below a solid waste facility is defined in 6 NYCRR Part 360 as all stratigraphic units into which contaminants that theoretically escape from the facility might reasonably be expected to enter and cause contamination. For the Permitted Site, previous hydrogeologic investigations defined the CSS as “groundwater flow in the unconsolidated glacial deposits and upper 30 to 40 feet of bedrock.” The detection monitoring well network at the Mill Seat Landfill monitors two (2) distinct sections of the CSS:

- A Zone wells – screened to monitor the lower portion of the CSS, generally between 15 to 30 feet below the top of bedrock; and
- B Zone wells – screened to monitor the upper portion of the CSS that includes the overburden and a portion of the weathered upper bedrock surface.

Based on hydrogeologic studies in the Proposed Landfill Expansion area, the definition of the CSS for the active Mill Seat Landfill described above applies to the Proposed Landfill Expansion area. This conclusion is based on the following observations:

- RQD values increase and fracture frequency decreases in bedrock core retrieved from the deepest wells and geometric mean hydraulic conductivity values calculated from rising head tests are an order of magnitude higher in B-Zone and A-Zone wells (upper 30 to 40 feet of bedrock) compared to deeper Z-Zone wells which indicates preferential groundwater flow in B-Zone and A-Zone well depths.

- Pumping test results for P-8S at the Mill Seat Landfill during the H&A investigation (1989) indicated that groundwater flowing at the bedrock/overburden interface was not in strong hydraulic communication with deeper sections of the pumping well (Z-zone well equivalent).

- Groundwater flow in bedrock is nearly horizontal with little to no vertical component of flow which is demonstrated by very low vertical head gradients.

- Average linear groundwater flow velocity in the Z-Zone bedrock is about 75% lower than the A-Zone flow velocity.

- Deeper bedrock background groundwater chemistry (Z-Zone wells) is substantially elevated in naturally occurring cations (boron, calcium, magnesium, potassium and sodium) and anions (chloride and sulfate) when compared with shallower (B-Zone and A-Zone) groundwater for wells more distant from wetland areas, indicating little mixing between the shallow and deeper bedrock groundwater.

In the unlikely scenario where leachate leakage occurs in either the Mill Seat Landfill or the Proposed Landfill Expansion, the dissolved phase constituents present in leachate would migrate very slowly in low permeability till. Seepage velocities calculated for the groundwater flowing in the till were calculated to flow at a rate of a few inches per year. Attenuation to soil particles and organic matter in the till would further retard the rate of constituent migration. Investigation data indicates water in the till flows toward the upper weathered bedrock (B-Zone). If constituents reached the bottom of the till, they would travel laterally in the B-Zone. Dispersion and diffusion could allow constituents to migrate laterally downward into shallow bedrock groundwater (A-Zone). Groundwater flow in bedrock is uniform and predominantly horizontal. Flow vectors are upward near the wetland areas east of the Permitted Site as evidenced by artesian flow conditions in some existing wells located closest to Wetland RG-7. Dissolved phase constituents present in the A-Zone would not migrate vertically deeper based on essentially horizontal hydraulic gradients measured between the A-Zone and Z-Zone wells and a much greater horizontal flow component. Water quality deeper than 40 feet in the bedrock would not be affected by a hypothetical release of leachate from the Mill Seat Landfill.

3. Environmental Monitoring Program

The following sections describe the environmental monitoring program for the Mill Seat Landfill Facility inclusive of the Mill Seat Landfill and the Proposed Landfill Expansion. The monitoring program describes sampling and monitoring of environmental media. Sampling locations are shown on Figures 7 and 8 and listed in Table 1. The frequency of monitoring is also identified in this section. Where a sampling frequency of quarterly is described, it refers to a frequency of three (3) times per year where the first quarter (winter months from January through March) is omitted at the Mill Seat Landfill (see Section 1.2). Sampling procedures are described in the Site Analytical Plan presented in Section 5.0.

3.1 Groundwater Monitoring

3.1.1 Groundwater Monitoring Network Description

The groundwater monitoring network consists of a series of well clusters located around the perimeter of the Permitted Footprint (see Figure 7). Referred to as “M” wells, each cluster incorporates a minimum of one (1) well screened across the overburden-bedrock interface (M-B series wells) and one (1) well screened in the approximate bottom 15 feet of the CSS of the site (M-A series wells). In addition, several well clusters consist of a third, deeper bedrock well (M-Z series wells). With development of the Proposed Landfill Expansion, existing wells associated with the Permitted Footprint M-2A, -2B, and -2Z as well as monitoring wells M-7A and -7B will require decommissioning prior to construction of Proposed Landfill Expansion Stages V-A and Stages VI A & B, respectively. Wells comprising the monitoring network for the Permitted Footprint are summarized on Table 1.

The Proposed Landfill Expansion will require installation of new groundwater monitoring wells to monitor the CSS. Monitoring wells to be installed to monitor groundwater quality at the Proposed Landfill Expansion area are summarized in Table 1 and their proposed locations shown on Figure 7. Monitoring well installation will be conducted in accordance with 6 NYCRR Part 360 2.11(a)(8)(ii), “Construction of Monitoring Wells and Piezometers”.

As discussed in Section 2.2, groundwater in the B-Zone and A-Zone, which comprise the CSS, flows in a northeast direction below the Permitted Footprint. Below the northern and central portions of the Proposed Landfill Expansion (Stages V through VIII), groundwater flows directly east toward Wetland RG-7 and gradually flows in a southeast direction toward the groundwater discharge area associated with Wetland RG-5 and Hotel Creek south of Stage IX. Because the Proposed Landfill Expansion will be constructed in a series of Stages which will take decades to complete (see fill progression schedule in Section 1.2), the monitoring well installations comprising the monitoring network in the Proposed Landfill Expansion would also be phased with landfill construction. For any Stage of landfill development, monitoring wells must be installed a minimum of one (1) year prior to Stage construction and placement of waste in order to complete the needed collection of background water quality data (see Section 3.1.2). For example, monitoring wells associated with Proposed Landfill Expansion Stages VIII and IX would not be installed until detailed design packages are being prepared for Stage construction. The sequence of monitoring well installation in the Proposed Landfill Expansion area is shown on Table 1.

Water level data collection is an important component of the EMP. The water level data will be used to verify horizontal groundwater flow directions and demonstrate vertical hydraulic gradients between designated flow zones. Therefore, water levels in Z-zone wells and several other wells will be monitored with the Permitted Site and the Proposed Landfill Expansion area during groundwater sampling events (see Section 3.1.4).

3.1.2 Existing (Background) Groundwater Quality Monitoring

The hydrogeologic investigation (report dated February 2015) preliminarily characterized existing groundwater quality in the Proposed Landfill Expansion area. The results found that the groundwater below the Proposed Footprint was similar to water quality characterized in the area of the Permitted Footprint. Before landfill construction and deposition of waste can occur in the Proposed Footprint, a more comprehensive assessment of existing groundwater quality associated with staged landfill construction in the Proposed Landfill Expansion area is required. The assessment will be completed for well installations coincident with staged landfill construction (see Table 1). At a minimum of one (1) or two (2) years before Stage construction, monitoring wells designated to monitor a particular Stage (see Section 3.1.1) will be installed. Each well will be sampled and analyzed on a quarterly basis for the 6NYCRR Part 360 Expanded Parameter List and a minimum of three (3) times for the 6NYCRR Part 360 Baseline Parameter List (see Section 3.1.3 for sample analyses). Analytical data will establish background water quality prior to waste placement. Upon completing these sampling events and determination of Water Quality Action Values (discussed in Section 4.1.1), waste placement in the Stage can occur.

3.1.3 Operational Groundwater Quality Monitoring

Groundwater samples will be collected from monitoring wells identified on Table 1 to monitor groundwater quality of the CSS during landfill operation. Sampling and analysis of groundwater during landfill operation will consist of two (2) quarters of sampling for the 6NYCRR Part 360 Routine Parameter List and one (1) quarter of sampling 6NYCRR Part 360 Baseline Parameter List. The baseline parameter monitoring program will be rotated quarterly. Consistent with prior monitoring of the Permitted Footprint, no sampling activities will occur during the winter quarter (January - March).

As additional Stages are constructed in the Proposed Landfill Expansion area, the fill progression will proceed southward. The *Engineering Report* describing the fill progression plan shows filling and shaping of the southern portion of the Permitted Footprint through completion of Stage VI-B construction. At that time, the sampling frequency of wells monitoring the Permitted Footprint (see Table 1 for list) will be modified. The monitoring frequency will be reduced to a semi-annual basis (i.e., Second Quarter and Fourth Quarter). The parameter list will include one (1) event for the 6NYCRR Part 360 Routine Parameter List and one (1) event for the 6NYCRR Part 360 Baseline Parameter List and will rotate annually.

3.1.4 Water Level Monitoring

Water level measurements will be taken in monitoring wells during sample collection at wells used to monitor operational groundwater quality. In addition, water levels in other wells and piezometers identified in Table 1 will be used to assess horizontal groundwater flow direction and calculate vertical hydraulic gradients at monitoring well clusters. The frequency of water level monitoring will be coincident with groundwater sample collection.

3.1.5 Monitoring Well Decommissioning

As various stages of landfill construction in the Proposed Landfill Expansion area, existing monitoring wells and piezometers not specified for operational monitoring will be decommissioned in accordance with 6NYCRR Part 360. Monitoring wells will be decommissioned by overdrilling, pulling and tremie grouting to surface with a cement/bentonite grout. A decommissioning plan will be provided to the NYSDEC prior to the removal of piezometers and monitoring wells.

3.2 Landfill System Monitoring

Landfill systems in the Mill Seat Landfill and Proposed Landfill Expansion will be monitored for protection of groundwater and surface water. Landfill systems include the leachate collection systems (primary and secondary), groundwater suppression systems, and storm water retention ponds.

3.2.1 Leachate Collection Systems

The Permitted Footprint is constructed with a double composite liner system that collects and conveys leachate out of the landfill Stage. A double composite liner system construction will be used in the Proposed Landfill Expansion (i.e. double composite liner). Leachate samples to be collected from the Mill Seat Landfill (depending on flow) include:

- Stage 1 - Primary leachate - The primary leachate collection system of Stage 1 (L1 Stage 1) will be sampled from the clean out port at Manhole 37P.

- Stage 1 - Secondary leachate - If flow is observed, the secondary leachate collection system of Stage 1 (L2 Stage 1) will be sampled from the clean out port at Manhole 37S

- Stage 2 and 3 - Primary leachate - The primary leachate collection system of Stage 2 and 3 (L1 Stage 2 - 3) will be sampled from the clean out port at Manhole 38P.

- Stage 2 and 3 - Secondary leachate - If flow is observed, the secondary leachate collection system of Stage 2 and 3 (L2 Stage 2 - 3) will be sampled from the secondary lateral outfall at the wet well located at Pump Station 1.

- Stage 4 – Primary leachate – The primary leachate collection system of Stage 4 (S4A-P) will be sampled from the Pump #1 sample tap in the Stage 4 Leachate Riser House

- Stage 4 – Secondary leachate – If flow is observed, the secondary leachate collection system of Stage 4 (S4A-S) will be sampled from the secondary line sample tap in the Stage 4 Leachate Riser House.

Leachate samples to be collected from the constructed Stages in the Proposed Landfill Expansion area (depending on flow) will include samples collected from sample taps of the sideriser pump systems housed in the associated leachate riser house for the following:

- Stage V – Primary leachate (S5A&B-P) and Secondary leachate (S5A&B-S)

- Stage VI – Primary leachate (S6A&B-P) and Secondary leachate (S6A&B-S)

- Stage VII – Primary leachate (S7-P) and Secondary leachate (S7-S)

- Stage VIII – Primary leachate (S8-P) and Secondary leachate (S8-S)

- Stage IX – Primary leachate (S9A&B-P) and Secondary leachate (S9A&B-S)

Leachate system samples are summarized in Table 1. Leachate system samples will be collected on a semi-annual basis (two times per year) and analyzed for the 6NYCRR Part 360 Expanded Parameter List.

3.2.2 Groundwater Suppression Systems

GWSS samples will be collected from gravity flowing discharge points located around the perimeter of the Permitted Footprint (estimated flow rate will be recorded) (designated GW 9 through GW 38) and from the riser house associated with groundwater pumped from the Stage IV underdrain (S4A-U). In the Proposed Footprint, a GWSS will be installed beneath the various Stages during construction. Each GWSS will convey collected groundwater to piping associated with a riser house which will be pumped to the storm water drainage system.

Groundwater samples will be collected from the riser house associated with Stage V through Stage IX designated S5A&B-U through S9A&B-U.

Groundwater samples collected from the operational GWSS will be obtained quarterly, coincident with the monitoring well sampling schedule, with two (2) quarters of sampling for the 6NYCRR Part 360 Routine Parameter List and one (1) quarter of sampling 6NYCRR Part 360 Baseline Parameter List. The baseline parameter monitoring program will be rotated quarterly.

Table 1 summarizes groundwater samples to be collected from the GWSS.

3.2.3 Storm Water Retention Ponds

Two (2) storm water retention ponds (sample IDs: DP-1 and DP-2) are associated with the Mill Seat Landfill. A third storm water retention pond (sample ID: DP-3) was temporarily operational during early stages of Stage IV but has since been decommissioned. Landfill construction in the Proposed Landfill Expansion area will require relocation of the storm water retention pond south of the Permitted Footprint to an area east of the Proposed Footprint (designated as SRP-8) and construction of a storm water retention pond situated at the south side of the Proposed Footprint designated SRP-7 (see Figure 4). Operational monitoring will require the sampling of storm water discharge from each of the three (3) storm water retention ponds (sample IDs: DP-1, SRP-7, and SRP-8) at the gabion structure at the pond’s outfall (Figure 7). When flowing, samples will be collected on a quarterly basis and analyzed for parameters consistent with those for groundwater.

3.3 Surface Water/Sediment Monitoring

Surface water and sediment samples will be collected from seven (7) locations in adjacent wetlands and Hotel Creek. Surface water/sediment sampling locations are shown on Figures 7 and Figure 8. Surface water sites include:

- S1 Location in Hotel Creek receiving recharge from Wetland RG-5 near Rt. 490
- S2 Downstream location from the Proposed Landfill Expansion in Hotel Creek
- S3 Wetland RG-7
- S4 Wetland RG-7
- S5 Downstream location from SRP-8 discharge to Hotel Creek
- S6 Drainage area near leachate holding tanks
- S8 Far downstream location in Hotel Creek

Note: Artesian source (A1) was historically referred to as S7

Surface water site S8 in Hotel Creek was historically requested by the Natural Resources Department of the NYSDEC and has been a permit condition for permit renewal applications. In addition to Routine and Baseline sampling conducted in Hotel Creek, monitoring will consist of daily recording of stream temperature from April through December and weekly monitoring for

Dissolved Oxygen on a weekly basis from April through October and monthly in November and December.

Surface water samples will be analyzed quarterly for the 6NYCRR Part 360 Routine Parameter List and 6NYCRR Part 360 Baseline Parameter List as dictated by the groundwater sampling schedule. Sediment samples will be collected at each sampling location when surface water samples are collected and analyzed for the parameter list presented in Section 5.

3.4 Ambient Air Quality Monitoring

Outdoor ambient air quality monitoring has been conducted at the Permitted Site to meet the guidelines specified in 6 NYCRR Part 360-1.14 - Operational requirements for all solid waste management facilities and 6 NYCRR Part 360-2.17 - Landfill operation requirements. Specifically, these regulations are concerned with fugitive dust emissions and impacts from decomposition gases. These regulations were promulgated so landfill activities would not have an adverse impact on public health and safety, the environment, or natural resources.

Ambient air quality monitoring, which includes particulate and explosive gas monitoring, will be conducted at locations shown on Figure 7. To obtain the most representative results, the wind at the time of sampling (prevailing winds) will dictate the placement of monitoring equipment to properly monitor ambient air derived from the Proposed Site. The frequency of ambient air monitoring will be as follows:

- Downwind working face (WF-AA) - Quarterly
- Northern property boundary (N-AA) - Annually
- Eastern downwind area (E-AA) - Annually
- Southern downwind area (S-AA) - Annually
- Western property boundary (W-AA) (typically upwind direction) - Annually

Particulate Monitoring:

To comply with 6NYCRR Part 360-1.14 - Operational requirements for all solid waste management facilities, the requirement states:

> “dust must be effectively controlled so that it does not constitute a nuisance or hazard to health, safety, or property. The facility owner or operator must undertake any and all measures as required by the department to maintain and control dust at and emanating from the facility.”

Fugitive dust monitoring will involve quantifying air-borne particulates (dust) in air consistent with dust monitoring protocols specified in NYSDEC DER-10 for Community Air Monitoring Programs using battery-powered, real time particulate monitors. The portable particulate monitors will have capabilities to monitor simultaneously for total suspended particulate matter (TSP) and respirable particulate matter 10 microns (PM10). Monitoring will be conducted at the locations shown on Figure 7 and at the frequency specified above. Monitoring will be performed for an eight-hour (8-hour) period during working hours and will avoid monitoring on days when precipitation is forecast. Monitoring methods are described in Section 5.

Explosive Gas Monitoring:

In addition to dust, 6 NYCRR Part 360-2.17- Landfill operation requirements states that,

> “decomposition gases generated within a landfill must be controlled to avoid hazards to health, safety, or property.”

To meet this requirement, LFG generated at the Mill Seat Landfill is collected and used as feedstock to generate electric power at the LFGTE Facility. LFG collection will also occur in the Proposed Landfill Expansion. To assess the adequacy of LFG collection, explosive gas monitoring will be conducted using an explosive gas monitor. The explosive gas monitoring will include operation of functional dedicated methane alarms at on-site structures including the Administrative Building, Scale House and Maintenance Building, and pump stations and testing for explosive gas each circumstance where site personnel are required to enter a manhole. Explosive gas monitoring in ambient air will be conducted at monitoring location stations shown on Figure 7 using portable explosive gas meters. Monitoring methods are described in Section 5.

3.5 Ambient Noise

Noise monitoring will be performed to establish if noise levels at the Mill Seat Landfill and Proposed Landfill Expansion are in compliance with 6 NYCRR Part 360-1.14 (p) - Operational Requirements for All Solid Waste Management Facilities. Noise monitoring will be conducted quarterly at the six (6) monitoring stations shown on Figure 7. Monitoring will be performed by field staff using a hand held sound level meter. Noise level monitoring will evaluate the equivalent continuous sound pressure level (Leq) measured in decibels (dB). Noise level monitoring methods are described in Section 5.

4. Data Evaluation

This section describes methods to evaluate environmental monitoring data during EMP implementation. Section 5.1.2 identifies reference documents for data comparison criteria described in this section.

4.1 Groundwater

The proposed methods to evaluate groundwater quality at the Permitted Footprint and Proposed Footprint are based on landfill design, detailed understanding of the hydrogeological conditions, and the assessment of groundwater quality data gathered from historical groundwater monitoring. The data evaluation procedures described herein have been previously used to monitor the Permitted Footprint and are consistent with requirements specified in 6NYCRR Part 360.

4.1.1 Background Monitoring

Background water quality will be established in the Proposed Landfill Expansion for each monitoring well used to monitor water quality prior to waste placement in Stages V through IX. As described in Section 3.12, new monitoring wells will be installed in the Proposed Landfill Expansion area to monitor specific Stages as landfill construction progresses. Each monitoring well will be sampled a minimum of four (4) times quarterly, once for the Expanded Parameter List and a minimum of three (3) times for the Baseline Parameter List, prior to waste placement. The data collected will be used to calculate a mean concentration for each constituent using all available background monitoring data. Natural and seasonal variability will produce varying concentrations of naturally occurring constituents. Therefore, the standard deviation from the mean will also be determined for each constituent. Water Quality Action Values (WQAVs) will be established for each constituent for each well by adding three (3) standard deviations to the mean concentration. Data from as many sampling events as possible will be used to develop the WQAVs prior to waste placement in the constructed Stage. WQAVs will be used to evaluate operational groundwater monitoring data.

4.1.2 Operational Monitoring

Groundwater chemistry at the Permitted Footprint and in the Proposed Landfill Expansion area will continue to be evaluated using intra-well comparisons, a procedure in which chemistry of a sample collected from each monitoring well is evaluated in relation to its own historical data. Operational groundwater monitoring using intra-well data comparisons is common practice and is fully supported by the NYSDEC and USEPA. In addition, intra-well data comparisons are more effective than upgradient to down-gradient comparisons at sites such as the Mill Seat

Landfill where groundwater chemistry is spatially variable both laterally and vertically. Spatial chemical variability at the Permitted Site is caused by the presence of natural mineralized salts and evaporites in bedrock (cations and anions such as sodium potassium, boron, chloride, bromide, and sulfate), upward hydraulic gradients near Wetlands RG-5 and RG-6 that allow higher salt content groundwater to migrate upward into shallower groundwater, and the use of rock salt for application on roads and highways near the Mill Seat Landfill. Natural geochemical variability must be accounted for by the data evaluation methodology. Therefore, intra-well data comparison has been proven effective in adequately monitoring groundwater at the Permitted Footprint for more than two (2) decades.

This data evaluation method primarily supports the assessment of naturally occurring inorganic constituents in groundwater. Since leachate contains low concentrations of organic chemicals as well as inorganic constituents, the detection of organic chemicals in groundwater will be a leading indicator of a release of leachate to groundwater.

Analytical data obtained for groundwater samples collected during landfill operational monitoring (inclusive of the Permitted Footprint and Proposed Footprint) will be evaluated through constituent-specific comparisons to:

- Organic and inorganic constituent detections above Class GA groundwater quality standards and guidance values presented in TOGS 1.1.1 (TOGS Standard)
- WQAVs established during background monitoring of the Permitted Footprint. WQAVs will be established for each proposed well installed to monitor the Proposed Expansion using a minimum four (4) quarters of background water quality data plus subsequent monitoring data available for the well prior to waste placement in the Proposed Landfill Expansion
- Significant increasing chemical constituent concentration data trends either related or unrelated to overall background changes to water quality as observed on time-series plots and the pattern of well trilinear Piper Plots and/or Stiff diagrams changes

If a constituent concentration (non-organic) is above the TOGS standard and WQAV, then the constituent in question will be evaluated for naturally increasing concentrations due to changing background chemistry. If background chemistry has not substantially changed, the well in question will be re-sampled to increase the reliability of the data within 14 days after notification of the NYSDEC. If an organic detection above TOGS standard is determined not to be related to laboratory analytical bias (i.e., false positive), the well will be re-sampled. The re-sampling analyte list will be discussed and agreed upon with the NYSDEC prior to sampling. An evaluation of the geochemical conditions in the secondary leachate collection systems and in GWSS will be immediately undertaken to assess a potential relationship between the anomalous detection and a potential geochemical change in the landfill system. The re-sampling results will be provided to the NYSDEC within 14-days of receiving re-sampling analytical data.

4.1.3 Alternative Source Demonstration

If re-sampling confirms the condition described in Section 4.1.2 where a constituent concentration is detected above the TOGS standard, above WQAVs, and background constituent concentrations remain stable, further investigation into the cause of the detection will be undertaken. This assessment, known as an Alternative Source Demonstration, will address potential causes of the condition such as changing background conditions, changes due to landfill construction, issues with conveyance piping for leachate and LFG, and issues associated with storm water runoff that are conditions not associated with an integrity issue of landfill liner system and necessitate assessment monitoring (as described in Section 4.1.4. If such a condition is determined to be the cause of the anomalous detected conditions, a report will be completed and submitted to the NYSDEC that describes the results of the geochemical evaluation and the Alternative Source Demonstration.

4.1.4 Assessment Monitoring

Assessment monitoring will be undertaken following the confirmation of the anomalous condition described above. Assessment monitoring will be concurrent with any actions taken during the Alternative Source Demonstration. Assessment monitoring will involve expanding the analytical parameter list from the Routine Parameter List to either the Expanded List or Baseline List depending on the nature of the anomalous detection. For example, if organic chemicals are of concern, then the Expanded Parameter List will be used for the next two (2) quarterly sampling events. If the nature of the anomalous detection is related to inorganic constituents, then the Baseline Parameter List will be used for the next two (2) quarterly sampling events. Nearby wells may be included in the assessment monitoring program should the nature of the anomalous detection suggest an expanded assessment of groundwater chemistry is warranted. The selection of the assessment monitoring parameter list and identification of wells to be included in the assessment monitoring program will be discussed with the NYSDEC. The assessment monitoring results will be documented in the quarterly monitoring reports. Assessment monitoring will be discontinued if the source of the anomalous detection is found to be unrelated to landfill activities or corrective actions address the anomalous detections and water quality returns to pre-condition levels.

4.1.5 Contingency Monitoring

A contingency water quality monitoring program will be developed if:

- The Alternative Source Demonstration does not identify the cause of the anomalous detection; and

- Assessment monitoring continues to confirm the existence of the anomalous condition.

Contingency monitoring efforts under this plan will focus on characterizing the nature and extent of the release and initiate an analysis of corrective actions. Depending on the nature and magnitude of the condition causing the anomalous detections in groundwater, the assessment of groundwater quality farther downgradient from the Permitted Footprint and Proposed Footprint may be warranted. Under conditions requiring implementation of contingency monitoring, a written CMP will be prepared describing a scope of work with sampling and analysis activities to be undertaken to address the anomalous conditions. The CMP will be provided to the NYSDEC for approval prior to implementation. Any additional wells installed to support contingency monitoring will be analyzed twice within 14 days for the Expanded Parameter List to assess existing water quality. Results will be provided to the NYSDEC as outlined in the CMP. Contingency monitoring could also include, but not be limited to: monitoring of additional monitoring wells for an expanded list of parameters; more frequent monitoring of landfill systems (i.e., secondary leachate collections systems, GWSS); additional monitoring of surface water (i.e., nearby wetlands, Hotel Creek); monitoring of off-site selected domestic wells; and systems installed for corrective action.

4.2 Surface Water and Sediment

The results of surface water quality sampling and analysis will be compared with historical data from the same sampling point using one (1) or more of the following: time series plots, Piper Plots, and/or Stiff Diagrams to assess overall changes in surface water quality. Data tables will include comparisons to New York State surface water quality standards and guidance values and New York State Sediment Guidance.

4.3 Landfill Systems

4.3.1 Leachate

Data for samples collected from the primary and secondary leachate collection system will be evaluated for overall changes in leachate quality. Sample results will be compared with historical data using time series, Piper Plots, and/or Stiff Diagrams to assess overall changes in leachate water quality, as required.

4.3.2 Groundwater Suppression System

Data for samples collected from the GWSS will be evaluated for overall changes in quality. Sample results will be compared with historical data using time series, Piper Plots, and/or Stiff Diagrams and New York State groundwater standards and guidance values to assess overall changes in surface water quality.

4.3.3 Storm Water Retention Ponds

The results of water quality sampling and analysis from retention ponds will be compared with historical data from the same sampling point using time series, Piper Plots, and/or Stiff Diagrams to assess overall changes in surface water quality. Data tables will include comparisons to New York State surface water quality standards and guidance values.

4.4 Ambient Air Monitoring

4.4.1 Particulate Monitoring

To assess whether a decrease in ambient air quality has occurred in the area of the Mill Seat Landfill and Proposed Landfill Expansion, the PM10 particulate air quality data will be compared to an action level of 150 ug/m^3 (15 minute average). TSP particulate air quality data will be compared to an action level of 250 ug/m^3 (8-hour average). While conservative, these shorter-term intervals will provide a real-time assessment of on-site air quality to assess adequacy of landfill operational procedures that promote site health and safety and protection of the public.

4.4.2 Explosive Gas

Explosive gas monitoring focuses on measuring the % of the LEL for methane. The NYSDEC will be notified in accordance with 6 NYCRR Part 360-2.17(f)(3) - Landfill operation requirements if explosive gas is present in excess of 25% of the LEL in structures both on-site and off-site, excluding components of the LFG control recovery system, and/or the LEL at the property boundary.

4.4.3 Noise

Noise levels at the Mill Seat Landfill and Proposed Landfill Expansion will be recorded at noise monitoring stations described in Section 3.5. Leq data will be compared to acceptable noise levels for the facility boundary during landfill working hours, as specified by 6NYCRR Part 1.14(p) - which is Leq 57 dB.

5. Site Analytical Plan

This section of this EMP constitutes the SAP as required under 6NYCRR Part 360-2.11(d) and is subdivided into three (3) subsections and is consistent with the regulations and guidance in TAGM SW-96-09 Development and Review of Site Analytical Plans:

- Data Quality Objectives
- Analytical Quality Assurance/Analytical Quality Control
- Field Sampling Procedures

Laboratory procedures and data quality review are discussed in Sections 6.0 and 7.0, respectively.

5.1 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support the goals of the monitoring program and are determined based upon the end use of the data. The end use of the data collected under this monitoring plan will be to document or monitor the functional performance of the Mill Seat Landfill and Proposed Landfill Expansion systems and to demonstrate to the regulatory agency that there is no adverse impact to the environment related to operation. The users of the data include regulatory agencies, landfill owner, landfill operator and the public (i.e. interested parties and environmental professionals). The DQOs will be met by establishing standardized field and lab procedures. Given that most of these procedures are specified within the regulations, the DQOs are essentially already established by the NYSDEC and will thus be attained by following the regulations. The goals of the various components of the regulations designed to meet the DQOs are discussed below.

5.1.1 Monitoring Programs

The primary objective of monitoring program implementation is to demonstrate that landfill operations are not adversely impacting environmental media. A monitoring program has been established to meet this objective.

Existing Water Quality

The goal for Existing Water Quality monitoring (also referred to as background water quality) is to collect and analyze representative groundwater samples such that the data can be used to establish a benchmark for comparison to future sampling events. The collected data will be processed and evaluated for both spatial and temporal variability and will be used to establish WQAVs as described in Section 4.1.1.

Operational Water Quality

The goal of the operational water quality monitoring program is to collect and analyze samples and evaluate the resulting data to determine if groundwater quality at a particular sample location has changed through landfill operation activities. The methods used to evaluate impacts to groundwater are described in Section 4.1.2.

Landfill Systems

The goal of monitoring landfill systems is to assess potential changes in: leachate quality; liquid quality in secondary leachate collection systems; groundwater quality in underdrains and storm water quality discharged from storm water retention ponds. Understanding the quality of liquids in landfill systems is important since it is the primary source of potential impact to site media.

Surface Water/Sediment

The goal of the surface water/ sediment quality monitoring program is to collect and analyze samples to determine if surface water/sediment quality has changed through landfill operation activities.

Ambient Air

The goal of ambient air monitoring is to ensure that particulates (dust) and LFG does not pose a health hazard during landfill operations and to comply with landfill operations regulations in 6NYCRR Part 360.

Noise

The goal of noise monitoring is to ensure compliance with landfill operations regulations in 6NYCRR Part 360-1.14.

5.1.2 Regulatory Programs and Standards

This EMP is written in accordance with 6NYCRR Part 360-2.11(c) and (d) and forms the basis for the environmental monitoring program for the Mill Seat Landfill and Proposed Landfill Expansion. The most current New York State Ambient Water Quality Standards and Guidance Values will be used, in part, to provide a comparative basis for the evaluation of the results of the environmental monitoring program. Applicable water quality regulations, standards, and criteria include:

Groundwater Monitoring Results

- Official Compilation of Codes, Rules, and Regulations of the State of New York, Chapter X, Division of Water Resources, Article 2, Part 703.5 (Classes and Quality Standards for Ground Waters as Applicable to Class GA Waters).
- Maximum Contaminant Levels (MCL's) as established under 40 CFR Part 141 (Safe Drinking Water Act).

Surface Water Monitoring Results

- Official Compilation of Codes, Rules, and Regulations of the State of New York, Chapter X, Division of Water Resources, Article 2, Title 6, Part 701, Classification and Standards of Quality and Purity.

Sediment Monitoring Results

- NYSDEC Technical Guidance for Screening Contaminated Sediments dated November 22, 1993 and January 2014 update

Landfill Operations

- 6NYCRR Part 360-2.17 Operational Requirements for All Solid Waste Management Facilities (applicable to leachate management, dust, landfill gas, noise)

5.1.3 Analytical Parameters and Detection Limits

The analytical parameters for liquids incorporated into this EMP have been subdivided into three (3) groups: Routine Parameters, Baseline Parameters and Expanded Parameters as defined by 6NYCRR Part 360-2.11(c). The analytical methods and detection limits for liquids to be employed for this EMP are presented in Table 2A through 2C. Table 2D presents the analytical methods and detection limits for sediment samples.

5.2 Analytical Quality Assurance/Analytical Quality Control

The following section presents and discusses the analytical objectives and procedures, which will be employed to meet the DQOs.

5.2.1 Analytical Goals and Protocols

The goal of the analytical program is to collect, document, and analyze the environmental samples in accordance with established methods and procedures such that the resulting data is representative of the sample matrix in the field and can be used for comparison to existing environmental conditions and standards. This goal will be accomplished through the assignment of qualified personnel, adherence to established quality control procedures, and the use of standardized methods and protocols for the collection, shipping, and analysis of the environmental samples.

5.2.2 Project Personnel and Responsibilities

The EMP will be implemented and managed by WMNY and the County under the regulatory authority of the NYSDEC. WMNY will be assisted by TestAmerica Laboratories, Inc. of Buffalo, New York (TestAmerica-Buffalo) or another approved sampling contractor, for the collection and shipment of the samples to the laboratory. Analysis of the samples will be completed by TestAmerica-Buffalo or another laboratory-certified by the NYSDOH ELAP in accordance with the NYSDEC's ASP.

The following shows affiliates and responsibility participation in this monitoring plan:

Responsibility	Current Affiliation
Program Management	WMNY – Market Area Engineer
Environmental Compliance and Sampling Manager	WMNY – Environmental Compliance Manager
Field Sampling	TestAmerica-Buffalo or approved contractor
Analytical Contact	TestAmerica-Buffalo or certified laboratory

If listed affiliate and responsibility change, a revised table will be provided to the NYSDEC.

5.2.3 Quality Control Procedures and Objectives for Measurement

To ensure that the data generated as a part of the EMP fulfills the needs of the DQOs, quality assurance practices will be maintained both in the field and in the laboratory. Quality control procedures and standards related to the field and laboratory are discussed in greater detail below.

Field Methodologies
It is essential to any monitoring program that samples (i.e., groundwater, surface water, leachate etc.) collected in the field and destined for laboratory analyses be representative of the conditions present at the time of sampling. To ensure sample representativeness and completeness, all sampling procedures will be completed in accordance with the Field Sampling Procedures (Section 5.3) and in Waste Management's Environmental Media Sampling Procedures Version 1.0 dated March 2012 (Attachment A).

For field-generated data (e.g. temperature, specific conductivity, pH measurements and turbidity measurements), the accuracy and precision of the data will be within the limits of the field instrument. Field instruments will be calibrated, used, and maintained according to the instrument manufacturer's directions and those procedures described in this SAP and Waste Management's Environmental Media Sampling Procedures.

Field Precision

The precision for field measurements is as follows:

pH meter - consecutive readings should agree within +/-0.2 pH units after the instrument has been field calibrated with standard buffers.
Conductivity meter - consecutive readings of a thermally stable sample should agree within ±5% after the instrument has been calibrated.
Thermometer - consecutive measurements of a given sample should agree to within +/-1 degree Celsius.
Eh Meter- consecutive readings should agree to within +/-0.25 millivolt (Mv). after meter calibration.
Dissolved Oxygen Meter - consecutive readings should agree to within +/-0.2 milligram/liter (mg/l) after meter calibration.
Turbidimeter - consecutive readings should agree to within +/- 20% after meter calibration.
Particulate Monitor - ±0.1% of reading or 0.001 mg/m^3,
Multi-gas - consecutive readings should agree to within +/-1% LEL, after meter calibration.
Noise Meter - consecutive readings should agree to within +/-0.1 dB after meter calibration.

Field Accuracy

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

Laboratory Certification and Methodologies

TestAmerica-Buffalo is certified under the NELAC Program on an annual basis and audited every two (2) years by NYSDEC. As such all laboratory procedures utilized by TestAmerica have been pre-approved by the NYSDEC. Laboratory procedures will adhere to established analytical method protocols and TestAmerica's SOPs.

Parameters to be tested for as a part of this EMP include the 6NYCRR Part 360 (October 1993) Routine Parameters, Baseline Parameters and Expanded Parameters. Samples will be analyzed following the methods in the NYSDEC ASP or an equivalent method.

The analytical methods and laboratory PQLs are provided in Table 2A to 2D. The quality control procedures and objectives for measurement related to the laboratory are presented in TestAmerica's Laboratory Quality Assurance Manual in Attachment B. A discussion related to some of these quality assurance measurements is provided below. The laboratory analysis plan is provided in Section 6.0.

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. Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common.

Analytical precision will be assessed by analyzing MS and MSD samples organics and matrix spike and laboratory duplicate samples (inorganics) and determining the RPD.

For all Part 360 Baseline and Expanded Parameter analyses a MS/MSD or laboratory duplicate pair will be collected at a frequency of not less than five (5) percent (one per twenty samples) or one (1) per sampling event, whichever is more frequent.

Total system precision, including field precision will be determined by analyzing duplicate samples collected in the field at the same location. The formula for calculating RPD is as follows:

$$\mathrm{RPD} = \{(Vl - V2)/(Vl+V2)/2\}\ \mathrm{X}\ 100$$

Where: RPD = Relative Percent Difference.
V1, V2 = The 2 values obtained by analyzing the duplicate samples or spike and spike recovery values.
|V1-V2| = The absolute value of the difference between the two measurements.
(V1+V2)/2 = Concentration of analyte obtained by analyzing the sample duplicate or spike recovery.

Accuracy

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity, which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. 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. Sampling accuracy may be determined through the assessment of trip blanks (volatile organics only) for each sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte. The %R for a matrix spike is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where: %R = Percent recovery
SSR = Concentration of analyte obtained by analyzing the sample plus the spike
SR = The background value; i.e., the concentration of the analyte obtained by analyzing the sample.
SA = Concentration of the analyte spike added to the sample.

Percent recovery of a laboratory control sample is determined by dividing the measured value by the known value and multiplying by 100.

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. 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. Dedicated sampling devices will be employed whenever possible, and Waste Management’s Environmental Media Sampling Procedures included in Attachment A will be followed. Analysis of trip blanks (volatile organics only) and method blanks will also be performed to monitor for possible 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. The analytical laboratory will follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Finally, samples will be taken and Chain-of-Custody (COC) procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of COC, and blank/duplicate procedures will be discussed in sections to follow.

Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = (V/T) \times 100$$

Where: $\%C$ = Percent completeness
V = Number of measurements judged valid.
T = Total number of measurements.

Comparability

Comparability expresses the degree of confidence with which one (1) data set can be compared to another. The comparability of all data collected for this EMP will be ensured by:

Using identified standard methods for both sampling and analysis phases;

- Requiring traceability of all analytical standards and/or source materials to USEPA or 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; and
- Requiring that all validated flags be used at any time an analytical result is used for any purpose whatsoever.

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

5.2.4 Standard Operating Procedures

Standard operating procedures for the field sampling are described Waste Management’s Environmental Media Sampling Procedures included in Attachment A.

Standard operating procedures related to the laboratory have been pre-approved by the NYSDOH as part of the NELAP Certification of TestAmerica-Buffalo. All laboratory analytical procedures will be completed in accordance with ASP protocols. The laboratory analysis plan is provided below in Section 6.0.

5.3 Field Sampling Procedures

The following section describes the procedures for collecting and shipping samples for laboratory analysis. Groundwater, surface water and leachate sample collection will follow Waste Management's Environmental Media Sampling Procedures Version 1.0 (Appendix A).

5.3.1 Procedures Prior to Sampling

General procedures followed prior to sample collection at each sampling point are as follows:

1. Locate the sampling point.
2. Observe and record the condition of the sampling point and its surrounding area on a Field Information Form. Information to be noted includes:
    - The condition of monitoring point's identification sign;
    - Recent disturbance in vicinity of sampling point;
    - Condition of the security system for sampling point;
    - Well, tank, or manhole integrity including condition of any cement footing or protective casing. In addition, note physical surroundings, obstructions, or kinks in well casing, water in annular space, grease around top of well on threaded cap, etc.;
    - Weather conditions (i.e., wind direction when sampling for volatiles and note if sampling was performed downwind of an active area); and
    - Evidence of contamination.

Prior to groundwater well purging and sampling, an accurate water level measurement is taken with a portable, conventional electric probe indicator that is triple rinsed with deionized water before each use. A permanent datum is provided at each well location. The water level measurement is recorded on the Field Information Form. Additionally, if previous analytical results suggest the potential presence of NAPLs, the well will be checked for immiscible layers prior to evacuation using an oil water interface probe. Otherwise, any observations of floaters or sinkers will be noted on the field data sheet.

Wells which are not equipped with bladder pumps will have the total well depth determined at least once per year to ensure that the wells are not silting in. The annual readings will be provided in tabular format. Corrective action may be required on the well if it is determined that excessive siltation has occurred in a well.

5.3.2 Sample Collection

Groundwater Sampling
WMNY groundwater monitoring well sampling systems dedicate all purging and sampling equipment to each well, thus minimizing any potential cross-contamination between wells that may be otherwise incurred during conventional water sampling. Samples will be collected using dedicated QED sampling pumps following sampling procedures described in Appendix A.

Field measurements consisting of specific conductance, Eh, pH, turbidity, and groundwater temperature measurements will be measured and recorded after collection of the volatile sample. Procedures provided with the instruments will be used for calibration and testing. All results will be recorded on the Field Information Form.

For the field measurements of Eh, pH, specific conductivity, dissolved oxygen and turbidity, an appropriately calibrated meter such as a Cole Palmer ORPTESTR, Myron L (pH & sc), YSI Model 55 DO Meter and DRT-15C field turbidity meters (or similar) will be utilized. The frequency of calibration of all field parameter measuring equipment will be in accordance with the manufacturer's requirements. If the values obtained are not within the normal range, the WMNY Program Manager will be notified immediately as it may be necessary to resample. The initial sample will not be discarded. Additional samples may be requested by the WMNY Program Manager to ascertain the cause of abnormal readings.

The collected groundwater samples will not be filtered. However, in the event that the turbidity of the sample cannot be reduced to 50 NTUs through sampling techniques or well development, micropurging and/or collection, analysis of both filtered and unfiltered samples for metals parameters may be used. A standard 0.45 micro filter capsule will be used if filtering is required. Once the sample has been collected the sample point will be secured and all sampling disposables will be removed from the area and properly disposed. Samples requiring organic analysis will not be field filtered.

The groundwater parameters which are collected at any site are collected based upon their volatilization sensitivity. The following order is followed by TestAmerica-Buffalo.

1. Volatile Organics
2. Field Readings
3. Total Organic Carbon
4. Extractable Organics
5. Total Metals
6. Phenols
7. Cyanides
8. Wet Chemistry
9. Others

Notes:

- Other samples may be collected and analyzed in addition to those listed above.
- If the monitoring well is very turbid, collections of samples for metals shall be performed immediately after volatile organics to minimize the influence of turbidity.

Surface Water Sampling

Upon arrival at the sampling location the general condition of the sample location and its surroundings will be recorded on a Field information Form. In addition, general sampling point integrity, weather conditions, visible contamination, odors, and unusual surface conditions will be observed. Surface water samples will be obtained as grab samples. Samples will be obtained from near the water surface.

Surface water samples will not be collected during precipitation events. The sampling conditions will be evaluated by the sampling team immediately prior to sample collection. A suitable work area will be set up as close to the sampling station as possible. Individual sample containers will be filled in the same priority order as detailed for groundwater. Sample collection procedures are described in Appendix A.

Sediment Sampling

Upon arrival at the sampling location the general condition of the sample location and its surroundings will be recorded on a Field information Form. In addition, general sampling point integrity, weather conditions, visible contamination, odors, and unusual surface conditions will be observed. Sediment samples will be obtained from the upper five centimeters of sediment. Sediment samples at any location will be collected once the surface water sampling at the location has been completed. As with surface water samples, the sequence for collection of sediment samples will be from the most downstream location to the most upstream location.

Samples will be collected in such a manner as to minimize disturbance of the sediment and minimize washing of the sediment as it is retrieved through the water column. Due to the shallowness of the water column, sediment samples will be collected with a stainless steel spatula. The collected sediment will be placed into a stainless steel bowl and the water will be decanted from the bowl. The process will be repeated until sufficient volume is present to fill required sample jars. The sample material in the bowl will be homogenized. Because none of the samples will be submitted for analysis for volatile organic compounds, constituent loss due to volatilization is not a concern. If analysis is required for volatile organic compounds, a grab sample will be collected. Note the approximate percentages of organic matter and soil particles on the Field Information Form. The mixing bowl and all non-dedicated sampling equipment will be cleaned by washing with a non-phosphate detergent and rinsing with distilled/deionized water. Once the sample has been collected the sample point will be secured and all sampling disposables will be removed from the area and properly disposed.

GWSS Sampling

Upon arrival at the sampling location the general condition of the sample location and its surroundings will be recorded on a Field information Form. In addition, general sampling point integrity, weather conditions, visible contamination, odors, and unusual surface conditions will be observed. At the Permitted Footprint, GWSS discharge points gravity flow (where saturated conditions exist) to swales and surface water drainage ditches. Samples bottles will be placed beneath the flowing discharge point and direct filled. The bottle will not be overfilled to avoid loss of sample preservative. A maximum of three (3) gravity flowing GWSS underdrains will be sampled each quarter. GWSS samples collected from Stage IV through IX will be collected from sample ports in the discharge piping located in the riser housing for each Stage. Samples procedures consistent with those for leachate will be followed (see Appendix A). Specific conductance, pH, redox, and temperature measurements will be obtained in the field immediately following sample collection. Once the sample has been collected the sample point will be secured and all sampling disposables will be removed from the area and properly disposed.

Leachate Sampling

Leachate sampling procedures are described in Appendix A. Upon arrival at the sampling location the general condition of the sample location and its surroundings will be recorded on a Field information Form. Leachate samples will be collected from sample ports off of the sideriser piping at the leachate station pump house. Adequate time for venting between collecting landfill system samples should LFG be present. Leachate should be the last sample collected if pore water and secondary leachate collection systems are sampled.

Particulate Monitoring

Although 6NYCRR Part 360 requirements do not specify a need for particulate monitoring, the current EMP requires monitoring for both TSP and PM10 and was established in 1993 to address 6NYCRR Part 360-1.14(k) which states,

> "Dust must be effectively controlled so that it does not constitute a nuisance or hazard to health, safety, or property. The facility owner or operator must undertake any and all measures as required by the department to maintain and control dust at and emanating from the facility."

A battery-powered particulate monitor (i.e.,TSI DustTrak DRX Aerosol Monitor) will be used to monitor PM10 and TSP downwind from the working face of the landfill. Particle measurements of TSP and PM10 will be recorded by the respective unit's data logger at a frequency of one minute intervals. While logging data, the units will display real-time dust measurements.

The monitoring units will be mounted on a tripod during the Mill Seat Landfill and Proposed Landfill Expansion operational hours. The real-time display on the monitor will be periodically observed to review particulate readings when occasional dust is observed generated by occasional truck traffic traveling to the working face on the haul road.

Monitoring of the working face and perimeter monitoring stations will occur over an 8-hour period during sampling.

Explosive Gas Monitoring

Explosive gas concentrations (LEL) at the active working face and perimeter monitoring stations will be performed using a Q-RAE Plus multi-gas meter, or equivalent. The meter utilizes catalytic compensated hydrocarbon sensor and microprocessor electronics to analyze and display explosive gas concentrations. Explosive gas readings (percent methane) will be recorded at five (5) minute intervals over a 15-minute period. Site buildings will be monitored by WMNY using continuous sensors with methane alarms.

Noise Monitoring

Field staff will conduct quarterly monitoring of noise levels at the Mill Seat Landfill and Proposed Landfill Expansion. The measuring instruments that can be used will be:

- Type 1 general purpose sound level meters,
- Type 2 sound level meters, or
- corresponding special sound level meters Type S1A or Type S2A.

The Casella CEL-63X Series sound monitor satisfies both ANSI/IEC Type 1 and 2 accuracy classifications and will be the preferable meter for monitoring. Monitoring of equivalent continuous sound pressure level in dB (Leq) will occur for 15 minutes at each station location during working hours. The average Leq (A-weighted) over the 15 minute interval will be recorded. Observations of environmental conditions should be noted in the field log book.

Field QC Sample

Field QC samples are used to monitor the reproducibility and representativeness of field sampling activities. The field QC samples are handled transported and analyzed in the same manner as the associated field samples. Field QC samples will include trip blanks, field duplicates and MS/MSDs. The quantity, field QC sample type and analysis are discussed in the Laboratory Analysis Plan in Section 6.0.

5.3.3 Sample Preservation, Shipment, and Holding Times

Since multiple analyses will be required, different types of containers and preservatives may be necessary. In these situations, multiple pre-labeled containers will be supplied by the laboratory for each sampling point. The appropriate preservatives will be provided in small vials during sample bottle preparation by the analytical laboratory. The volume requirements, containers, preservatives, and holding times for each parameter are listed in Table 3.

The appropriate sample bottles that have been prepared in the laboratory with the appropriate preservative will be used to collect samples from each location. Containers for collecting samples for volatile organics analysis will be filled to slightly more than full before the septum and cap are placed on the container to ensure that it is free of head space (sampling personnel will check for air bubbles by inverting the container and tapping it). Following filling and capping the bottles will be inverted to mix the preservatives with the sample.

Immediately after collection, bottles will be placed in insulated shuttles or coolers with ice packs. Volatile organic containers will be arranged such that they do not come into contact with the ice packs. Executed Field Information Forms and Chain-of-Custody Forms will be placed inside the sample coolers and custody sealed. Samples will then be transported to TestAmerica-Buffalo, or other approved laboratory, and will arrive within 48 -hours of collection.

5.3.4 Chain-Of-Custody

At the time each sample is taken, a COC form will be completed by the sampler and placed in the sample chest. Upon transfer of sample possession to subsequent custodians, the COC form will be signed by the person taking custody of the sample container. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of samples, including temperature, will be recorded by the receiver. The COC forms will be included in the analytical report prepared by the laboratory and will be considered an integral part of that report.

As part of the COC procedure, each sample container will be labeled with the sample number and the parameter to be sampled.

All sampling procedures, measurements, and observations will be recorded on the COC forms, including the following information:

- Facility site name, sample point identification number, and other pertinent identifiers;
- Sample method (dedicated bailer or bladder pump, grab, composite, etc.);
- Type of sample and necessary treatment (e.g. filtering, if necessary);
- Sampler's identity and signature;
- Analytical requirements; and
- Other information required by Waste Management’s sampling SOPs.

Upon receipt of the samples at the laboratory, the date and time of arrival will be noted on the COC forms. The laboratory receiver will verify that the seal is intact and custody has not been broken, and make note of sample bottle condition on the forms. These forms will be retained by the laboratory and returned with the results of the analysis.

6. Laboratory Analysis Plan

This section describes the procedures for laboratory analysis.

In accordance with 6NYCRR Part 360-2.11(d)(4)(i), TestAmerica is certified by NYSDOH, ELAP to perform ASP laboratory services in the State of New York. TestAmerica will maintain this certification through the analysis of performance samples and routine auditing by NYSDOH as required by ELAP. TestAmerica-Buffalo laboratory has established SOPs relating to the receipt, analysis and reporting of samples. A copy of TestAmerica's Laboratory Quality Manual is included in Attachment B. If a different laboratory is used, a copy of that laboratories quality assurance manual will be submitted to the NYSDEC.

6.1 Program Quality Assurance/Quality Control Procedures

Trip blanks, equipment blanks, field (aka blind) duplicates and matrix spike samples provide quality assurance/quality control measures for the monitoring program.

6.1.1 Trip Blanks

Trip blanks are a required part of the field sampling QA/QC program. They are used to detect contamination that may be introduced in the field (either atmospheric or from sampling equipment), in transit, or in the bottle preparation, sample log-in, or sample storage stages at the laboratory. Laboratory method blanks are used during the analytical process to detect any laboratory introduced contamination that may occur during analysis.

Trip blanks are samples of organic-free water (e.g. deionized) prepared at the laboratory. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory. Trip blank sample bottles must not be opened at any time during this process. Upon return to the laboratory, trip blanks will be analyzed using the same procedures and methods that are used for the collected field samples.

One (1) trip blank will be analyzed for each cooler containing samples to be analyzed for volatile organics. Coolers which do not contain samples for volatile organics analysis will not require a trip blank to be analyzed. The trip blanks will be prepared by the laboratory and placed in the coolers prior to sample collection.

6.1.2 Field Duplicates

Field Duplicate Samples are samples that are submitted from a split of the same sample media. Field duplicates will be used to assess the sampling and analytical reproducibility. Both samples are collected utilizing the same methods and are submitted for the same laboratory analysis however different sample identification numbers are used.

For Routine, Baseline or Expanded Parameter analysis, field duplicate samples will be collected at a frequency of one (1) per every 20 samples or one (1) per event, whichever is more frequent. These samples will be collected from a randomly selected location, which is known to produce sufficient volumes of water.

6.1.3 Matrix Spike/Duplicate

MS/ MSD Samples are two (2) additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology.

For routine parameter analysis, one (1) matrix spike and one (1) matrix spike duplicate/laboratory duplicate sample will be analyzed per laboratory batch as required by the analytical methods.

For Baseline or Expanded Parameter analysis, one (1) matrix spike and matrix spike duplicate/laboratory duplicate will be collected at a frequency of one (1) per every 20 samples or one (1) per event, whichever is more frequent.

These samples will be collected from a randomly selected location. Groundwater sample locations will be collected from wells which are known to produce sufficient volumes of water.

6.2 Laboratory Quality Control Procedure

The laboratory quality control program has been audited, certified and approved by NYSDEC and describes the mechanisms the laboratory employs to ensure that all data reported meets or exceeds all applicable USEPA and NYSDEC requirements. It describes the laboratory's experience, its organizational structure, and procedures in place to ensure quality of the analytical data. The laboratory quality manual and Test America-Buffalo laboratory SOPs outline the sampling, analysis, and reporting procedures used by the laboratory.

TestAmerica has established specific procedures and checklists for the receipt, storage, and handling of environmental samples to assure their integrity and security. These procedures are discussed in detail in the TestAmerica-Buffalo SOPs and include detailed chain-of-custody records, secured storage and laboratory areas, and the tracking of each sample from its receipt at the lab through data generation and reporting.

The acceptance criteria and frequency for both initial and continuing calibration of the analytical instruments used by TestAmerica are documented in the TestAmerica SOPs and are described in

NYSDEC ASPs. TestAmerica will complete internal data validation for Routine Parameters in accordance with NYDEC requirements.

DQR, or equivalent, are requests submitted to the laboratory to formally review results that differ from historical results, or that exceed certain permit requirements or quality control criteria. The laboratory prepares a formal written response to each DQR explaining the discrepancy. The DQR is the first line of investigation following any anomalous result.

Audits are an important component of the quality assurance program at the laboratory. Audits are conducted by the laboratory. Internal system and performance audits are conducted periodically to ensure adherence by all laboratory departments to the QAPP. External audits are conducted by accrediting agencies or states. These reports are transmitted to department managers for review and response. Corrective measures must be taken for any finding or deficiency found in an internal or external audit.

Corrective action will be necessary if precision or accuracy limits are outside the acceptable limits. In such an event, the following corrective actions may be employed, depending upon the particular situation.

- Calculations are rechecked.
- Sample handling, i.e., digestion, concentration, and/or extraction logs are checked for discrepancies in sample handling.
- Analyte concentration is reviewed to determine if it has severely influenced the reliability of the precision or recovery calculations.
- Instrument and method performance is verified by inspecting data on standard reference materials processed in the same data set.
- Quality control data on the other samples in the data set, including surrogate recovery, internal standards, etc., are reviewed to determine if the problem is method related or sample related.
- If original sample is available, the sample is assessed for homogeneity.
- If sample is unavailable and no explanation for poor quality control results can be determined, additional samples will be obtained. If additional sample is unavailable, the results are issued with a qualification as to their accuracy.

TestAmerica has established procedures and responsibilities for corrective actions as well as a summary of probable sources and suggested corrective actions. These are presented in the TestAmerica SOPs.

6.3 Practical Quantitation Limits (PQL)

WMNY proposes to utilize laboratory-specific PQLs as the reporting limits of applicable low-detection analytes (especially organics). The USEPA developed the concept of the PQL to address the issue of analytical variability. The PQL concept was developed for compliance with the Safe Drinking Water Act (50 FR 46906, Nov. 13, 1985) where it is defined: "The PQL thus represents the lowest level achievable by good laboratories within specified limits during routine laboratory operating conditions."

Tables 2A through 2D provide the PQLs for laboratory analytes.

6.4 Analytical Methodologies

The analytical methods to be used for the analysis of each parameter are included in Table 3.

7. Data Quality Review, Reporting and Recordkeeping

Prior to submittal of a monitoring report to the NYSDEC, several data evaluation, reporting, and recordkeeping tasks will be implemented. The following sections describe the evaluation, reporting and recordkeeping procedures that are followed upon receipt of the analytical report.

7.1 Data Quality Review

Each analytical report received from the laboratory will undergo two (2) levels of quality management. These quality assessment procedures are described below.

7.1.1 Initial QA/QC Checks

Before the data are subjected to statistical analysis, WMNY will evaluate the data by examining the quality control information accompanying the data report from the laboratory. Relevant quality control data include measures of accuracy (percent recovery), precision (RPD), and sample contamination (blank determinations).

Data that fail any of these checks will be flagged for closer evaluation and a DQR. Results of the DQR will be submitted with the analytical data in the routine monitoring report. A brief summary of these relevant quality control data follows. A more complete description is contained in the laboratory QAPP.

Accuracy defines the relationship between the laboratory's measurements of a sample's concentration and the "true", but unknown concentration of the sample. Because the "true" concentration is unknown, accuracy must be measured indirectly by determining the percent recovery of a sample called the MS. The MS is analyzed under the same conditions as the groundwater sample and its concentration is determined. Because the MS has a known concentration its percent recovery can be calculated. It is assumed that the groundwater sample behaves exactly like the MS and thus the "true" concentration of the submitted groundwater sample can be back-calculated. Control criteria for percent recovery are taken from regulatory method requirements.

Precision is the assessment of the variability that can be expected in data that result from the analytical procedures employed. It provides a measure of the reproducibility which is estimated through duplicate measurements of a MS. Two (2) matrix spike samples are prepared as described above, a MS and a MSD. Both spikes are analyzed along with the unknown sample and the RPD between the two (2) spikes is determined. Control criteria for RPD are taken from regulatory method requirements.

The potential for sample contamination is assessed by measurements of "blank" samples. Blanks are samples of ultra-pure laboratory water that are not spiked with any analytes and are carried through the field sampling and laboratory environments. These samples are known as "field," "lab," and "equipment" blanks. It is assumed that any analytes that occur in the field or laboratory which might add to the concentration of the analyte in the sample will be picked up by the blank samples and measured. If any of the analytes of interest are found in the blank samples it is an indication of potential contamination of the unknown sample.

7.1.2 Data Validation

Analytical data will be reviewed by a validator that is not associated with the laboratory that is experienced and qualified in NYSDEC validations.

Five percent (5%) of the analytical data generated for groundwater sampling events for which Baseline or Expanded Parameters are analyzed will be validated. All the NYSDEC Category B QA/QC criteria for five percent (5%) of the samples will be reviewed.

Data will be validated consistent with the Waste Management’s Environmental Media Data Validation Procedures and other EPA analytical methods used for sample analysis for the project. Qualifiers added to the data and the conditions for addition of the qualifiers are those specified in EPA guidance documents "National Functional Guidelines for Organic Data Review", dated October 1999, EPA-540/R-99/008, "National Functional Guidelines for Inorganic Data Review", dated February, 1994, EPA-540/R-94-013.

7.1.3 Qualitative Data Evaluation

Following the initial QA/QC checks, all data will undergo a second level of review by graphing historical time trends and comparing new results with these historical trends to flag visual outliers or other anomalous data. If a clearly anomalous result is found, a DQR will be initiated with the laboratory to ascertain if laboratory error is involved. In addition, field information will be checked for anomalous occurrences or observations that might help to explain the outlier result.

7.2 Data Reporting Requirements

Data obtained from the environmental monitoring data will be reported to the NYSDEC within 90 days of concluding the sampling event (including DO and temperature monitoring as S-8 in Hotel Creek), unless more rapid reporting is required as a result of significant increases. The reporting of analytical data will be completed in accordance with 6NYCRR Part 360-2.ll(c)(5)(iv).

The quarterly reports will include a review of site conditions, tables providing the data and comparisons to NYSDEC groundwater standards, the results of time series graphs and Piper, Stiff and Ternary diagrams as appropriate, groundwater elevation data, any data quality issues determined by the laboratory or the outside independent data validator for a baseline event and conclusions regarding the presence/absence of significant increases. In addition, leachate quality data (semi-annual), underdrain water quality (for operating underdrains), surface water and sediment quality, ambient air monitoring, and noise monitoring will be submitted with each quarterly report.

An annual report will also be submitted which summarizes the data collected over the previous year, including discussions regarding observed changes in groundwater, surface water, leachate, etc. and will include potentiometric surface maps supporting evaluations of groundwater flow directions.

7.3 Data Record Keeping Requirements

All analytical data are maintained by the laboratory indefinitely. The laboratory ensures that, at each stage of a process where a permanent data record is required, security measures are in place to guarantee the integrity of the data. SOPs are in place for computer security, computer data storage and back-up. In addition, all raw chemical data provided by the laboratory will be available for review upon request.

8. References

AMEC Geomatrix, Inc., 2011. Environmental Monitoring Plan for the Mill Seat Landfill Facility, Revised May 2011.

GEI Consultants, Inc. P.C., 2015. Hydrogeologic Investigation Report – Proposed Mill Seat Expansion, February 2015.

O'Brien & Gere Engineers, Inc. 2003. Environmental Monitoring Plan for the Mill Seat Landfill Facility, September 2003.

Tables

TABLE 1
MONITORING LOCATIONS

Mill Seat Landfill
Town of Riga, New York

Monitoring Wells	Frequency
Original Permited Footprint Monitoring Wells (Water Quality)	*Quarterly (1) ; reduced to Semi-Annually when Stage VII becomes operable*
M-1A* (M-1B is unsaturated and cannot be sampled)	
M-2A (to be decommissioned with Stage V-A construction)	
M-2B (to be decommissioned with Stage V-A construction)	
M2Z (to be decommissioned with Stage V-A construction)	
M-4A	
M-4B	
M-6A	
M-6B	
M-7A (to be decommissioned with Stage VI-B construction)	
M-7B (to be decommissioned with Stage VI-B construction)	
M-8A	
M-8B	
M-10A	
M-10B	
M-14A	
M-14B	
M-15A	
M-15B	
M-16A	
M-16B	
M-17A	
M-17B	
M-18A	
M-18B	
M-19A	
M-19B	
M-20A	
M-20B	
M-22A	
M-22B	
M-23A**	
M-23B**	
M-24A**	
M-24B**	
M-25A*	
M-25B*	
A-1 (artesian well)	

Existing Permitted Footprint Monitoring Wells (Water Levels only)	***Frequency***
M-1Z	*Quarterly (1) ; reduced to Semi-Annually when Stage VII becomes operable*
M-8Z	
M-16Z	
M-18Z	
M-19Z	
M-23Z	

Monitoring Wells	Frequency
Expansion Area Monitoring Wells (Water Quality)	*Quarterly (1)*
M-26A	
M-26B	
M-27A	
M-27B	
M-28A	
M-28B	
M-29A (re-name MW- SEA-4A)	
M-29B (re-name MW-1D-2006 aka, MW-SEA-4B)	
M-30A	
M-30B	
M-31A	
M-31B	
M-32A	
M-32B	
M-33A	
M-33B	
M-34A	
M-34B	
M-35A (re-name MW- SEA-2A)	
M-35B (re-name MW- SEA-2B)	
M-36A * (re-name MW- SEA-1A)	
M-36B * (re-name MW- SEA-1B)	

Expansion Area Monitoring Wells (Water Levels only)	***Frequency***
MW-SEA-5A	*Quarterly (1)*
MW-SEA-5B	
PZ-SEA-5Z	
MW-SEA-6A	
MW-SEA-6B	
PZ-SEA-6Z	
MW-SEA-3Z	
PZ-SEA-3Z	
PZ-SEA-1Z	
Shallow overburden piezometers to be decommisioned prior to stage construction	

Color coding above for well installation/background monitoring sequencing with Expansion Area Stage Development
Sampling with Proposed Stage V and Stage VI operation
Sampling with Proposed Stage VII and Stage VIII operation
Sampling with Proposed Stage IX operation

Surface Water/Sediment Locations	Frequency
S1 / SED1	*Quarterly (1)*
S2 / SED2	
S3 / SED3	
S4 / SED4	
S5 / SED5	
S6 / SED6	
S8 / SED8	

Landfill System (Sample ID)	Frequency
Retention Ponds	*Quarterly (1)*
DP-1	
DP-2 (detention pond will be relocated to SRP-8)	
SRP-7	
Primary Leachate Sampling Points	*Semi-Annually*
L1 Stage 1	
L1 Stage 2-3	
S4A-P	
S5A&B-P	
S6A&B-P	
S7-P	
S8-P	
S9A&B-P	
Secondary Leachate Sampling Points	
L2 Stage 1	
L2 Stage 2-3	
S4A-S	
S5A&B-S	
S6A&B-S	
S7-S	
S8-S	
S9A&B-S	

Noise Monitoring (Sample ID - Location)	Frequency
P-1 - North property boundary	*Quarterly (1)*
P-2 - East property boundary	
P-3 - Along Brew Road	
P-4 - Southeast facility boundary	
P-5 - Southwest facility area	
P-6 - West property boundary	

Ambient Air Testing (Explosive Gas/Particulates)	Frequency
WF-AA - Working Face	*Quarterly (1)*
N-AA - North property boundary	*Annually*
E-AA - East of Expansion	
S-AA - South of Expansion	
W-AA - West of Expansion	

Groundwater Suppression System Sites	Frequency
GW 9-1.2	*Quarterly (1)*
GW 11-1.2	
GW 13-1.2	
GW 15-1.2	
GW 16-1.2	
GW 17-1.2	
GW 18-1.2	
GW 19-1.2	
GW 20-1.2	
GW 21-1.2	
GW 22-1.2	
GW 23-1.2	
GW 24-1.2	
GW 25-1.2	
GW 26-1.2	
GW 27-1.2	
GW 28-1.2	
GW 29-1.2	
GW 30-1.2	
GW 31-1.2	
GW 32-1.2	
GW 33-1.2	
GW 38-1.2	
S4A-U	
S5A&B-U	
S6A&B-U	
S7-U	
S8-U	
S9A&B-U	

Notes:

*** upgradient wells for water quality monitoirng**

**** cross gradient wells for water quality monitoring**

Leachate sampling - Stage 1, Stage 2-3, and S4 refer to permitted footprint others refer to Landfill Expansion

(1) Quarterly sampling excludes the winter months (January through March); sampling frequency is therefore three (3) times per year.

TABLE 2A
EXPANDED MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters [1]	CAS RN	Method	PQL	units
Leachate Indicators (ug/L)				
Total Kjeldahl Nitrogen	STL00296	351.2	0.200	mg/L as N
Ammonia, distilled	7664-41-7	350.1	0.200	mg/L as N
Nitrate	14797-55-8	Nitrate_Calc	0.0500	mg/L as N
Biochemical Oxygen Demand 5 day	STL00311	5210B	2.00	mg/L
Chemical Oxygen Demand	STL00070	410.4	10.0	mg/L
Total Dissolved Solids	STL00242	2540C_Calcd	10.0	mg/L
Total Organic Carbon	7440-44-0	SM5310D	1.00	mg/L
Sulfate	14808-79-8	300.0_28D	2.00	mg/L
Alkalinity, Total	STL00171	2320B	5.00	mg/L
Phenolics, Total Recoverable	STL00166	420.4	0.00800	mg/L
Chloride	16887-00-6	300.0_28D	0.500	mg/L
Hardness as CaC03	STL00009	2340C	2.00	mg/L
Color	STL00153	2120B	0.0100	Color Units
Inorganic Parameters				
Aluminum	7429-90-5	6010C	60.0	ug/L
Antimony	7440-36-0	6010C	7.00	ug/L
Arsenic	7440-38-2	6010C	10.0	ug/L
Barium	7440-39-3	6010C	500	ug/L
Beryllium	7440-41-7	6010C	3.00	ug/L
Boron	7440-42-8	6010C	500	ug/L
Bromide	24959-67-9	300.0_28D	0.200	mg/L
Cadmium	7440-43-9	6010C	1.00	ug/L
Calcium	7440-70-2	6010C	500	ug/L
Chromium	7440-47-3	6010C	25.0	ug/L
Chromium, hexavalent	18540-29-9	7196A	0.00600	mg/L
Cyanide, Total	57-12-5	9012B	0.00500	mg/L
Cobalt	7440-48-4	6010C	5.00	ug/L
Copper	7440-50-8	6010C	10.0	ug/L
Iron	7439-89-6	6010C	50.0	ug/L
Lead	7439-92-1	6010C	5.00	ug/L
Magnesium	7439-95-4	6010C	500	ug/L
Manganese	7439-96-5	6010C	25.0	ug/L
Mercury	7439-97-6	7470A	0.200	ug/L
Nickel	7440-02-0	6010C	30.0	ug/L
Potassium	7440-09-7	6010C	3000	ug/L
Selenium	7782-49-2	6010C	9.00	ug/L
Silver	7440-22-4	6010C	5.00	ug/L
Sodium	7440-23-5	6010C	500	ug/L
Thallium	7440-28-0	6010C	20.0	ug/L
Tin	7440-31-5	6010C	8000	ug/L
Vanadium	7440-62-2	6010C	14.0	ug/L
Zinc	7440-66-6	6010C	10.0	ug/L
Volatile Organic Compounds (VOCs)				
1,1,1,2-Tetrachloroethane	630-20-6	8260C	5.00	ug/L
1,1,1-Trichloroethane	71-55-6	8260C	5.00	ug/L
1,1,2,2-Tetrachloroethane	79-34-5	8260C	0.500	ug/L
1,1,2-Trichloroethane	79-00-5	8260C	0.500	ug/L
1,1-Dichloroethane	75-34-3	8260C	1.00	ug/L
1,1-Dichloroethene	75-35-4	8260C	1.00	ug/L
1,1-Dichloropropene	563-58-6	8260C	1.00	ug/L
1,2,3-Trichloropropane	96-18-4	8260C	0.890	ug/L
1,2-Dibromo-3-Chloropropane	96-12-8	8260C	1.00	ug/L
1,2-Dibromoethane	106-93-4	8260C	5.00	ug/L
1,2-Dichlorobenzene	95-50-1	8260C	2.00	ug/L

TABLE 2A
EXPANDED MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters (1)	CAS RN	Method	PQL	units
1,2-Dichloroethane	107-06-2	8260C	0.500	ug/L
1,2-Dichloropropane	78-87-5	8260C	0.720	ug/L
1,3-Dichlorobenzene	541-73-1	8260C	1.00	ug/L
1,3-Dichloropropane	142-28-9	8260C	1.00	ug/L
1,4-Dichlorobenzene	106-46-7	8260C	2.00	ug/L
2,2-Dichloropropane	594-20-7	8260C	1.00	ug/L
2-Butanone	78-93-3	8260C	100	ug/L
2-Chloro-1,3-butadiene	126-99-8	8260C	2.00	ug/L
2-Hexanone	591-78-6	8260C	10.0	ug/L
4-Methyl-2-pentanone	108-10-1	8260C	5.00	ug/L
Acetone	67-64-1	8260C	100	ug/L
Acetonitrile	75-05-8	8260C	26.0	ug/L
Acrolein	107-02-8	8260C	40.0	ug/L
Acrylonitrile	107-13-1	8260C	10.5	ug/L
3-Chloropropene (Allyl Chloride)	107-05-1	8260C	1.00	ug/L
Benzene	71-43-2	8260C	0.700	ug/L
Bromochloromethane	74-97-5	8260C	2.50	ug/L
Bromodichloromethane	75-27-4	8260C	1.00	ug/L
Bromoform	75-25-2	8260C	2.00	ug/L
Bromomethane	74-83-9	8260C	5.00	ug/L
Carbon disulfide	75-15-0	8260C	5.00	ug/L
Carbon tetrachloride	56-23-5	8260C	1.00	ug/L
Chlorobenzene	108-90-7	8260C	2.00	ug/L
Chloroethane	75-00-3	8260C	5.00	ug/L
Chloroform	67-66-3	8260C	0.500	ug/L
Chloromethane	74-87-3	8260C	5.00	ug/L
cis-1,2-Dichloroethene	156-59-2	8260C	1.00	ug/L
cis-1,3-Dichloropropene	10061-01-5	8260C	0.400	ug/L
Dibromochloromethane	124-48-1	8260C	1.00	ug/L
Dibromomethane	74-95-3	8260C	5.00	ug/L
Dichlorodifluoromethane	75-71-8	8260C	2.00	ug/L
Ethyl methacrylate	97-63-2	8260C	1.00	ug/L
Ethylbenzene	100-41-4	8260C	2.00	ug/L
Iodomethane	74-88-4	8260C	5.00	ug/L
Isobutanol	78-83-1	8260C	100	ug/L
Methacrylonitrile	126-98-7	8260C	10.0	ug/L
Methyl methacrylate	80-62-6	8260C	1.00	ug/L
Methylene Chloride	75-09-2	8260C	5.00	ug/L
Propionitrile	107-12-0	8260C	30.0	ug/L
Styrene	100-42-5	8260C	5.00	ug/L
Tetrachloroethene	127-18-4	8260C	0.500	ug/L
Toluene	108-88-3	8260C	2.00	ug/L
trans-1,2-Dichloroethene	156-60-5	8260C	1.00	ug/L
trans-1,3-Dichloropropene	10061-02-6	8260C	0.400	ug/L
trans-1,4-Dichloro-2-butene	110-57-6	8260C	5.00	ug/L
Trichloroethene	79-01-6	8260C	1.00	ug/L
Trichlorofluoromethane	75-69-4	8260C	5.00	ug/L
Vinyl acetate	108-05-4	8260C	5.00	ug/L
Vinyl chloride	75-01-4	8260C	2.00	ug/L
Xylenes, Total	1330-20-7	8260C	5.00	ug/L

TABLE 2A
EXPANDED MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters [(1)]	CAS RN	Method	PQL	units
Semi-Volatile Organic Compounds (SVOCs)				
1,2,4,5-Tetrachlorobenzene	95-94-3	8270D	5.00	ug/L
1,2,4-Trichlorobenzene	120-82-1	8270D	10.0	ug/L
1,4-Naphthoquinone	130-15-4	8270D	10.0	ug/L
1-Naphthylamine	134-32-7	8270D	10.0	ug/L
2,2'-Oxybis(1-chloropropane)	108-60-1	8270D	5.00	ug/L
2,3,4,6-Tetrachlorophenol	58-90-2	8270D	5.00	ug/L
2,4,5-Trichlorophenol	95-95-4	8270D	5.00	ug/L
2,4,6-Trichlorophenol	88-06-2	8270D	5.00	ug/L
2,4-Dichlorophenol	120-83-2	8270D	5.00	ug/L
2,4-Dimethylphenol	105-67-9	8270D	5.00	ug/L
2,4-Dinitrophenol	51-28-5	8270D	10.0	ug/L
2,4-Dinitrotoluene	121-14-2	8270D	5.00	ug/L
2,6-Dichlorophenol	87-65-0	8270D	10.0	ug/L
2,6-Dinitrotoluene	606-20-2	8270D	5.00	ug/L
2-Acetylaminofluorene	53-96-3	8270D	10.0	ug/L
2-Chloronaphthalene	91-58-7	8270D	5.00	ug/L
2-Chlorophenol	95-57-8	8270D	5.00	ug/L
2-Methylnaphthalene	91-57-6	8270D	5.00	ug/L
2-Methylphenol	95-48-7	8270D	5.00	ug/L
2-Naphthylamine	91-59-8	8270D	10.0	ug/L
2-Nitroaniline	88-74-4	8270D	10.0	ug/L
2-Nitrophenol	88-75-5	8270D	5.00	ug/L
3 & 4 Methylphenol	15831-10-4	8270D	10.0	ug/L
3,3'-Dichlorobenzidine	91-94-1	8270D	5.00	ug/L
3,3'-Dimethylbenzidine	119-93-7	8270D	40.0	ug/L
3-Methylcholanthrene	56-49-5	8270D	10.0	ug/L
3-Nitroaniline	99-09-2	8270D	10.0	ug/L
4,6-Dinitro-2-methylphenol	534-52-1	8270D	10.0	ug/L
4-Aminobiphenyl	92-67-1	8270D	10.0	ug/L
4-Bromophenyl phenyl ether	101-55-3	8270D	5.00	ug/L
4-Chloro-3-methylphenol	59-50-7	8270D	5.00	ug/L
4-Chloroaniline	106-47-8	8270D	5.00	ug/L
4-Chlorophenyl phenyl ether	7005-72-3	8270D	5.00	ug/L
4-Nitroaniline	100-01-6	8270D	10.0	ug/L
4-Nitrophenol	100-02-7	8270D	10.0	ug/L
5-Nitro-o-toluidine	99-55-8	8270D	10.0	ug/L
7,12-Dimethylbenz(a)anthracene	57-97-6	8270D	10.0	ug/L
Acenaphthene	83-32-9	8270D	5.00	ug/L
Acenaphthylene	208-96-8	8270D	5.00	ug/L
Acetophenone	98-86-2	8270D	5.00	ug/L
Anthracene	120-12-7	8270D	5.00	ug/L
Benz(a)anthracene	56-55-3	8270D	5.00	ug/L
Benzo[a]pyrene	50-32-8	8270D	5.00	ug/L
Benzo(b)fluoranthene	205-99-2	8270D	5.00	ug/L
Benzo(ghi)perylene	191-24-2	8270D	5.00	ug/L
Benzo(k)fluoranthene	207-08-9	8270D	5.00	ug/L
Benzyl alcohol	100-51-6	8270D	20.0	ug/L
Bis(2-chloroethoxy)methane	111-91-1	8270D	5.00	ug/L
Bis(2-chloroethyl)ether	111-44-4	8270D	5.00	ug/L
Bis(2-ethylhexyl) phthalate	117-81-7	8270D	5.00	ug/L
Butyl benzyl phthalate	85-68-7	8270D	5.00	ug/L
Chlorobenzilate	510-15-6	8270D	20.0	ug/L
Chrysene	218-01-9	8270D	5.00	ug/L
Diallate	2303-16-4	8270D	10.0	ug/L

TABLE 2A
EXPANDED MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters [(1)]	CAS RN	Method	PQL	units
Dibenz(a,h)anthracene	53-70-3	8270D	5.00	ug/L
Diethyl phthalate	84-66-2	8270D	5.00	ug/L
Dimethoate	60-51-5	8270D	10.0	ug/L
Dimethyl phthalate	131-11-3	8270D	5.00	ug/L
Di-n-butyl phthalate	84-74-2	8270D	5.00	ug/L
Di-n-octyl phthalate	117-84-0	8270D	5.00	ug/L
Diphenylamine	122-39-4	8270D	10.0	ug/L
Disulfoton	298-04-4	8270D	10.0	ug/L
Ethyl methanesulfonate	62-50-0	8270D	10.0	ug/L
Famphur	52-85-7	8270D	40.0	ug/L
Fluoranthene	206-44-0	8270D	5.00	ug/L
Fluorene	86-73-7	8270D	5.00	ug/L
Hexachlorobenzene	118-74-1	8270D	5.00	ug/L
Hexachlorobutadiene	87-68-3	8270D	5.00	ug/L
Hexachlorocyclopentadiene	77-47-4	8270D	5.00	ug/L
Hexachloroethane	67-72-1	8270D	5.00	ug/L
Hexachloropropene	1888-71-7	8270D	10.0	ug/L
Indeno[1,2,3-cd]pyrene	193-39-5	8270D	5.00	ug/L
Isodrin	465-73-6	8270D	10.0	ug/L
Isophorone	78-59-1	8270D	5.00	ug/L
Isosafrole	120-58-1	8270D	10.0	ug/L
Kepone	143-50-0	8270D	50.0	ug/L
m-Dinitrobenzene	99-65-0	8270D	20.0	ug/L
Methapyrilene	91-80-5	8270D	50.0	ug/L
Methyl methanesulfonate	66-27-3	8270D	10.0	ug/L
Naphthalene	91-20-3	8270D	5.00	ug/L
Nitrobenzene	98-95-3	8270D	5.00	ug/L
N-Nitrosodiethylamine	55-18-5	8270D	10.0	ug/L
N-Nitrosodimethylamine	62-75-9	8270D	10.0	ug/L
N-Nitrosodi-n-butylamine	924-16-3	8270D	10.0	ug/L
N-Nitrosodi-n-propylamine	621-64-7	8270D	5.00	ug/L
N-Nitrosodiphenylamine	86-30-6	8270D	5.00	ug/L
N-Nitrosomethylethylamine	10595-95-6	8270D	10.0	ug/L
N-Nitrosopiperidine	100-75-4	8270D	10.0	ug/L
N-Nitrosopyrrolidine	930-55-2	8270D	10.0	ug/L
o,o',o''-Triethylphosphorothioate	126-68-1	8270D	10.0	ug/L
o-Toluidine	95-53-4	8270D	10.0	ug/L
Parathion	56-38-2	8270D	10.0	ug/L
Methyl parathion	298-00-0	8270D	10.0	ug/L
p-Dimethylamino azobenzene	60-11-7	8270D	10.0	ug/L
Pentachlorobenzene	608-93-5	8270D	10.0	ug/L
Pentachloronitrobenzene	82-68-8	8270D	10.0	ug/L
Pentachlorophenol	87-86-5	8270D	10.0	ug/L
Phenacetin	62-44-2	8270D	10.0	ug/L
Phenanthrene	85-01-8	8270D	5.00	ug/L
Phenol	108-95-2	8270D	5.00	ug/L
Phorate	298-02-2	8270D	10.0	ug/L
p-Phenylene diamine	106-50-3	8270D	800	ug/L
Pronamide	23950-58-5	8270D	10.0	ug/L
Pyrene	129-00-0	8270D	5.00	ug/L
Safrole	94-59-7	8270D	10.0	ug/L
sym-Trinitrobenzene	99-35-4	8270D	10.0	ug/L
Thionazin	297-97-2	8270D	10.0	ug/L

TABLE 2A
EXPANDED MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters [1]	CAS RN	Method	PQL	units
Pesticide and Herbicide				
4,4'-DDD	72-54-8	8081B	0.0500	ug/L
4,4'-DDE	72-55-9	8081B	0.0500	ug/L
4,4'-DDT	50-29-3	8081B	0.0500	ug/L
Aldrin	309-00-2	8081B	0.0500	ug/L
alpha-BHC	319-84-6	8081B	0.0500	ug/L
beta-BHC	319-85-7	8081B	0.0500	ug/L
Chlordane	57-74-9	8081B	0.500	ug/L
delta-BHC	319-86-8	8081B	0.0500	ug/L
Dieldrin	60-57-1	8081B	0.0500	ug/L
Endosulfan I	959-98-8	8081B	0.0500	ug/L
Endosulfan II	33213-65-9	8081B	0.0500	ug/L
Endosulfan sulfate	1031-07-8	8081B	0.0500	ug/L
Endrin	72-20-8	8081B	0.0500	ug/L
Endrin aldehyde	7421-93-4	8081B	0.0500	ug/L
gamma-BHC (Lindane)	58-89-9	8081B	0.0500	ug/L
Heptachlor	76-44-8	8081B	0.0500	ug/L
Heptachlor epoxide	1024-57-3	8081B	0.0500	ug/L
Methoxychlor	72-43-5	8081B	0.500	ug/L
Toxaphene	8001-35-2	8081B	0.500	ug/L
Herbicides				
2,4,5-T	93-76-5	8151A	0.500	ug/L
2,4-D	94-75-7	8151A	0.500	ug/L
Dinoseb	88-85-7	8151A	0.500	ug/L
2,4,5-TP (Silvex)	93-72-1	8151A	0.500	ug/L
Polychlorinated biphenyls (PCBs)				
Aroclor 1016	12674-11-2	8082A	0.500	ug/L
Aroclor 1221	11104-28-2	8082A	0.500	ug/L
Aroclor 1232	11141-16-5	8082A	0.500	ug/L
Aroclor 1242	53469-21-9	8082A	0.500	ug/L
Aroclor 1248	12672-29-6	8082A	0.500	ug/L
Aroclor 1254	11097-69-1	8082A	0.500	ug/L
Aroclor 1260	11096-82-5	8082A	0.500	ug/L

Notes:

(1) The following field parameters are also taken: static water levels (in wells and sumps), specific conductance, temperature, floaters or sinkers, pH, Eh, DO (SW only), field observations and turbidity.

Dioxins and dibenzofuran analysis was waived by the NYSDEC for the Mill Seat LF
CAS RN is the Chemical Abstract Number
Method is EPA Method #
PQL is Practical Quantification Limit
ug/L is micrograms per liter
mg/L is milligrams per liter
Metals are totals

TABLE 2B
ROUTINE MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters (1)	CAS RN	Method	PQL	units
Leachate Indicators				
Total Kjeldahl Nitrogen	STL00296	351.2	0.200	mg/L as N
Ammonia (as N)	7664-41-7	350.1	0.0200	mg/L as N
Nitrate	14797-55-8	Nitrate_Calc	0.0500	mg/L as N
Biochemical Oxygen Demand	STL00311	5210B	2.00	mg/L
Chemical Oxygen Demand	STL00070	410.4	10.0	mg/L
Total Organic Carbon	7440-44-0	SM5310D	1.00	mg/L
Total Dissolved Solids	STL00242	2540C_Calcd	10.0	mg/L
Sulfate	14808-79-8	300.0_28D	2.00	mg/L
Alkalinity, Total	STL00171	2320B	5.00	mg/L
Phenolics, Total Recoverable	STL00166	420.4	0.00800	mg/L
Chloride	16887-00-6	300.0_28D	0.500	mg/L
Bromide	24959-67-9	300.0_28D	0.200	mg/L
Total Hardness	STL00009	2340C	2.00	mg/L
Color	STL00153	2120B	0.0100	Color Units
Inorganic Parameters				
Cadmium	7440-43-9	6010C	1.00	ug/L
Calcium	7440-70-2	6010C	500	ug/L
Iron	7439-89-6	6010C	50.0	ug/L
Lead	7439-92-1	6010C	5.00	ug/L
Magnesium	7439-95-4	6010C	500	ug/L
Manganese	7439-96-5	6010C	25.0	ug/L
Potassium	7440-09-7	6010C	3000	ug/L
Sodium	7440-23-5	6010C	500	ug/L

Notes:

(1) The following field parameters are also taken: static water levels (in wells and sumps), specific conductance, temperature, floaters or sinkers, pH, Eh, DO (SW only), field observations and turbidity.
CAS RN is the Chemical Abstract Number
Method is EPA method #
PQL is Practical Quantification Limit
ug/L is micrograms per liter
mg/L is milligrams per liter
Metals are totals

TABLE 2C
BASELINE MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters (1)	CAS RN	Method	PQL	units
Leachate Indicators				
Total Kjeldahl Nitrogen	STL00296	351.2	0.200	mg/L as N
Ammonia (as N)	7664-41-7	350.1	0.0200	mg/L as N
Nitrate	14797-55-8	Nitrate_Calc	0.0500	mg/L as N
Biochemical Oxygen Demand	STL00311	5210B	2.00	mg/L
Chemical Oxygen Demand	STL00070	410.4	10.0	mg/L
Total Organic Carbon	7440-44-0	SM5310D	1.00	mg/L
Total Dissolved Solids	STL00242	2540C_Calcd	10.0	mg/L
Sulfate	14808-79-8	300.0_28D	2.00	mg/L
Alkalinity, Total	STL00171	2320B	5.00	mg/L
Phenolics, Total Recoverable	STL00166	420.4	0.00800	mg/L
Chloride	16887-00-6	300.0_28D	0.500	mg/L
Bromide	24959-67-9	300.0_28D	0.200	mg/L
Total Hardness	STL00009	2340C	2.00	mg/L
Color	STL00153	2120B	0.0100	Color Units
Inorganic Parameters				
Aluminum	7429-90-5	6010C	60.0	ug/L
Antimony	7440-36-0	6010C	7.00	ug/L
Arsenic	7440-38-2	6010C	10.0	ug/L
Barium	7440-39-3	6010C	500	ug/L
Beryllium	7440-41-7	6010C	3.00	ug/L
Boron	7440-42-8	6010C	500	ug/L
Cadmium	7440-43-9	6010C	1.00	ug/L
Calcium	7440-70-2	6010C	500	ug/L
Chromium	7440-47-3	6010C	25.0	ug/L
Chromium, hexavalent	18540-29-9	7196A	0.00600	mg/L
Cobalt	7440-48-4	6010C	5.00	ug/L
Copper	7440-50-8	6010C	10.0	ug/L
Cyanide	57-12-5	9012A	0.00500	mg/L
Iron	7439-89-6	6010C	50.0	ug/L
Lead	7439-92-1	6010C	5.00	ug/L
Magnesium	7439-95-4	6010C	500	ug/L
Manganese	7439-96-5	6010C	25.0	ug/L
Mercury	7439-97-6	7470A	0.200	ug/L
Nickel	7440-02-0	6010C	30.0	ug/L
Potassium	7440-09-7	6010C	3000	ug/L
Selenium	7782-49-2	6010C	9.00	ug/L
Silver	7440-22-4	6010C	5.00	ug/L
Sodium	7440-23-5	6010C	500	ug/L
Sulfide	18496-25-8	SM4500_S2_F	1000	ug/L
Thallium	7440-28-0	6010C	20.0	ug/L
Vanadium	7440-62-2	6010C	14.0	ug/L
Zinc	7440-66-6	6010C	10.0	ug/L
Volatile Organic Compound (VOCs)				
1,1,1,2-Tetrachloroethane	630-20-6	8260C	1.00	ug/L
1,1,1-Trichloroethane	71-55-6	8260C	1.00	ug/L
1,1,2,2-Tetrachloroethane	79-34-5	8260C	1.00	ug/L
1,1,2-Trichloroethane	79-00-5	8260C	1.00	ug/L
1,1-Dichloroethane	75-34-3	8260C	1.00	ug/L
1,2,3-Trichloropropane	96-18-4	8260C	1.00	ug/L
1,2-Dibromo-3-Chloropropane	96-12-8	8260C	1.00	ug/L

TABLE 2C
BASELINE MONITORING PARAMETER LIST

Mill Seat Landfill
Town of Riga, New York

Parameters (1)	CAS RN	Method	PQL	units
1,2-Dibromoethane	106-93-4	8260C	1.00	ug/L
1,2-Dichlorobenzene	95-50-1	8260C	1.00	ug/L
1,2-Dichloroethane	107-06-2	8260C	1.00	ug/L
1,2-Dichloropropane	78-87-5	8260C	1.00	ug/L
1,4-Dichlorobenzene	106-46-7	8260C	1.00	ug/L
2-Butanone	78-93-3	8260C	5.00	ug/L
2-Hexanone	591-78-6	8260C	5.00	ug/L
4-Methyl-2-pentanone	108-10-1	8260C	5.00	ug/L
Acetone	67-64-1	8260C	5.00	ug/L
Acrylonitrile	107-13-1	8260C	5.00	ug/L
Benzene	71-43-2	8260C	1.00	ug/L
Bromochloromethane	74-97-5	8260C	1.00	ug/L
Bromodichloromethane	75-27-4	8260C	1.00	ug/L
Bromoform	75-25-2	8260C	1.00	ug/L
Bromomethane	74-83-9	8260C	1.00	ug/L
Carbon disulfide	75-15-0	8260C	1.00	ug/L
Carbon tetrachloride	56-23-5	8260C	1.00	ug/L
Chlorobenzene	108-90-7	8260C	1.00	ug/L
Chloroethane	75-00-3	8260C	1.00	ug/L
Chloroform	67-66-3	8260C	1.00	ug/L
Chloromethane	74-87-3	8260C	1.00	ug/L
cis-1,2-Dichloroethene	156-59-2	8260C	1.00	ug/L
cis-1,3-Dichloropropene	10061-01-5	8260C	1.00	ug/L
1,2-Dichloroethene	540-59-0	8260C	2.00	ug/L
Dibromochloromethane	124-48-1	8260C	1.00	ug/L
Dibromomethane	74-95-3	8260C	1.00	ug/L
Dichlorodifluoromethane	75-71-8	8260C	2.00	ug/L
Ethylbenzene	100-41-4	8260C	1.00	ug/L
Methylene Chloride	75-09-2	8260C	1.00	ug/L
Styrene	100-42-5	8260C	1.00	ug/L
Tetrachloroethene	127-18-4	8260C	1.00	ug/L
Toluene	108-88-3	8260C	1.00	ug/L
trans-1,2-Dichloroethene	156-60-5	8260C	1.00	ug/L
trans-1,3-Dichloropropene	10061-02-6	8260C	1.00	ug/L
trans-1,4-Dichloro-2-butene	110-57-6	8260C	5.00	ug/L
Trichloroethene	79-01-6	8260C	1.00	ug/L
Trichlorofluoromethane	75-69-4	8260C	1.00	ug/L
Vinyl acetate	108-05-4	8260C	5.00	ug/L
Vinyl chloride	75-01-4	8260C	1.00	ug/L
Xylenes, Total	1330-20-7	8260C	2.00	ug/L

Notes:

(1) The following field parameters are also taken: static water levels (in wells and sumps), specific conductance, temperature, floaters or sinkers, pH, Eh, DO (SW only), field observations and turbidity.
CAS RN is the Chemical Abstract Number
Method is EPA method #
PQL is Practical Quantification Limit
ug/L is micrograms per liter
mg/L is milligrams per liter
Metals are totals

TABLE 2D
SEDIMENT BASELINE AND ROUTINE PARAMETERS

Mill Seat Landfill
Town of Riga, New York

Parameters [(1)]	CAS RN	Method	PQL	units
Inorganic Parameters				
Aluminum	7429-90-5	6010C	10.00	mg/Kg
Antimony	7440-36-0	6010C	15.00	mg/Kg
Arsenic	7440-38-2	6010C	2.00	mg/Kg
Barium	7440-39-3	6010C	0.50	mg/Kg
Beryllium	7440-41-7	6010C	0.20	mg/Kg
Cadmium	7440-43-9	6010C	0.20	mg/Kg
Calcium	7440-70-2	6010C	50.00	mg/Kg
Chromium	7440-47-3	6010C	0.50	mg/Kg
Chromium, hexavalent	18540-29-9	7196A	0.80	mg/Kg
Cobalt	7440-48-4	6010C	0.50	mg/Kg
Copper	7440-50-8	6010C	1.00	mg/Kg
Cyanide, Total	57-12-5	9012B	1.00	mg/Kg
Iron	7439-89-6	6010C	10.00	mg/Kg
Lead	7439-92-1	6010C	1.00	mg/Kg
Magnesium	7439-95-4	6010C	20.00	mg/Kg
Manganese	7439-96-5	6010C	0.20	mg/Kg
Mercury	7439-97-6	7471B	0.02	mg/Kg
Nickel	7440-02-0	6010C	5.00	mg/Kg
Potassium	7440-09-7	6010C	80.00	mg/Kg
Selenium	7782-49-2	6010C	4.00	mg/Kg
Silver	7440-22-4	6010C	0.60	mg/Kg
Sodium	7440-23-5	6010C	140.00	mg/Kg
Thallium	7440-28-0	6010C	6.00	mg/Kg
Vanadium	7440-62-2	6010C	0.50	mg/Kg
Zinc	7440-66-6	6010C	2	mg/Kg
Volatile Organic Compound (VOCs)				
1,1,1,2-Tetrachloroethane	630-20-6	8260C	5.00	ug/Kg
1,1,1-Trichloroethane	71-55-6	8260C	5.00	ug/Kg
1,1,2,2-Tetrachloroethane	79-34-5	8260C	5.00	ug/Kg
1,1,2-Trichloroethane	79-00-5	8260C	5.00	ug/Kg
1,1-Dichloroethane	75-34-3	8260C	5.00	ug/Kg
1,1-Dichloroethene	75-35-4	8260C	5.00	ug/Kg
1,2,3-Trichloropropane	96-18-4	8260C	5.00	ug/Kg
1,2-Dibromo-3-Chloropropane	96-12-8	8260C	5.00	ug/Kg
1,2-Dichlorobenzene	95-50-1	8260C	5.00	ug/Kg
1,2-Dichloroethane	107-06-2	8260C	5.00	ug/Kg
1,2-Dichloropropane	78-87-5	8260C	5.00	ug/Kg
1,4-Dichlorobenzene	106-46-7	8260C	5.00	ug/Kg
2-Hexanone	591-78-6	8260C	25.00	ug/Kg
Acetone	67-64-1	8260C	25.00	ug/Kg
Acrylonitrile	107-13-1	8260C	25.00	ug/Kg
Benzene	71-43-2	8260C	5.00	ug/Kg
Bromoform	75-25-2	8260C	5.00	ug/Kg
Bromomethane	74-83-9	8260C	5.00	ug/Kg
Carbon disulfide	75-15-0	8260C	5.00	ug/Kg
Carbon tetrachloride	56-23-5	8260C	5.00	ug/Kg
Chlorobenzene	108-90-7	8260C	5.00	ug/Kg
Bromochloromethane	74-97-5	8260C	5.00	ug/Kg
Dibromochloromethane	124-48-1	8260C	5.00	ug/Kg
Chloroethane	75-00-3	8260C	5.00	ug/Kg
Chloroform	67-66-3	8260C	5.00	ug/Kg
Chloromethane	74-87-3	8260C	5.00	ug/Kg

TABLE 2D
SEDIMENT BASELINE AND ROUTINE PARAMETERS

Mill Seat Landfill
Town of Riga, New York

Parameters [1]	CAS RN	Method	PQL	units
cis-1,2-Dichloroethene	156-59-2	8260C	5.00	ug/Kg
cis-1,3-Dichloropropene	10061-01-5	8260C	5.00	ug/Kg
Dibromomethane	74-95-3	8260C	5.00	ug/Kg
Bromodichloromethane	75-27-4	8260C	5.00	ug/Kg
Ethylbenzene	100-41-4	8260C	5.00	ug/Kg
1,2-Dibromoethane	106-93-4	8260C	5.00	ug/Kg
2-Butanone	78-93-3	8260C	25.00	ug/Kg
4-Methyl-2-pentanone	108-10-1	8260C	25.00	ug/Kg
Methylene Chloride	75-09-2	8260C	5.00	ug/Kg
Styrene	100-42-5	8260C	5.00	ug/Kg
Tetrachloroethene	127-18-4	8260C	5.00	ug/Kg
Toluene	108-88-3	8260C	5.00	ug/Kg
trans-1,2-Dichloroethene	156-60-5	8260C	5.00	ug/Kg
trans-1,3-Dichloropropene	10061-02-6	8260C	5.00	ug/Kg
trans-1,4-Dichloro-2-butene	110-57-6	8260C	5.00	ug/Kg
Trichloroethene	79-01-6	8260C	5.00	ug/Kg
Trichlorofluoromethane	75-69-4	8260C	5.00	ug/Kg
Vinyl acetate	108-05-4	8260C	10.00	ug/Kg
Vinyl chloride	75-01-4	8260C	5.00	ug/Kg
Xylenes, Total	1330-20-7	8260C	10.00	ug/Kg

Notes:

(1) The following field parameters are also taken: static water levels (in wells and sumps), specific conductance, temperature, floaters or sinkers, pH, Eh, DO, field observations and turbidity.

Orange indicates Routine Parameters

CAS RN is the Chemical Abstract Number

Method is EPA method #

PQL is Practical Quantification Limit

ug/kg is micrograms per kilogram

mg/L is milligrams per kilogram

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	Trip blank	MS/MSD /Spike Duplicate*
VOCs (USEPA Methods 5030B/8260C)[1,2]	Aqueous	2-40 milliliter glass vials with Teflon® septum	4°C pH<2 FC pH4-5 for Acrylonitrile*	7 days from collection for analysis for unpreserved. 14 days from collection for analysis for unpreserved.	One per 20 samples or one per matrix (for less than 20 samples)	1 ea. Per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples)
VOCs (USEPA Methods 50030B/8260C)[1,2]	Solids	5 grams of sample in 2-40 milliliter pre-weighed and post-weighed glass vials with Teflon® septum containing stir bar and sodium bisulfate preservative	4°C	14 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples)
SVOCs and Orthophosphorus pesticides (USEPA Methods 3510C/3520C/8270D)[1,2]	Aqueous	1-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	**Trip blank**	**MS/MSD /Spike Duplicate***
SVOCs and Orthophosphorus pesticides (USEPA Methods 3510C/3520C/8270D) [1,2]	Solids	250 milliliter wide mouth glass container with Teflon® lined lid 100 grams sample volume required	4°C	14 days from collection to extraction; 40 days from extraction to analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Organochlorine Pesticides (USEPA Methods 3510C/3520C/8081B) [1,2]	Aqueous	1-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Organochlorine Pesticides (USEPA Methods 3510C/3520C/8081B) [1,2]	Solids	250 milliliter wide mouth glass container with Teflon® lined lid 250 grams sample volume required	4°C	14 days from collection to extraction; 40 days from extraction to analysis	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
PCBs (USEPA Methods 3510C/3520C/8082A) [1,2]	Aqueous	1-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	Trip blank	MS/MSD /Spike Duplicate*
PCBs (USEPA Methods 3541/3550B/8082A) [1,2]	Solid	250 milliliter wide mouth glass container with Teflon® lined lid 100 grams sample volume required	4°C	14 days from collection to extraction; 40 days from extraction to analysis	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Herbicides (USEPA Methods 3510C/3520C/8151A) [1,2]	Aqueous	1-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Metals (USEPA Methods 3005A/6010C) [1,2]	Aqueous	1-1000 milliliter polyethylene or fluorocarbon (TFE or PFA) container. 500 milliliters sample volume	HNO_3 to pH<2, 4°C	180 days from collection for analysis	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Mercury (USEPA Method 7470A) [1,2]	Aqueous	1-1000 milliliter polyethylene or fluorocarbon (TFE or PFA) container. 500 milliliters sample volume required.	HNO_3 to pH<2, 4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	Trip blank	MS/MSD /Spike Duplicate*
Metals (USEPA Methods 3050B/6010C) [1,2]	Solids	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container. 50 grams sample volume required.	4°C	180 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Mercury (USEPA Method 7471B) [1,2]	Solids	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container. 50 grams sample volume required.	4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	Trip blank	MS/MSD /Spike Duplicate*
Cyanide (USEPA Methods 9010B/9012B) [1,2]	Aqueous	1-500 milliliter plastic bottle. 100 milliliters sample volume	NaOH to pH>12, 4°C OA	14 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Cyanide (USEPA Methods 9010B/9012B) [1,2]	Solids	4 ounce wide mouth glass container with Teflon® lined lid	4°C	14 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Hexavalent chromium (USEPA Method 7196A) [1,2]	Aqueous	1-250 or 500 milliliter plastic bottle	4°C	24 hours from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Hexavalent chromium (USEPA Method 3060A/7196A) [1,2]	Solids	4 ounce wide mouth glass container with Teflon® lined lid	4°C	7 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Total Alkalinity (USEPA Method 310.1) [1,3]	Aqueous	1-250 or 500 milliliter plastic bottle, headspace free	4°C	14 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	**Matrix**	**Sample containers and volumes**	**Preservation**	**Extraction and Analysis Holding times**	**QC Sample Frequency**		
					Field duplicate	**Trip blank**	**MS/MSD /Spike Duplicate***
Ammonia nitrogen (USEPA Method 350.1) [1,3]	Aqueous	4 ounce wide mouth glass container with Teflon® lined lid. 50 grams sample volume required.	H_2SO_4 to pH<2, 4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Bromide, Chloride, Sulfate (USEPA Method 300.0) [4]	Aqueous	1-500 milliliter plastic bottle. 200 milliliters sample volume	4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Nitrate (USEPA Method 3000.0) [4]	Aqueous	1-500 milliliter plastic bottle. 200 milliliters sample volume	4°C	48 hours from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Total Rec. Phenol (USEPA Method 420.2) [1,3]	Aqueous	1-250 or 500 milliliter glass bottle	H_2SO_4 to pH<2, 4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
TOC (USEPA Method 415.1) [1,3]	Aqueous	1-250 or 500 milliliter plastic bottle	H_2SO_4 to pH<2, 4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

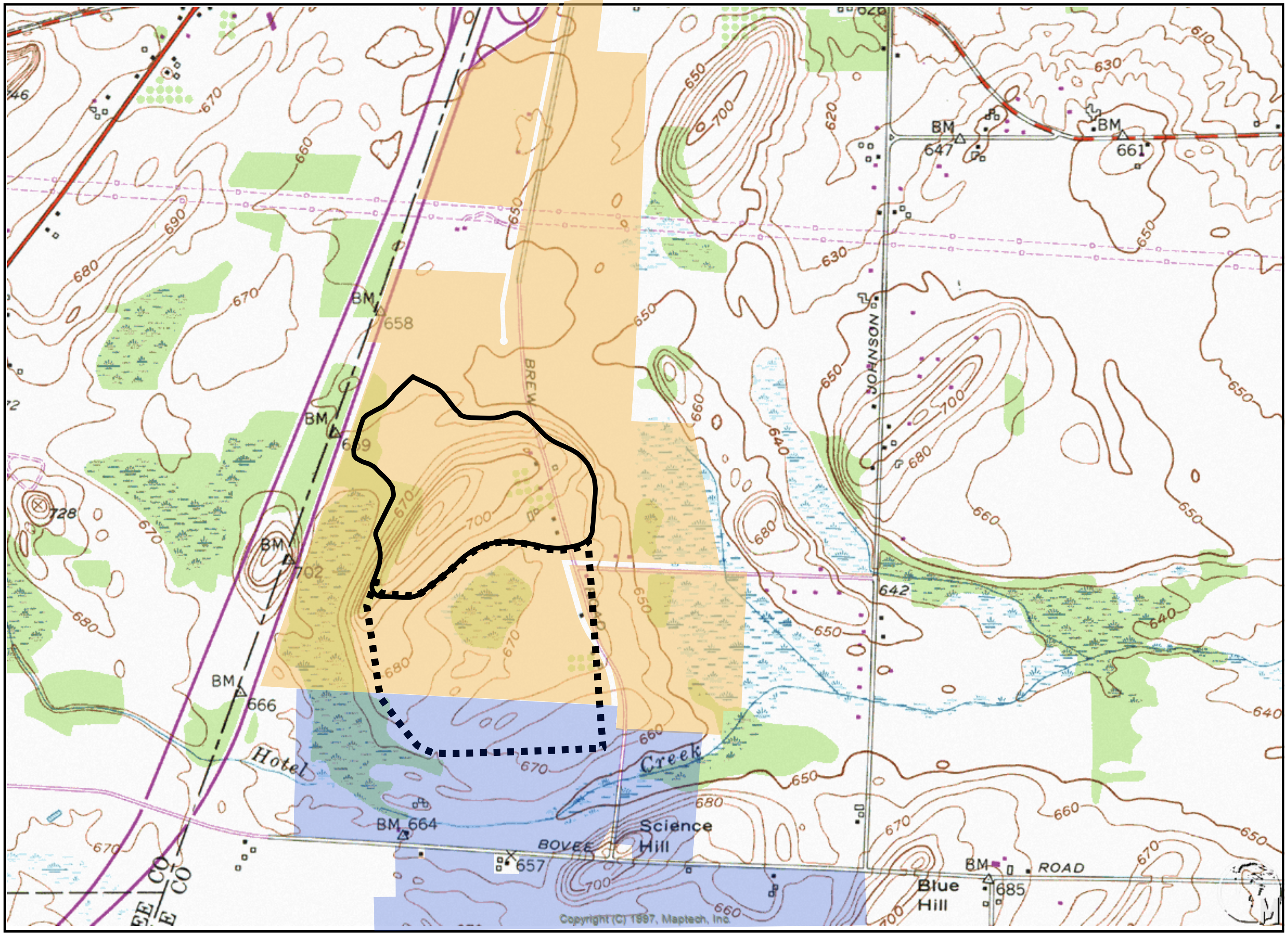
Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	Trip blank	MS/MSD /Spike Duplicate*
BOD (USEPA Method 405.1) [1,3]	Aqueous	1-250 or 500 milliliter plastic bottle	4°C	48 hours from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
COD (USEPA Method 410.4) [1,3]	Aqueous	1-250 or 500 milliliter plastic bottle	H_2S0_4 to pH<2, 4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
Color (USEPA Method 110.2) [1,3]	Aqueous	1-250 or 500 milliliter plastic bottle	4°C	48 hours from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
TDS (USEPA Method 160.1) [1,3]	Aqueous	1-250 or 500 milliliter plastic bottle	4°C	7 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

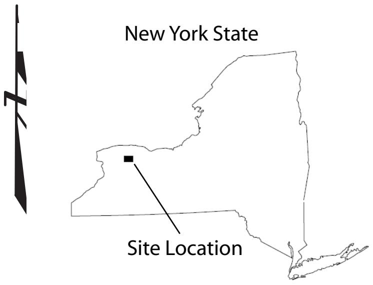
TABLE 3
LABORATORY METHODS, BOTTLE, PRESERVATIVE AND HOLDING TIMES
Mill Seat Landfill
Town of Riga, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Extraction and Analysis Holding times	QC Sample Frequency		
					Field duplicate	Trip blank	MS/MSD /Spike Duplicate*
Hardness (USEPA Method 130.2)[1,3]	Aqueous	1-250 or 500 milliliter polyethylene bottle	$HN0_3$ to pH <2, 4°C	6 months	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)
TKN (USEPA Method 351.2)[1,3]	Aqueous	1-500 milliliter plastic bottle	H_2S0_4 to pH<2, 4°C	28 days from collection for analysis	One per 20 samples or one per matrix (for less than 20 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)

NOTES:
*MS/MSD indicates matrix spike/matrix spike duplicate sample for organic analyses. Spike duplicate is performed for inorganic analyses.
FC indicates that if free chlorine is present in samples, it must be removed by the appropriate addition of Na2S203 or ascorbic acid
OA indicates that if oxidizing agents are present, add 5 ml 0.1N NaAs02 per liter and 0.6g of ascorbic acid per liter.

1- New York State Department of Environmental Conservation (NYSDEC). 2004. *Analytical Services Protocol.* Albany, N.Y.
2- United States Environmental Protection Agency (USEPA). 2004. *Test Methods for Evaluating Solid* Waste*: Physical/Chemical Methods, SW-846,3rd* Edition, Update IV. Washington D.C.
3- United States Environmental Protection Agency (USEPA). 1983. *Methods for Chemical Analysis of Water and Wastes,* Cincinnati, Ohio.
4- United States Environmental Protection Agency (USEPA). 1993a. *Methods for the Determination* of *Inorganic Substances in Environmental Samples,* EPA-600/R-93/100. Washington, D.C.
C -degrees Celsius
NA- not applicable
VOCs indicates volatile organic compounds
SVOCs indicates semi volatile organic compounds
PCBs indicates polychlorinated biphenyls
BOD indicates biological oxygen demand
COD indicates chemical oxygen demand
TDS indicates total dissolved solids
TOC indicates total organic carbon
TKN indicates total kjeldahl nitrogen
A temperature blank will be submitted with each sample cooler.



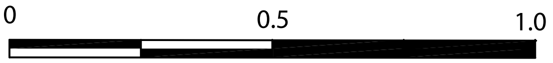


🟧 Monroe County Property (source: http://www.monroecounty.gov)

🟦 WMNY Property (source: B&L 2014)

— Permitted Landfill Footprint (approximate)

▪ ▪ ▪ ▪ Proposed Landfill Expansion Footprint (approximate)



SCALE
(miles, approximate)

Modified from original figure prepared by AMEC-Geomatrix, Inc. dated August 2010

Mill Seat Landfill
Proposed Landfill Expansion
Environmental Monitoring Plan

Town of Riga, New York
Monroe County

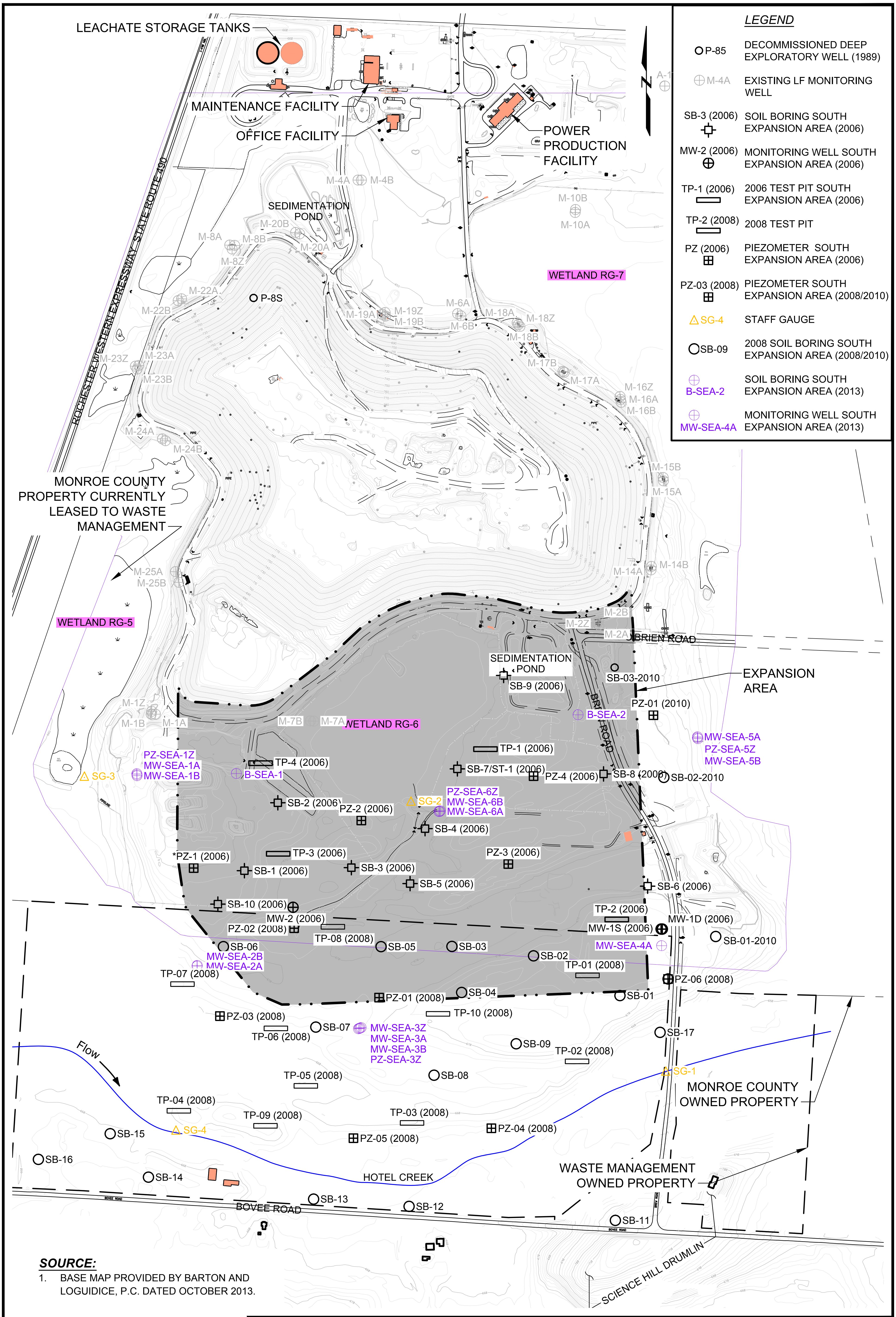
GEI Consultants

Project 1328270

SITE LOCATION

January 2015

Figure 1



SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
Proposed Landfill Expansion
Environmental Monitoring Plan

Town of Riga, New York
Monroe County

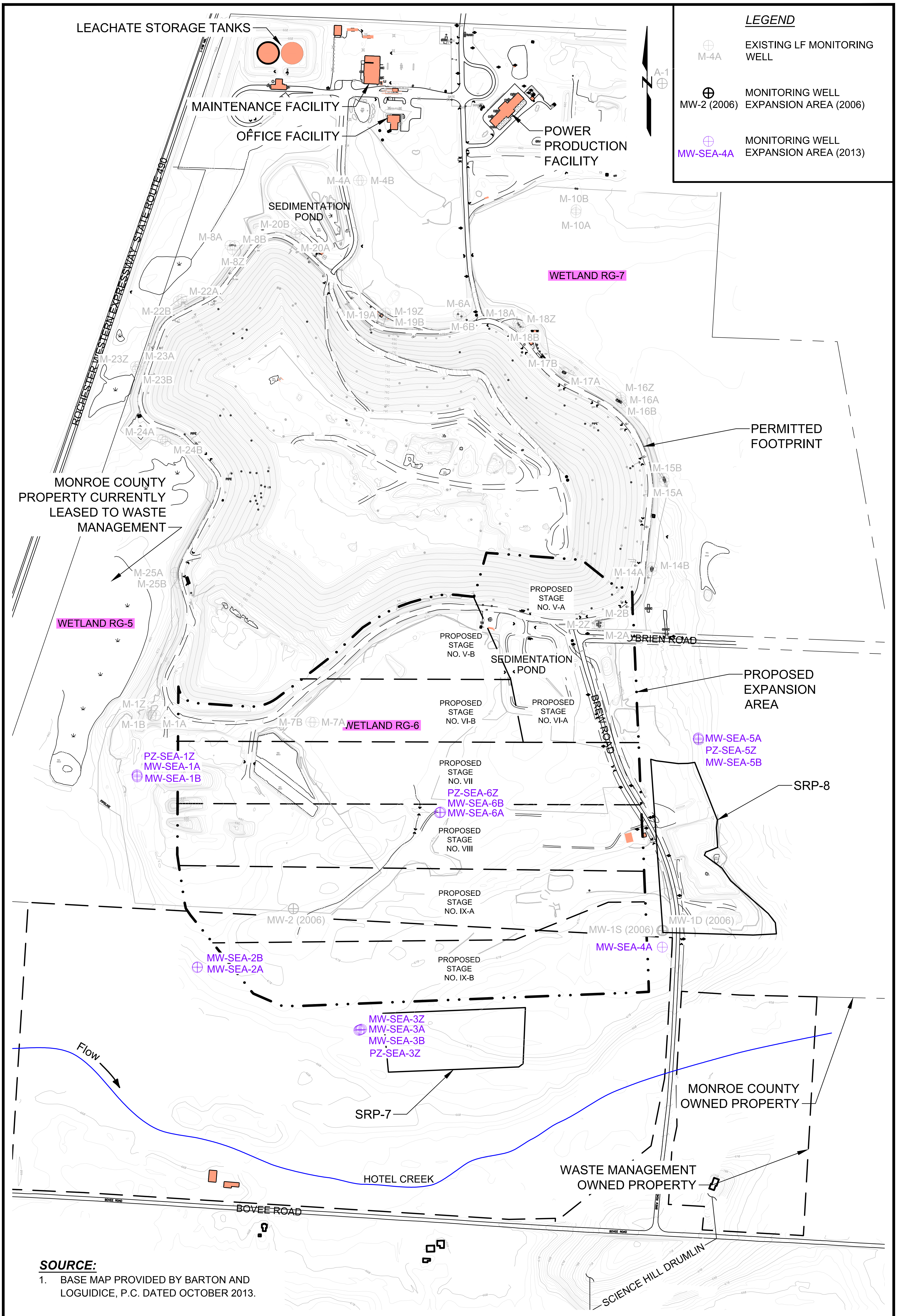
GEI Consultants

Project 1328270

PROPOSED EXPANSION FOOTPRINT

January 2015

Figure 2



SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 500' 1000'

SCALE: 1" = 500'

Mill Seat Landfill
Proposed Landfill Expansion
Environmental Monitoring Plan

Town of Riga, New York
Monroe County

GEI Consultants

EXPANSION FOOTPRINT WITH PROGRESSION OF FILL STAGES

Project 1328270 | January 2015 | Figure 3

\\gtb1v-fs01\ I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\Environmental Monitoring Plan\Expansion Footprint F4 and F8.dwg - 1/29/2015

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill Proposed Landfill Expansion Environmental Monitoring Plan	GEI Consultants	B-ZONE POTENTIOMETRIC SURFACE (APRIL 3, 2014)	
Town of Riga, New York Monroe County	Project 1328270	January 2015	Figure 4

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\20 - B-Zone Potentiometric Surface - 2014-04-03.dwg - 1/15/2015

SOURCE:
1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill Proposed Landfill Expansion Environmental Monitoring Plan	GEI Consultants	A-ZONE POTENTIOMETRIC SURFACE (NOVEMBER 14, 2013)
Town of Riga, New York Monroe County	Project 1328270	January 2015 Figure 5

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\21 - A-Zone Potentiometric Surface - 2013-11-14.dwg - 1/15/2015

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

0 200' 400'
SCALE: 1" = 200'

Mill Seat Landfill
Proposed Landfill Expansion
Environmental Monitoring Plan

Town of Riga, New York
Monroe County

GEI Consultants

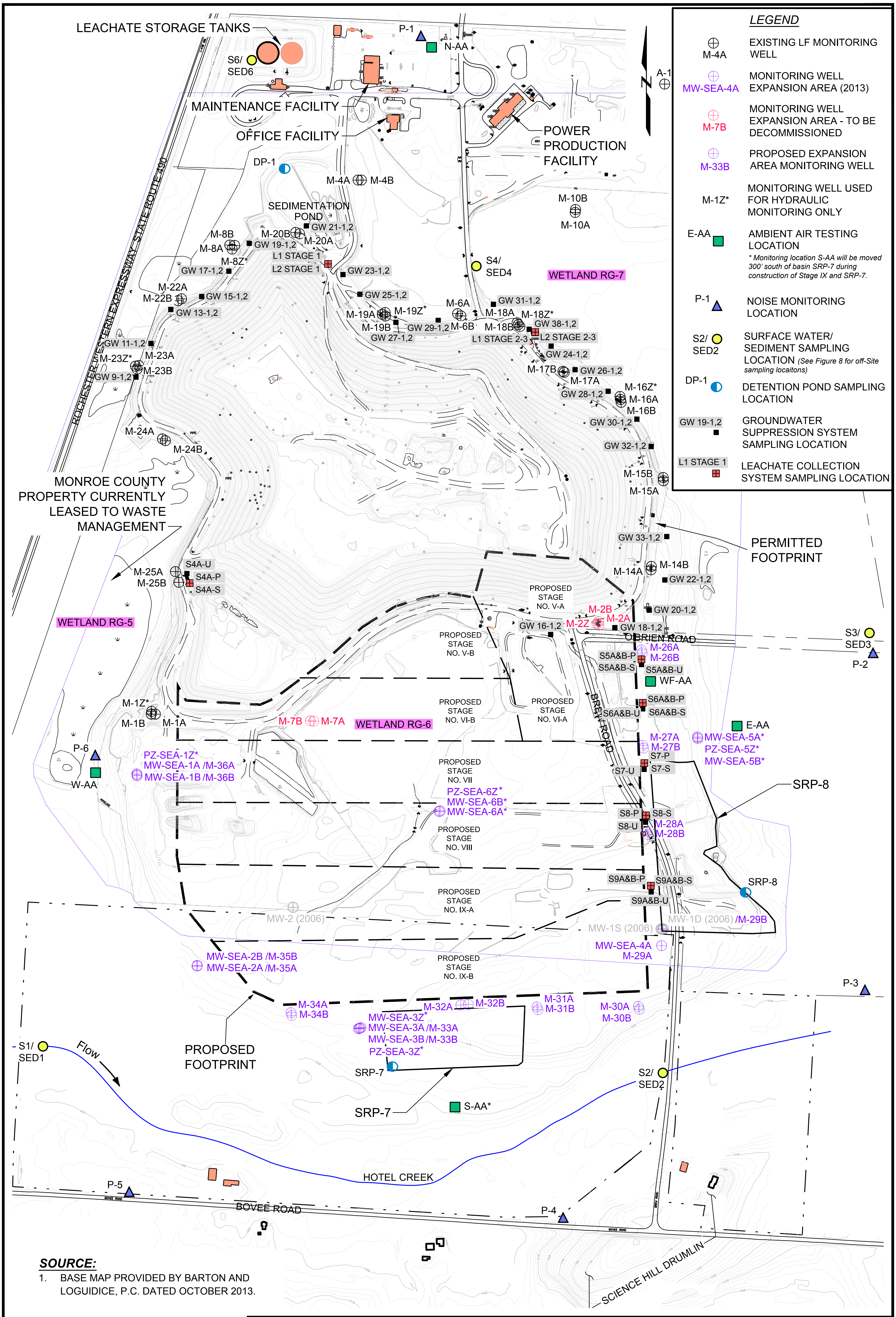
Project 1328270

Z-ZONE
POTENTIOMETRIC SURFACE
(APRIL 3, 2014)

January 2015

Figure 6

---- I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\24- Z-Zone Potentiometric Surface - 2014-04-03.dwg - 1/15/2015



LEGEND

M-4A ⊕	EXISTING LF MONITORING WELL
MW-SEA-4A ⊕	MONITORING WELL EXPANSION AREA (2013)
M-7B ⊕	MONITORING WELL EXPANSION AREA - TO BE DECOMMISSIONED
M-33B ⊕	PROPOSED EXPANSION AREA MONITORING WELL
M-1Z*	MONITORING WELL USED FOR HYDRAULIC MONITORING ONLY
E-AA 🟩	AMBIENT AIR TESTING LOCATION ** Monitoring location S-AA will be moved 300' south of basin SRP-7 during construction of Stage IX and SRP-7.*
P-1 ▲	NOISE MONITORING LOCATION
S2/ SED2 ●	SURFACE WATER/ SEDIMENT SAMPLING LOCATION *(See Figure 8 for off-Site sampling locaitons)*
DP-1 ◐	DETENTION POND SAMPLING LOCATION
GW 19-1,2 ■	GROUNDWATER SUPPRESSION SYSTEM SAMPLING LOCATION
L1 STAGE 1 🟥	LEACHATE COLLECTION SYSTEM SAMPLING LOCATION

SOURCE:

1. BASE MAP PROVIDED BY BARTON AND LOGUIDICE, P.C. DATED OCTOBER 2013.

Mill Seat Landfill
Proposed Landfill Expansion
Environmental Monitoring Plan

Town of Riga, New York
Monroe County

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MONITORING NETWORK

January 2015

Figure 7

\\gtb1v-fs01\ I:\Project\Waste Management of NY\Mill Seat Landfill\1328270\Figures\Environmental Monitoring Plan\Expansion Footprint F4 and F8.dwg - 1/29/2015

SOURCE:
1. 2011 BING MAPS ACCESSED VIA ARCGIS ONLINE *(www.arcgis.com)*.
2. NYS GIS CLEARINGHOUSE

0 800 1,600
SCALE: 1" = 800'

Mill Seat Landfill
Proposed Landfill Expansion
Environmental Monitoring Plan

Town of Riga, New York
Monroe County

GEI Consultants

Project 1328270

WETLAND BOUNDARIES
AND SURFACE WATER
SAMPLING LOCATIONS

January 2015

Figure 8

J:\Projects\Waste Managment of New York\Mill Seat Landfill\MillSeat-Landfill Wetland Boundaries and SW.mxd

Attachment A

Waste Management Environmental Protection Program – Environmental Media Sampling Standard

ENVIRONMENTAL MEDIA SAMPLING STANDARD

March 2012

Version 1.0

Prepared by:

Waste Management
Environmental Protection Program

WASTE MANAGEMENT

Table of Contents

APPENDICES

1. Groundwater
2. Surface Water
3. Leachate

1.0 INTRODUCTION

This Environmental Media Sampling Standard (Standard) presents baseline performance objectives for sample collection at sites (landfill, hauling company, etc.) where Waste Management (WM) has environmental responsibility.

For this Standard, ‘environmental media samples’ are samples of material such as groundwater, surface water, stormwater, leachate, soil, air, gas, or other media that are collected as part of environmental or regulatory compliance programs. Environmental media samples are frequently submitted for laboratory analysis but may be collected for field testing or visual inspection.

Each WM facility will have a WM Representative responsible for the sampling covered by this Standard. The WM Representative may be a Site/Operations Manager, Engineering Manager, Groundwater Protection (GP) Director, Environmental Protection (EP) Manager, or other designee.

1.1 Organization of this Standard

This Standard presents baseline performance criteria for collecting environmental media samples at WM sites. Appendices to the Standard provide detailed techniques and performance requirements for specific media such as groundwater, surface water, and leachate. Samplers must read the appendix for any media they sample.

1.2 Goals and Objectives

The objective of establishing this Standard for sample collection is to assure that samples: (1) are representative of the media being sampled, (2) satisfy sampling requirements of applicable regulations and permits, and (3) are collected using methods and procedures consistently applied throughout WM.

The ultimate goal of this Standard is to assure that ‘Representative Samples’ are collected. A Representative Sample is:

1. Characteristic of the media being sampled.
2. Not measurably altered by:
    - Sampling equipment
    - Introduction of foreign material
    - Container handling or storage
    - Sample collection procedures

1.3 Applicability

This Standard is applicable to anyone -- WM personnel or third-party contractor -- who collects samples on behalf of WM.

Provisions of this Standard may be superseded by site-, state-, or permit-specific requirements. Questions regarding the Standard and site-specific sampling requirements should be directed to the WM representative.

2.0 QUALIFICATIONS AND REQUIRMENTS

Samplers are required to be independently trained and have experience performing the sampling that will be conducted at WM facilities. Sampling may only be performed at a WM facility by WM-approved samplers.

WM-approved samplers are those who have:

- Received formal sampling training by qualified personnel for the media that they will be sampling and are competent in applicable sampling techniques.
- Read this Standard and its media-specific Appendices.
- Completed WM training on general sampling requirements and media-specific training modules (live, video, or on-line), if available.
- Passed any tests administered after training.
- Completed WM refresher training and testing every two years.

3.0 SAMPLING AT WASTE MANAGEMENT FACILITIES

A sampling event at a WM facility will usually be completed by a sampling team, which includes (1) a WM representative, (2) on-site sampler(s), and (3) the analytical laboratory. Sampling requirements will be specified in one or more controlling documents.

3.1 Controlling Documents

The controlling document(s) establish sampling locations, frequency, chemical parameters, and collection methods. The document(s) may be in the form of any of the following:

- Site Permit
- Site-Specific Sampling and Analysis Plan (SAP)
- Regulations
- WM Environmental Sampling Standard
- State Guidance

3.2 Sampling Team and Responsibilities

Waste Management uses a team-approach when sampling is performed. Active and effective communication is expected among all the team members. The following describes the team and responsibilities.

3.2.1 WM Representative: The primary point-of-contact. May be the site Operations Manager, Engineer, Environmental Protection (EP) Manager, GP Director, or Gas Operations Manager. The responsibilities of the WM representative include:

- Providing sampling personnel with most current sampling requirements and Controlling Documents.
- Notifying samplers of changes in site conditions that may affect sampling.
- Providing oversight to ensure that the sample collection satisfies WM's minimum requirements and the appropriate regulatory requirements.
- Final decision making when questions arise.

3.2.2 Sampler(s): May be WM personnel or a third-party contractor. The responsibilities of the on-site sampler include:

- Knowing and agreeing to follow the contents of this Standard.
- Knowing and following site-specific sampling requirements prescribed in applicable Controlling Documents.
- Verifying that they are following the most current Controlling Documents.
- Coordinating with the WM Representative prior to sampling.
- Following all safety requirements including any site-specific safety training and OSHA requirements.
- Communicating with the analytical laboratory regarding schedule, sampling supplies, shipping, and questions.
- Collecting representative samples.
- Completing sampling on time.
- Notifying the WM Representative of any condition that may compromise sample integrity or preclude collection of required samples.
- Completing all required documentation.
- Handling and storing samples as required by applicable Controlling Documents.
- Submitting samples for laboratory analysis within the required time frame.

3.2.3 Analytical Laboratory: The analytical laboratory provides analytical services and serves as a technical resource in support of those services. The responsibilities of the analytical laboratory include:

- Preparation and delivering of sample container orders in accordance with an Addendum form approved by the WM representative (or designee).
- Timely correction of errors with a sample container order or replacement of broken sample containers.
- Performing analysis according to Controlling Document requirements.
- Responding to requests and questions from on-site samplers and the WM Representative.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Proper quality assurance and quality control (QA/QC) must be practiced throughout a sampling event. The 3 underlying objectives of sampling QA/QC are:

1. Assuring sample integrity
2. Avoiding sample contamination
3. Properly documenting the sampling event

4.1 Pre-Sampling

Before arriving on site and beginning to sample, samplers must complete a number of tasks.

4.1.1 Reviewing Sample Container Sets

Samplers are responsible for verifying that all necessary sample containers are on-hand before sampling is performed. Prior to arriving on site to sample, sample container sets must be inspected to verify that all necessary containers are present and should be cross-checked with the approved Addendum. If containers are broken or missing, additional containers must be procured from the laboratory performing analysis. The WM Representative must approve the use of containers not provided by the laboratory contracted to perform analysis. WM recommends completing sample set inspection no less than 1 week before sampling is to occur.

Short Hold Time Samples: Samples with a hold time of less than 5 days must be noted by the samplers in advance of sampling. The collection and delivery of those samples must be coordinated with the laboratory to assure delivery and analysis within the hold time.

4.1.2 Inspecting and Calibrating Field Instruments

Field instruments must be clean and tested prior to arrival at the site. All meters must be calibrated throughout the sampling event on a daily basis according to manufacturers' calibration procedures. Samplers must verify that calibration solution has not expired. Calibration must be documented -- documentation must include personnel, date, time, calibration target, and final calibration readings.

4.2 Sampling QA/QC

This section describes QA/QC that must be followed during the process of collecting samples.

4.2.1 Controlling Documents

Samplers must have copies of relevant portions of the most current controlling document(s) on hand when sampling is performed. Samplers must know:

- Which locations must be sampled.
- The parameters being sampled and sample container requirements for each sample point.
- The order in which sampling locations must be sampled.
- The order in which sample containers must be filled.
- Specific procedures required for collecting samples.

4.2.2 Sample Point Inspection

Prior to collecting samples, samplers must inspect the sample point and surrounding area, note if the sample point is damaged or in disrepair, and identify any unusual condition that could affect sample results. Observations must be recorded on the Field Information Form (FIF), a field log book, WM form, or other means appropriate for the sample type. Samplers must report any unusual or unexpected condition that could affect sample results to the WM Representative before collecting a sample.

4.2.3 Decontamination

All non-disposable or non-dedicated field equipment must be decontaminated using a non-phosphate-containing detergent. Disposable sampling equipment must be rinsed with distilled or deionized water prior to use.

4.2.4 Gloves

New power-free latex or nitrile gloves must be worn when handling sample equipment and collecting samples. Samplers must change gloves upon arriving at a new sample location or touching a surface that has not been decontaminated.

4.2.5 Sample Collection, Labeling, and Handling

Samplers must avoid overfilling sample containers and losing preservatives. All sample containers must be clearly labeled and include sample location, date, and time. Samples of uncontaminated media must not be placed in the same cooler as highly-contaminated samples or wastewater samples. Samples and coolers must be isolated from potential sources of contamination.

4.2.6 Temperature Control

Where temperature control is required, samples must be placed in a cooler that contains bags of water-ice immediately after collection. Blue ice or other cooling packs are prohibited. The ice-containing cooler must be on hand when samples are collected. When temperature control is required, the goal is to cool samples to 4 degrees Centigrade.

4.2.7 Quality Control Samples

Quality control (QC) samples must be collected in accordance with the site Controlling Documents or as directed by WM. QC samples may include duplicates, trip blanks, equipment blanks, field blanks and/or split samples. Details on QC samples are presented in the Media specific Appendices.

Duplicate Samples

A duplicate sample is collected at a location and submitted for analysis to allow for assessment of analytical consistency. When collecting duplicate samples:

- Use matching sets of laboratory-supplied sample containers.
- Collect samples by alternately filling matching sample containers from each sample container set.
- Identify the sampling location of a duplicate on the FIF.

Trip Blanks

Trip blanks are provided by the laboratory to assess whether samples were affected during transport and must accompany the sample containers until they are returned to the laboratory. Trip blanks are typically limited to analysis of volatile compounds and are not to be opened at any time.

Equipment Blanks

Equipment blanks are collected to assess if the use of non-dedicated sampling equipment has had an impact on the samples collected. When collecting field blanks:

- Prepare the sample using laboratory-supplied water.
- Pass the laboratory-supplied water through or over a non-dedicated device after it has been decontaminated and prior to use.
- Identify the sampling location where the blank was prepared on the FIF.

Field Blanks

Field blanks are collected to assess if the samples may have been affected from the ambient sampling environment. When preparing field blanks:

- Prepare the blank using laboratory-supplied water.
- Prepare the blank up-wind of the sample point and down-wind, if possible, of potential contaminant sources (such as flares or truck traffic).
- Identify the sample location on the FIF.

Split Samples

Split samples are collected when multiple sample sets are collected for analysis by third parties or different laboratories. Where sample volume is limited, collect the samples required by the controlling documents first, then fill other sample containers. Where sample volume is not limited, fill sample containers using the same procedure for duplicate samples.

4.2.8 Field Information Form

Proper documentation is a crucial part of the sampling program QA/QC. Samplers must document sample collection information on a media-specific FIF. The original forms must be submitted to the laboratory along with sample containers, and a copy retained by the samplers. Where authorized, the FIF may be digital and the data recorded electronically.

The FIF contains information regarding sampling procedures and field measurements. A separate FIF must be filled out for each sample location – even when a scheduled sampling location is not sampled.

At a minimum, the following must be documented on a FIF:

- Site name, sample point, and sample date
- Sampling equipment
- Field measurements
- Sample appearance including odor and color
- If QC samples were taken (e.g., duplicate, equipment blank, field bank, split sample)
- Weather conditions: wind direction, speed, temperature, and precipitation

4.3 Post-Sampling

Post-sampling QA/QC procedures must be followed for any samples collected for laboratory analysis.

4.3.1 Chain of Custody Form

Strict chain-of-custody (COC) procedures are necessary from the time the samples are collected until they arrive at the laboratory for analysis. The samples must be in the custody of assigned WM personnel, an assigned agent, or the laboratory.

The COC must be included in the cooler with the samples. When multiple coolers are used, a COC form must be completed for, and included with, the sample containers in each cooler.

A typical COC is included in the Attachments.

The COC must contain, at a minimum, the following:

- Site Name
- Sample points
- Date and time of sampling
- Type of sample (composite, grab, groundwater, leachate, surface water)
- Number of containers per sample point
- Preservatives
- Analysis Required
- Special Remarks

The COC must be signed with the date and time whenever any of the following occurs:

- Receipt of the samples
- Each time the samples are transferred to the custody of another person

If the samples are being shipped, the COC must be signed and enclosed within the shipping container in a watertight bag. Shipping agents such as Federal Express do not sign the chain-of-custody form. The shipping receipt must be retained by the samplers as part of the record documenting sample transfer.

4.3.2 Sample Packaging

Samples must be packed appropriately for the media being sampled, the fragility of sample containers, and temperature control. Sample containers should be cleaned and clearly labeled before packing. Sample containers must be stored upright and protected from breakage. The COC and FIF must be sealed in a plastic bag and placed on top of the sample containers within the cooler. If sample coolers are being shipped by a courier, the coolers must have custody seals affixed across the opening and covered with tape. Custody seals will identify coolers that have been opened prior to receipt by the laboratory

Individual media sample packaging requirements are presented in the Appendices.

4.3.3 Sample Delivery

Samples must be promptly delivered to the laboratory. WM program laboratories provide shipping. Samplers must assure that sample coolers are secure and not leaking water.

5.0 MEDIA-SPECIFC APPENDIX

Samplers must read the media specific appendix to this Standard.

ATTACHMENTS

FORMS

TestAmerica Buffalo
10 Hazelwood Drive

Amherst, NY 14228
phone 716.504.9852 fax 716.691.7991

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_______ of ______ COCs
Address	**Analysis Turnaround Time**			Job No.
City/State/Zip	Calendar (C) or Work Days (W) ___________			
(xxx) xxx-xxxx Phone	TAT if different from Below _________			SDG No.
(xxx) xxx-xxxx FAX	☐ 2 weeks			
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type**	**Matrix**	**# of Cont.**	**Filtered Sample**																			Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____________

Possible Hazard Identification

☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For __________ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

APPENDIX 1

GROUNDWATER

Environmental Media Sampling Standard

Appendix 1

GROUNDWATER SAMPLING

March 2012

Prepared by:

Waste Management
Groundwater Protection Program

Table of Contents

Attachments

1. Field Information Form
2. Well Condition Summary Form
3. Low Flow Purging/Sampling Procedures

1.0 SCOPE

Appendix 1, Groundwater Sampling (Appendix 1), presents WM's requirements for collecting groundwater samples at WM sites. This Appendix must be read in conjunction with the Environmental Media Sampling Standard.

2.0 OVERVIEW OF THE MEDIA

Groundwater is water located beneath the ground surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is typically withdrawn for environmental testing by constructing monitoring or observation wells.

3.0 SAMPLING OBJECTIVES

The objective when sampling groundwater is to assure that samples: (1) are representative of the groundwater in the formation screened by the well, (2) satisfy sampling requirements of applicable regulations and permits, and (3) are collected using methods and procedures consistently applied throughout WM.

The primary goal when sampling groundwater is to assure that 'Representative Groundwater Samples' are collected. A Representative Groundwater Sample is:

1. Characteristic of formation water screened by the well.
2. Not measurably altered by:
    - Sampling equipment
    - Container handling or storage
    - Sample collection procedures

4.0 GROUNDWATER SAMPLING EQUIPMENT

WM requires the use of QED bladder pumps for groundwater sampling. The use of other equipment must be approved by the WM Groundwater Protection Program (GPP) Director. The WM GPP Director may approve:

1. Dedicated bailers
2. Disposable bailers
3. Electric submersible pumps

5.0 WELL CONDITION INSPECTION

During each sampling event, samplers must inspect and document the condition of each well prior to collecting samples. The condition of each monitoring well and surrounding area must be recorded on the WM Well Condition Summary Form (WCSF) included in the Attachments to this Appendix. Samplers must inspect the well and surrounding area and document basic well maintenance needs as well as any condition that may affect sample integrity. The WCSF must be left with the WM Representative upon completion of the sampling event.

Conditions that should be noted on the form include:

1. Missing locks, labels, or weep holes
2. Damaged casing or concrete pad
3. Inoperable pumps
4. Excessive vegetation growth
5. Poor well visibility
6. Other maintenance needs

When samplers encounter unusual conditions at a well that could affect sample integrity (i.e. result in collecting a non-representative sample) samplers must notify the WM Representative before collecting the sample. With input from sampling personnel, the WM Representative will decide whether to delay sampling, or collect a sample.

Some examples of unusual conditions that could affect sample integrity include:

- A damaged well or sample pump
- Evidence of tampering
- Gas emanating from well
- Strong or unusual odors
- Significant soil staining or other evidence that a spill may have occurred near the well
- Excessive turbidity

At the completion of the sampling event the WCSF is left with the WM Representative.

6.0 PURGING AND SAMPLING

6.1 Water Level Measurement

Water levels must be measured:

- With an electronic instrument to the nearest hundredth of a foot (i.e. 0.01-ft)
- With an instrument that has been rinsed with deionized or distilled water before use at each well
- Prior to purging
- During purging when feasible

Where significant groundwater level fluctuation occurs over a short time period, pre-purging water levels must be obtained from all wells in one day or in as short a period as practical.

Samplers must assure that water level measuring tapes are properly calibrated and have not stretched or shortened.

6.2 Field Parameters

Field parameters must be recorded (1) during purging, and (2) when collecting laboratory samples. Measurements must be taken with calibrated electronic meters. Although WM prefers the use of in-line flow-through cells, hand-held instruments may be used.

WM requires:
- pH
- Temperature
- Specific conductance

WM recommends:
- Dissolved oxygen
- Turbidity
- Oxidation reduction potential (Eh/ORP)

Field measurements must be taken in the field as soon as possible and no more than 15 minutes after collection. Samples are not to be sent to the laboratory for field measurements or field filtering, if required.

6.2.1 Inconsistent Measurements

Samplers must identify inconsistent measurements by comparing current data to results from the prior sampling event. Inconsistent data are results between 2 sampling events that vary more than the following:
- pH: +/- 1 unit
- Specific conductance: +/- 25%
- Turbidity: Significant change in clarity

Where inconsistent data are observed, samplers must verify the calibration of the meters. If calibration is not the problem, a reasonable attempt must be made to resolve the issue by performing additional purging. Where this does not resolve the issue, samplers must report the data to the WM Rep before collecting a sample. For other field parameters such as temperature, dissolved oxygen, and Eh/ORP, simply records any significant variability on the Field Information Form (FIF).

6.2.2 Excessive Turbidity

WM's goal is for groundwater samples to have a turbidity of less than 50 NTU.
- Where turbidity falls between approximately 50 NTU and 500 NTU, samplers must attempt to reduce the turbidity by performing additional purging for a reasonable period, or reducing the purge rate. Following these activities, document the activities performed and any change in turbidity on the FIF, then proceed with sample collection.

- Where turbidity exceeds 500 NTU and cannot be reduced below 500 NTU, samplers must contact the WM Representative and only collect a sample when authorized.

6.3 Sampling

6.3.1. Low-flow Purging Method

Included in the attachments is WM's Procedure for Low-Flow (Minimal Drawdown) Purging and Sampling, which provides WM's general methodologies for low-flow sampling and parameter stabilization criteria. These methods must be followed if specific methods are not approved by a state or specified in site controlling documents.

Low flow purging is the preferred method for sampling at WM facilities where approved by regulation or permit. Pump flow rates must be selected to approximate the yield of the well such that minimal drawdown of the water level in the well is observed or so that a stabilized pumping water level is achieved as quickly as practical.

Measurement of stabilization of parameters must begin with purging and continue at regular intervals until stabilization is achieved. Typically stabilization measurements are recoded every 3 to 5 minutes; however, the frequency of measurements may vary based on the purge rate and the volume of the sampling system -- the goal is to purge at least one volume of the pump and tubing between readings.

Once stabilization has been achieved, sampling can be conducted at the same pumping rate or at a lower flow rate if necessary. The flow rate for sampling must not be increased over the purging flow rate.

6.3.2 Traditional Purging

When low-flow purging is not utilized, monitoring wells must be pumped prior to sample collection according to site-specific requirements -- typically until 3 to 5 well volumes are removed. Samplers must record water levels during purging, and pump the well at a flow rate that minimizes drawdown. Drawdown during purging will vary depending on a number of field considerations, including: permeability of the formation, water column height within the well, pump intake depth, and recharge rate. The pump intake must never be exposed.

When using traditional purging methods, the goal is to stabilize field parameters with as little drawdown in the well as possible. Samplers must record field parameters during purging. Measurement of stabilization of parameters must begin with purging and continue at regular intervals until stabilization is achieved. If parameters are not stabilized after the requisite numbers of well volumes are purged, samplers must make a reasonable effort to achieve stabilization by performing additional purging and recording stabilization measurements. The frequency of measurements will vary based on the purge rate and the volume of the sampling system.

Stabilization has been achieved when 3 successive measurements meet the following stabilization criteria:

pH:	+/- 0.2 pH units
Conductance:	+/- 5 %
Dissolved oxygen:	+/- 10.0% or 0.2 mg/L.

6.3.3 Wells that Purge Dry

When a well purges dry, recharge is very slow, drawdown is excessive, and the well is almost completely evacuated when pumping at a low flow rate (0.5 liter per minute is used as a rule-of-thumb). Field parameters do not stabilize; therefore, field parameters are only recorded when samples are collected.

WM generally uses one of two methods to sample wells that purge dry:

1. The Complete Evacuation method, where the well is purged nearly dry, allowed to recover, and then sampled.
2. Minimal Purge sampling, where only the water within the dedicated sampling equipment is purged prior to sampling the water within the well screen area.

Complete Evacuation Method: When using the Complete Evacuation method, wells are purged dry then allowed to recover before collecting samples. When using this method:

- Document the date and time for both well evacuation and sample collection.
- Evacuate the well until it yields little or no water.
- Record the total volume of water removed.
- Allow the well to recover as specified in the site's controlling documents.
  - If recovery criteria are not specified, collect samples:
    - after the water level has recovered to 50% of the original water level
    - when there is sufficient water to fill all sample bottles
    - 24 hours after evacuation.
- Record field parameters after collecting the samples for laboratory analysis.

Minimal Purge Method: This method is not approved for use in all states; therefore it must only be used when specified in the controlling documents or authorized by the WM GPP Director. When using this method, dedicated sampling pumps are required; bailers or non-dedicated pumps may not be used. To perform this method, samplers must:

- Calculate the volume of water within the dedicated sample pump and tubing
- Purge 1 to 3 times that volume
- Record the total volume of water purged.
- Record field parameters after samples for laboratory analysis are collected

The pumping rates used for minimal purge sampling are generally 100 ml/minute or less.

6.4 Bailers

Bailers may only be used when approved by the WM GP Director. WM prefers using disposable bailers -- non-dedicated bailers must not be used. When bailers are approved for use, samplers must:

- Attach new unused nylon line to the bailer each time it is used, regardless of whether the bailer is dedicated or disposable.

- Thoroughly rinse the bailer and line with distilled or deionized water prior to use.
- Minimize splashing and bubbling as the bailer fills by slowly lowering the bailer below the water surface.
- Lower the bailer to the midpoint of the well screen when performing traditional purging or to the bottom of the well screen if sampling with the complete evacuation method.
- Prevent the bailer or bailer line from touching the ground.

Where dedicated bailers are used, they must be hung within the well above the water level between sampling events and the bailer line discarded.

6.5 Purge Water Handling

Where the controlling documents do not specify purge water handling, the purge water must be discharged to the ground at least 20 feet from the wellhead and draining away from the well.

6.6 Collecting Samples

Groundwater samples must be collected in the shortest possible time subsequent to purging the well and stabilization of field parameters. Samplers must assure that bottles placed in the coolers are clean and free of external contaminants.

6.6.1 Filling Sample Bottles

Sample bottles must be filled directly from the sampling pump or filter apparatus with minimal air contact. Volatile Organic Analyses (VOA), Total Organic Halides (TOX), and alkalinity bottles must be headspace-free (i.e. no air bubbles in the sample bottle).

When filling the sample bottles, the samplers must follow these procedures:

1. Place bottle caps threads up on a clean surface.
2. Do not place sample tubing in the sample bottles or allow the discharge tubing to touch the ground.
3. Do not overfill any containers that have been pre-preserved.
4. Collect VOA vials last.
5. Place samples in ice-packed coolers immediately after collection.

5.6.2 Sample Filtration

When sample filtration is required, the samples must be filtered in the field using an in-line 0.45-micron membrane filter. Filters must be conditioned prior to filling sample bottles. To condition filters, at least 2 filter volumes of water must pass through the filter before filling sample bottles. A new filter must be used for each well and each sampling event.

6.7 Blanks

Trip Blanks, Field Blanks and Equipment Blanks must be collected as stated in the site controlling documents.

6.7.1 Trip Blanks

- A trip blank is prepared at the laboratory and shipped with the bottle set. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory.
- Trip Blank sample bottles are not opened at any time. If Trip Blank sample bottles are accidentally opened, note this fact on the Chain-of-Custody (COC) form.
- Trip Blanks must be identified on the COC form using the designations TB- (#) as the recommended sample designation.
- If the number of trip blanks is not specified in the controlling documents then the frequency must be determined by the WM Representative.

6.7.2 Field Blanks

- Field blanks are prepared in the field at the sampling site using laboratory-supplied bottles and deionized or laboratory-supplied water.
- Field blanks must be prepared by filling the sample bottles at the location of one of the wells in the sampling program.
- Prepare field blanks at the sample location most likely to be affected by external influences such as blowing dust, odors, or vehicle traffic.
- Identify the well at which the field blank is prepared on the FIF along with any information or observations that may explain anomalous results.
- Field blanks are not filtered.
- Identify field blanks on the COC form using the designations FB- (#) as the recommended sample designation.
- If the frequency of field blanks is not specified in the site controlling documents then they must be collected on a frequency determined by the WM Representative.

6.7.3 Equipment Blanks

- Equipment blanks are required for all sampling events where non-dedicated pumps or bailers are used.
- Equipment blanks are prepared by pouring the deionized or laboratory-supplied water into or over the sampling device after it has been properly decontaminated, then pouring the water into the equipment blank bottles with the appropriate preservative.
- The well at which the Equipment Blank is prepared must be identified on the FIF.
- A minimum of one equipment blank for each day that monitor wells are sampled with non-dedicated equipment is required.

7.0 DOCUMENTATION

Proper documentation is a crucial part of the monitoring program’s quality assurance and quality control (QA/QC). Complete, consistent, and accurate documentation of field measurements, procedures, meter calibration, and field observations is required.

During each sampling event, the sampling team must fill out 3 forms: (1) FIF, (2) COC Form, and (3) WCSF. Copies of these forms are included in the Attachments. All forms must be filled out completely and legibly.

7.1 Field Information Form

The FIF provides information related to each sample collected and must be completed by the sampling team for each well where sampling is required – even if the well is not sampled. The original FIF must be submitted to the laboratory with the samples and COC form, and a copy must be retained by the samplers.

7.2 Well Condition Summary Form

The purpose of the WCSF is to communicate well maintenance needs to the WM Representative. Unless required, the form is not submitted to the laboratory with the FIF or COC.

7.3 Chain of Custody Form

Strict chain-of-custody procedures are required. From the time the sample bottles leave the laboratory until the issuance of the analytical laboratory results, the samples and/or sample containers must be in the custody of assigned WM personnel, an assigned agent, or the laboratory.

8.0 SAMPLE PACKAGING AND SHIPMENT

Groundwater samples must be packed to avoid breakage during transport to the laboratory. Sample coolers must contain adequate amounts of water ice to cool samples to 4 degrees Celsius. When packing and shipping coolers, samplers must:

- Double-bag ice to prevent water from leaking into the cooler.
- Protect bottles from potential breakage.
- Avoid over-packing the coolers with samples.
- Pack leachate or other highly impacted samples in separate coolers.
- Place the COC Forms and FIFs in a sealed plastic bag inside the sample cooler.
- Affix custody seals over the lid opening and secure the cooler by taping over the seals.

Samples must be delivered to the analytical laboratory as soon as practical and within any required sample hold times. Typically overnight sample shipment is pre-arranged by WM's contract laboratory. It is the sampling team's responsibility to verify shipping arrangements or arrange for sample delivery.

ATTACHMENTS

Page ____ of ____

METER CALIBRATION LOG

PROJECT NAME:________________________________ DATE:________________________________

PROJECT NUMBER:________________________________ SAMPLER:________________________________

MODEL:________________________________ SERIAL NO.:________________________________

pH METER

Time	pH 10 Buffer Check	pH 7 Buffer Check	pH 4 Buffer Check	Temp of Calibration Soln (°C)

Buffer Lot Numbers: pH 4:______________ pH 7:__________ pH 10:__________

CONDUCTIVITY METER

Temp. of Calibration Soln	Corrected Cond. @ 25°C	Time

Calibration Solution Lot Number:____________________

Calibration Range for Solution ____________________

REDOX METER

Temp (°C)	E_H Reading (mV)	Time

Calibration Solution Lot Number:________________

Calibration Range for Solution ________________

MODEL:________________________________ **SERIAL NO.:**________________________

Turbidity Meter

Gel Value (NTU)	Reading (NTU)	Time
0 – 10 range		
0 – 100 range		
0 – 1,000 range		
0 – 10 range		
0 – 100 range		
0 – 1,000 range		

Problems/Corrective Actions:____

____

Signature:________________________________ Date:________________________

QC'd By:________________________________ Date:________________________

WASTE MANAGEMENT

WELL CONDITION INSPECTION FORM

Site: ______________________________ Personnel: ______________________________

Date: ______________________________ Page ______ of ______

Well ID	Protective Casing	Well Casing	Label	Lock	Sample Equipment Type	General Turbidity	Well Yield	Comments/Observations *
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	
	☐ OK ☐ Damaged	☐ OK ☐ Damaged	☐ OK ☐ Inadequate	☐ Yes ☐ No		☐ Clear ☐ Turbid	☐ OK ☐ Inadequate	

* Note ponding water, weep holes, or any other information pertaining to well condition. Provide additional details on listed items.

Return this form to Site Manager - FOR INTERNAL USE ONLY.

WASTE MANAGEMENT

Well Condition Summary Form

Facility: ____________________________ Well/Piezometer Name: _____________________

Evaluator: ___________________________ Evaluation Date: ____________________________

	Y	N	N/A
Is the well's location appropriately shown on a facility map?			
Is the well adequately flagged if hard to find?			
Is the well elevation information inscribed at or on the well correct?			
Is the well: ☐ flush with surface? ☐ above ground?			
Is the well free of physical damage?			
Is the well labeled on the inside?			
Is the well labeled on the outside?			
Does the well have protective posts, if necessary?			
Do above ground wells have weep holes at the base of the protective casing?			
Does the area around the well appear clean?			
Is the casing secure (attempt to move along two perpendicular axes)?			
Is the surface seal void of differential erosion around and under the base?			
Is the surface seal free of cracks that might affect the integrity of the seal?			
Is the surface seal sloped to prevent ponding around the well?			
Is the well free from standing or ponded water?			
Is the well locked to prevent unauthorized access?			
Is the protective casing cap void of large gaps which would breach security?			
Is the locking cap free of rust?			
Is there a survey mark on the riser/wellhead assembly cap?			
Is the riser cap vented?			
Is the annular space free of animal/insect nests?			
Is the annular space appropriately filled with filtering material?			
If a pump, can it be lifted a few inches? (do not test prior to sampling)			
Is the well free of kinks or bends?			

COMMENTS: ____

____

____

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name:

Site No.:

Sample Point:

Sample ID

This Waste Management Field Information Form is Required

This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: ____________________

PURGE INFO

PURGE DATE (MM DD YY)	**PURGE TIME** (2400 Hr Clock)	**ELAPSED HRS** (hrs:min)	**WATER VOL IN CASING** (Gallons)	**ACTUAL VOL PURGED** (Gallons)	**WELL VOLs PURGED**

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment … Dedicated: Y or N

Filter Device: Y or N   0.45 µ **or** ______ µ (circle or fill in)

Purging Device ______

Sampling Device ______

A- Submersible Pump
B-Peristaltic Pump
C-QED Bladder Pump

D-Bailer
E-Piston Pump
F-Dipper/Bottle

X-Other: ____________________

Filter Type: ______

A-In-line Disposable
B-Pressure

C-Vacuum
X-Other ____________________

Sample Tube Type: ______

A-Teflon
B-Stainless Steel

C-PVC
D-Polypropylene

X-Other: ____________

WELL DATA

Well Elevation (at TOC) ______ (ft/msl)

Depth to Water (DTW) (from TOC) ______ (ft)

Groundwater Elevation (site datum, from TOC) ______ (ft/msl)

Total Well Depth (from TOC) ______ (ft)

Stick Up (from ground elevation) ______ (ft)

Casing ID ______ (in)

Casing Material ______

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit ______		pH (std)		Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
		1st		1st						
		2nd		2nd						
		3rd		3rd						
		4th		4th						
Suggested range for 3 consec. readings or note Permit/State requirements:			+/- 0.2		+/- 3%	--	--	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form*

FIELD DATA

SAMPLE DATE (MM DD YY)	**pH** (std)	**CONDUCTANCE** (umhos/cm @ 25°C)	**TEMP.** (°C)	**TURBIDITY** (ntu)	**DO** (mg/L-ppm)	**eH/ORP** (mV)	**Other:** ________ **Units** ________

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: ____________________ Odor: ____________________ Color: ____________________ Other: ____________________

Weather Conditions (required daily, or as conditions change)**:** Direction/Speed: ____________ Outlook: ____________ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____________________

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
____/____/____			
____/____/____			

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client, PINK - Field Copy

Procedure for Low-Flow (Minimal Drawdown) Purging and Sampling

(December 3, 2009)

Introduction

The Low-Flow purging and sampling technique is the preferred procedure for groundwater sampling under a wide range of hydrogeologic settings. The objective of low-flow/minimal drawdown purging is to obtain a sample that is most representative of the ambient groundwater conditions near the well, taking into consideration aquifer heterogeneities and site-specific subsurface conditions, without imparting bias due to excessive pump rates or formation stress.

The Low-Flow method of purging and sampling involves using a pump to purge water at a constant low rate to achieve field parameter stabilization, while minimizing stress on the aquifer. This method has been well documented as a preferred methodology for collecting representative samples from groundwater (*Low-Flow (Minimal Drawdown), Ground-Water Sampling Procedures*, Puls and Barcelona, USEPA, April 1996). Low-Flow purging is considered by leading researchers as superior to bailing and high-rate pumping and results in a more representative sample than the typical “three volume” well purge methodology or well evacuation.

This procedure is accomplished by measuring field parameters at periodic intervals during purging with a flow cell container. The flow cell is an inline purge cell, which will allow the sample technician to constantly monitor field water quality parameters such as temperature, pH, dissolved oxygen, and conductivity. Other techniques or containers can be used to collect samples for periodic measurements, provided that periodic and representative samples can be collected.

The following sections provide a general discussion on each aspect of the Low-Flow procedure with bulleted items being procedural steps.

1.0 Equipment

Dedicated pumps are ideal for low flow purging. Sites that have observation wells without dedicated pumps will require the use of portable (non-dedicated) pumps (bailers cannot to be used for low-flow purging). The sampling team should have all equipment necessary for purging and sampling wells at low flow rates. Other equipment may include:

- Water Level Tape or other water level measuring device;
- Flow cell to monitor field parameters;
- Calibrated purge water container;
- Dedicated pump system or disposable sample tubing (for non-dedicated pumps); and
- Field Meters for pH, Temperature, Dissolved Oxygen, and Conductivity/Specific Conductance.

Prior to each sampling event the field probes will be calibrated in accordance with the owner’s manual provided and the site-specific sampling plan. Field probes should be checked for drift every four hours or at the end of the day at a minimum.

It is important to identify the range, resolution and accuracy of the instruments used to determine if the selected stabilization criteria can be measured. If the instruments available *cannot accurately measure the stabilization criteria above, consult with the regulatory program manager to determine if different criteria values would be appropriate for your sampling program.*

2.0 Decontamination

Sites that have observation wells without dedicated pumps will require the use of non-dedicated pumps. All non-dedicated equipment used during the purging and sampling process must be decontaminated prior to each use, including tubing, unless it is disposable):

- Downhole equipment, such as a water level indicator, is to be triple-rinsed between well locations.
- Discard disposable polyethylene tubing used with non dedicated pumps after use at each well.

Sample bottles will be provided and properly prepared by the analytical laboratory scheduled to perform the analysis. No cleaning or preparation of sampling bottles by field personal will be performed.

Purge Volumes and Monitoring Frequency

Low-flow purging does not require the calculation of the water volume in the well, since purging is based solely on indicator parameter stabilization. Rather, the volume of the pump and discharge tubing are necessary for making calculations needed to determine field measurement frequency and/or the minimum purge ("passive") sampling system purge volume. Pump chamber or bladder volumes can be obtained from the manufacturer. Volumes of the sample tubing can be calculated or taken from the table below.

Discharge Tubing Volumes	
Tubing Diameter	**Volume/foot**
1/2" OD/3/8" ID	20 ml
3/8" OD/1/4" ID	10 ml
1/4" OD/1/8" ID	5 ml

Well casing volumes should only be calculated if required by Permit or State Regulation and recorded on field information forms. In addition, well casing volumes may be needed in any case where parameter stabilization is not achieved after a three-casing-volume purge (see below).

Sampling equipment volumes are calculated or recorded for use in determining the frequency of field measurements. Depending on the equipment configuration, calculate and record the volume of the pump and sample tubing using the methodology described above (the volumes are typically converted to liters). The frequency of field readings is based on the time required to purge at least one volume of the pump and tubing system. For example, a pump and tubing volume of 500-ml purged at a rate of 250 ml/minute will be purged in two minutes; readings should be at least two minutes apart. In any case, it is important to ensure that the field parameters are measured on independent samples of water.

2.1 Purge Rates

The objective of the purging process is to remove sufficient water from within the well screen zone to result in a sample that is representative of actual aquifer conditions adjacent to the well. The sampling pump or pump intake should be located within the well screen. This pump location is already established for dedicated pumps. For non-dedicated pumps, the intake is placed within the screened interval, typically in the center of the screen. If the water column in the screen is shorter than the overall screen length, the pump should be placed lower in the screen but no lower than about 6-12 inches from the bottom of the screen to avoid picking up any settled solids in the well.

A low pumping rate (typically less than 1,000 ml/min) is used to minimize drawdown within the well and formation and mobilization of formation solids. Lower flow rates may be required during sampling. Flow rate is determined by measuring the time it takes to fill a calibrated container, or by measuring the volume of one pump discharge cycle and multiplying this volume by the number of cycles per minute (e.g., 125 ml/cycle x 4 CPM = 500 ml/min). Drawdown is monitored by measuring the water level below the top of the well casing with a water level indicator or similar device (e.g. transducer) while pumping. Drawdown will be stabilized during purging. Flow rates and drawdown are recorded on a field log, field data form or with a data logger.

- Measure water levels prior to initiating purging;
- Calculate well volumes, if required by permit;
- Calculate sampling system volume and determine indicator parameter measurement frequency;
- Lower water level meter probe to 1-2 feet below static water level;
- Connect the flow cell to the discharge tube from the pump;
- Begin purge at a rate of 100-200 ml/min (or at a rate determined from prior events);
- Check drawdown with a water level tape while pumping;
- If drawdown stabilizes quickly, increase the pumping rate in increments of 100 ml/min until drawdown increases, then reduce the rate slightly after a few minutes to achieve a stable pumping water level;
- If the water level continues to drop, reduce purge rate by 100 ml/min increments until the water level stabilizes;
- Once water level stabilization is achieved, proceed to indicator parameter stabilization.

Parameter Stabilization

Parameter stabilization ensures that the well is adequately purged and sampled groundwater is representative of formation water. In order to determine when a well has been adequately purged, samplers should:

- Monitor pH, specific conductance, and dissolved oxygen of the ground water removed during purging;
- Observe and record the water level drawdown; and

- Record the purge rate and note the volume of water removed if required by guidance or permit.

A well is adequately purged when the pH, specific conductance, and dissolved oxygen stabilize. Stabilization occurs as follows:

pH: +/- 0.2 pH units
Conductance: +/- 5 % of reading value
Dissolved oxygen: +/- 10.0% or 0.2 mg/L, whichever is greater.

Temperature is not a reliable indicator of stabilization, being affected by ambient temperature at the well head, sunlight, and some sampling devices such as electric pumps. Temperature is typically measured to provide correction for temperature dependent parameters (e.g., DO % saturation, pH, and specific conductance).

While turbidity is not a direct measurement of water chemistry and is not used as an indicator parameter of stabilization, it is useful to support data from metals analyses. To avoid artifacts in sample analysis, turbidity should be as low as possible when samples are taken. Turbidity should be measured at least three times, once when purging is initiated, again after the water level in the well stabilizes, and again when the water chemistry indicator parameters being measured are stable. Turbidity should also be measured any time the pumping rate is increased or the water level in the well drops noticeably. If the initial turbidity reading is high (>50 NTU) and the second reading is not significantly lower, the pump rate should be reduced. The turbidity value measured prior to sampling will be recorded. If this value exceeds 50 NTU, procedures should be reviewed and the source of the elevated turbidity determined.

3.0 Sampling

Wells should be sampled immediately upon completion of purging operations. Once the water level stabilizes, the purge rate should remain constant during low-flow sampling (generally less than 500 ml/min). For VOCs, lower sampling rates (100 - 200 milliliters/minute) may be required.

- Record field parameters prior to sampling;
- Record depth to water levels prior to sampling (note if the well has not stabilized).
- Record the flow rate determined using a calibrated measuring device;
- Disconnect the flow cell other equipment from the pump discharge tube;
- Collect samples from the pump discharge tube
- Collect large volume samples first (e.g.,1 liter bottles), then VOC samples, and any filtered samples last;

If, after three well volumes have been removed, the chemical parameters have not stabilized according to the above criteria, the sampling team may elect to collect a sample. The conditions of sampling should be noted in the field log or field information form.

3.1 Low Yield Formations

In some situations, even with very slow purge rates, the well drawdown may not stabilize. In this case, sampling the water within the well screen zone provides the best opportunity to determine the formation water chemistry, as well evacuation can greatly affect sample chemistry through changes in dissolved gas levels, dissolved metals and VOCs.

Attempts should be made to avoid purging wells to dryness. This can usually be accomplished by slowing the purge rate. If the well is evacuated during the purging procedures shown above, the sample may be collected as soon as a sufficient volume of water has recovered in the well. If the well goes dry repeatedly (i.e. over multiple monitoring events) prior to sampling, then a minimum purge or "passive" sampling approach should be used in lieu of well evacuation.

Minimum Purge ("Passive") Sampling

For wells that cannot achieve a stabilized water level and purge dry even at very low pumping rates, an alternative to the traditional evacuation approach is to use minimum purge (sometimes called "passive") sampling techniques to avoid the pitfalls of well evacuation and obtain a better estimation of the formation water quality. Sampling the water present in the screen zone provides the greatest chance of obtaining samples with minimal alteration of the chemistry. Although the low movement rate of the ground water in the screen provides only a limited exchange, avoiding the alteration caused by the factors mentioned above is really the best alternative.

The minimum purge approach requires the removal of the smallest possible purge volume prior to sampling, generally limited to the volume of the sampling system. The sampling system volume is minimized by using very small diameter tubing and the smallest possible pump chamber volume. Plastic tubing should have sufficient wall thickness to minimize the potential for oxygen transfer through the tubing when pumping at very low flow rates. After purging 1-3 volumes of the sampling system, samples are taken from the subsequent water pumped. Since minimum purge sampling requires the minimum possible disturbance to the water column and surrounding formation, dedicated sampling systems are required for this approach.

The pumping rates used for minimum purge sampling are much lower than for low-flow purging, generally 100 ml/minute or less. Drawdown is expected, since it cannot be avoided; however, it is still advisable to pump at the lowest possible rate to limit drawdown to the minimum possible. Monitoring indicator parameters for stability is not part of this approach, since the intention is not to purge until stabilization of these measurements. The pH, specific conductance and turbidity or any other required field parameters should be measured during collection of the sample from the recovered volume. *Regulatory approval should be obtained prior to collecting a sample using this method.*

Field Records

Field information must be recorded during purging and sampling. At a minimum, the following information should be included in the field forms for each groundwater monitoring well.

- Purge Information (pumping rate, purge volume if required);
- Equipment Specifications (pump type, filter type and pore size if used);
- Well Data (depth to water, total depth, groundwater elevation);
- Field Measurements during purging and at the time of sample collection; and
- General weather conditions or other comments

This data is to be recorded on field forms and/or in a data logger.

Other Technical Issues

The following are other technical issues addressed as follows by the facility:

- Dedicated pump intakes are generally set at the middle of the screen. Where water levels have dropped due to drought conditions, the sampling team may lower the pump in order to obtain sufficient sample.
- For wells installed in bedrock, packers are only required to seal off the zone of interest if the bedrock has been determined to be competent (e.g. is not highly fractured).
- The flow cell system does not require decontamination between wells, because the act of purging removes any liquids from other wells and because sampling takes place upstream of the flow cell and only after disconnecting the pump discharge tubing.

APPENDIX 2

SURFACE WATER AND STORMWATER

Environmental Media Sampling Standard

Appendix B

STORMWATER & SURFACE WATER SAMPLING

Version 1.0 - October 2010

Prepared by:

Waste Management
Groundwater Protection Program

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Attachments

1. Field Information Form – Surface Water and Stormwater

1.0 SCOPE

This Appendix on Surface Water and Stormwater Sampling (Appendix B), presents the requirements for collecting surface water and groundwater samples at Waste Management (WM) sites. This Appendix must be read in conjunction with the Environmental Media Sampling Standard (EMSS, or Sampling Standard). Nothing in this Appendix supersedes local or state regulatory requirements, and where there are such conflicts, the regulatory requirements take precedent. All sampling teams should make any conflicts known to the WM Representative as soon as they are discovered.

Any sampling team performing surface water and stormwater sampling must be familiar with the contents of this Appendix and any site-specific sampling requirements prior to beginning a sampling event.

2.0 OVERVIEW OF THE MEDIA

Surface water is water that has collected in a stream, river, lake, wetland, or ditch. In contrast, stormwater is precipitation or runoff that is diverted into conveyances, sewers, or containment areas designed to manage the flow and discharge. In many instances stormwater eventually discharges to surface water. At WM facilities stormwater is typically associated with runoff from sloped areas adjacent to landfill units or from paved areas at hauling/transfer operations.

3.0 SAMPLING OBJECTIVES

The objective when sampling surface water and stormwater is to assure that samples: (1) are representative of the water in the conveyance, pond/lake or flow stream, (2) satisfy the requirements of applicable regulations and permits, and (3) are collected using methods and procedures approved by WM.

The primary goal when sampling surface water and stormwater is to assure that "Representative Surface Water and Stormwater Samples" are collected. A Representative Surface Water and Stormwater Sample is:

1. Characteristic of water in the conveyance, flow path, sump, pond, lake, impoundment, flow stream, or discharge.
2. Not measurably altered by sampling equipment, container handling or storage, or sample collection procedures.

4.0 SAMPLING EQUIPMENT

Various types of equipment may be used to collect surface water and stormwater samples depending on sample point location and access. The most commonly used includes:

1. Plastic or glass jars
2. Sample bottles
3. Dipper
4. Bucket
5. Bailer

Equipment used for surface water and stormwater sampling may be disposable, dedicated to the sampling location, or thoroughly cleaned and decontaminated between sample locations. Sampling equipment that has been used for sampling leachate, wastewater, or other industrial discharge must not be used to collect samples of surface water and stormwater.

5.0 SAMPLE POINT CONDITION INSPECTION

During each sampling event, samplers must inspect and document the condition of each surface water and stormwater sample location prior to collecting samples. The condition of each location and surrounding area must be recorded on the Field Information Form – Surface Water and Stormwater, included as Attachment 1 to this Appendix. Samplers must inspect the sample location and surrounding area, and document basic maintenance needs and identify conditions that may require attention from WM.

Conditions that should be noted include:

1. Structural damage.
2. Staining, sheens, or other evidence of leaks or spills.
3. Landfill gas emanating from sample location or surrounding area.
4. Strong or unusual odors.
5. Discoloration.

Notify the WM Representative if any of these conditions are observed.

6.0 SAMPLING PROCEDURES

The following sections describe the basic techniques and minimum expectations for sampling surface water and stormwater at WM facilities. For additional detail please contact the WM Representative.

6.1 Field Parameters

Field parameters must be recorded when collecting samples for laboratory analysis. Measurements must be taken with electronic meters that have been properly calibrated as described in the EMSS.

In addition to those parameters specified in the site controlling documents, WM requires:
- pH
- Temperature
- Specific conductance

WM recommends:
- Dissolved oxygen
- Turbidity
- Oxidation reduction potential (Eh/ORP)

Field measurements must be taken in the field as soon as possible and no more than 15 minutes after collection. Samplers must collect a new sample if field measurements are not recorded within 15 minutes.

6.2 Stagnant Water

Before collecting samples, samplers must evacuate any stagnant water from discharge lines, and ensure that stagnant water in conveyances, sumps or streams are evacuated or avoided. WM considers water that has been standing for more than 24 hours to be “stagnant;” however, this can vary depending on site-specific conditions. Purging or avoiding the sampling of stagnant water must be coordinated with the WM Representative to assure that (1) it is appropriate to evacuate the location prior to sampling, (2) the appropriate volume of water is evacuated, or (3) the appropriate method for avoiding the stagnant water is applied.

6.3 Sampling Methods

The two primary methods of collecting surface water and stormwater samples at WM sites are “Direct,” and “Indirect.”
- Direct Sampling is simply the process of collecting a water sample directly into the sample container.
- Indirect Sampling is performed by first using a container to retrieve the water sample, then transferring it to the sample bottle.

Regardless of the method used, samplers must notify the WM Representative before sampling any water that has an unusual color or odor, contains visible oils, or has excessive solids.

6.3.1. Direct Sampling Method

Direct sampling is performed when it is feasible to fill sample bottles directly from a flow channel or discharge point. This is most common where the water discharges at a fairly slow rate or when sample bottles do not contain preservatives.

When using direct sampling, the objective is to minimize disturbance of the sample and avoid losing any preservative by overfilling the bottle. In flowing water, always place the mouth of the container facing upstream, and all other equipment downstream.

6.3.2 Indirect Sampling Method

Indirect sampling is performed when it is infeasible to fill sample bottles directly from the sample collection point. Factors that can prevent direct filling of sample containers and require a sampler to perform indirect sampling include:

- Safety concerns
    - Slip and fall
    - Confined space
- Limited access
- High discharge rate
- Use of preservatives

Where these – or other – conditions require the use of indirect sampling, samplers will use an appropriately-size transfer container to first collect the sample before transferring it to the sample container. Follow all criteria described above for direct sampling. Once samples are collected, they must be transferred to the sample containers as soon as possible. When filling the sample containers, the objective is to minimize disturbance of the sample and avoid losing any preservative by overfilling the bottle.

6.4 Dry Sample Location

If the sample location is dry or flow is insufficient to collect a sample:

- Contact the WM Representative,
- Work with the WM Representative and determine what needs to be done to collect the sample, if possible.
- If a sample cannot be collected, complete a Field Information Form for the location and document the attempt, including direction obtained from the WM Representative.

7.0 DOCUMENTATION

Proper documentation is a crucial part of the monitoring program's quality assurance and quality control (QA/QC). Complete, consistent, and accurate documentation of field measurements, procedures, meter calibration, and field observations is required.

During each sampling event, the sampling team must fill out 2 forms: (1) Field Information Form, and (2) Chain of Custody (COC) Form. These forms are critical to properly documenting the sampling event and must be filled out completely and accurately. Complete the sampling documentation as specified in the Environmental Media Sampling Standard.

8.0 SAMPLE PACKAGING AND SHIPMENT

Samples must be packed for shipment as specified in the EMSS. Unless the cooler contains short-hold-time samples, samples must be delivered to the analytical laboratory within 48 hours of collection. Typically overnight sample shipment is pre-arranged by WM's contract laboratory. It is the sampling team's responsibility to verify shipping arrangements or arrange for sample delivery within the hold times.

ATTACHMENTS

FIELD INFORMATION FORM

Surface Water and Stormwater

WASTE MANAGEMENT

Laboratory Use Only / Lab I.D.: ______

Site Name: ______

Sample I.D. ______

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: ☐ D - Direct / I - Indirect / V - Visual

Sampling Equipment: ☐ D - Dipper / T - Transfer Vessel / S - Sample Bottle / O - Other ______

Sample Type: ☐ Grab / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25"C)	Temp 'C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: ______ Color: ______ Other: ______

Sheen Present ☐ Y or ☐ N Foam Present: ☐ Y or ☐ N Floating Solids: ☐ Y or ☐ N

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: ______ Precipitation: ☐ Y or ☐ N

Specific Comments: ______

______

______

______

Date	Name	Signature	Company
/ /			
/ /			

APPENDIX 3

WASTEWATER AND LEACHATE

Environmental Media Sampling Standard

APPENDIX C

LEACHATE SAMPLING

Version 1.0 - October 2012

Prepared by:

Waste Management
Groundwater Protection Program

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Attachments

1. Field Information Form
2. Well Condition Summary Form

1.0 SCOPE

Appendix C, Leachate Sampling (Appendix C), presents the requirements for collecting leachate samples at WM sites. This Appendix must be read and used in conjunction with the Environmental Media Sampling Standard (EMSS or Sampling Standard).

2.0 OVERVIEW OF THE MEDIA

Leachate is any liquid that comes in contact with waste. Typically, leachate contains dissolved inorganic chemicals, metals, organic and biochemical compounds, and may also contain suspended solids.

3.0 HEALTH AND SAFETY

Sampling leachate potentially creates health and safety concerns for sampling personnel. Health and safety concerns include exposure to explosive landfill gas, the presence of oxygen depleted environments, and chemical exposure. Health and safety is beyond the scope of this standard. Samplers must coordinate with the WM Representative before sampling begins to assure that all site-specific and regulatory health and safety requirements are met.

4.0 ENVIRONMENTAL PROTECTION

Leachate must not be released to the environment during sampling. All excess leachate and decontamination water must be properly disposed following site and regulatory requirements. Leachate and decontamination water must be returned to the leachate collection and removal system (LCRS) or disposed in the same manner as leachate. Samplers must verify proper disposal methods and locations with the WM Representative.

In the event of a spill or release, samplers must take reasonable action to mitigate the release, provided it does not violate health and safety requirements. Samplers must report any spill or discharge of leachate outside of a containment area to the WM Representative as soon as possible.

5.0 SAMPLING OBJECTIVES

The objective when sampling leachate is to assure that samples: (1) are representative of the liquid present in the containment area (e.g. sump, pond, manhole, tank, etc.), flow stream, or discharge being sampled, and (2) satisfy the requirements of applicable regulations and permits.

A Representative Leachate Sample is:

1. Characteristic of water in the conveyance, flow path, sump, pond, impoundment, flow stream, or discharge.
2. Not measurably altered by sampling equipment, container handling or storage, or sample collection procedures

6.0 LEACHATE SAMPLING EQUIPMENT

Various types of equipment may be used to collect leachate samples depending on sample point location and access. The most commonly used includes:

1. Plastic or glass jars
2. Sample bottles
3. Dipper
4. Bucket
5. Bailer

Equipment used for leachate sampling must be disposable or only used for leachate sampling. Leachate sampling equipment must not be used to collect samples of other environmental media such as surface water, stormwater or groundwater.

7.0 SAMPLE POINT CONDITION INSPECTION

During each sampling event, samplers must inspect and document the condition of each leachate sample location prior to collecting samples. The condition of each location and surrounding area must be recorded on the Field Information Form (FIF). Samplers must inspect the sampling point and surrounding area and document basic maintenance needs and identify conditions that may require attention, including:

1. Staining or other evidence of leaks or spills.
2. Landfill gas emanating from sample location or surrounding area.
3. Strong or unusual odors
4. Damage or evidence of tampering of the sample location.

Notify the WM Representative if any unusual conditions or problems are observed.

8.0 SAMPLING

The following sections describe the basic techniques and minimum expectations for sampling leachate at WM facilities. For additional detail please contact the WM Representative.

8.1 Leachate Level Measurement

When required, leachate levels must be measured with an instrument dedicated to leachate monitoring. An instrument used to record leachate levels must not be used for any other purpose. Samplers must assure that level measuring devices are properly calibrated and are accurately recording liquid levels.

8.2 Field Parameters

Field parameters must be recorded as specified in the Controlling Documents as discussed in the EMSS. Measurements must be taken with properly-calibrated electronic meters.

WM requires:

- pH
- Temperature
- Specific conductance

Flow-through cells must not be used when sampling leachate. WM recommends using handheld field meters dedicated for use with leachate. Non-dedicated field meters must be cleaned and decontaminated between uses.

Field measurements must be taken in the field as soon as possible and no more than 15 minutes after collection. Samplers must collect another sample if field measurements are not taken within 15 minutes.

8.3 Purging Stagnant Fluid from Pumps and Discharge Lines

Before collecting samples, samplers must evacuate any stagnant water from discharge lines, and ensure that stagnant water if present in conveyances, sumps or pumps are evacuated or avoided. WM considers water that has been standing in a sump, conveyance, or discharge line for more than 24 hours to be “stagnant;” however, this can vary depending on site-specific conditions. Purging stagnant fluids must be coordinated with the WM Representative to assure that (1) the appropriate volume is evacuated, and (2) that the evacuated liquid is properly contained and disposed.

8.4 Sampling Methods

The two primary methods of collecting leachate samples at WM sites are “Direct,” and “Indirect.”

- Direct Sampling is simply the process of collecting a sample directly into the sample container.
- Indirect Sampling is performed by first using a container to retrieve the sample, then transferring it to the sample bottle.

8.4.1. Direct Sampling Method

Direct sampling is performed when it is feasible to fill sample bottles directly from the leachate discharge point. This is most common where sample ports have been installed or the discharge rate can be controlled and reduced for sample collection. In flowing water (such as a sump or other direct access point), always place the mouth of the container facing upstream, and all other equipment or downstream.

When using direct sampling, the objective is to minimize disturbance of the sample and avoid overfilling the bottle and losing any preservative in the sample container.

8.4.2 Indirect Sampling Method

Indirect sampling is performed when samplers are unable to safely fill sample bottles directly from the leachate collection point or where direct sampling will compromise sample integrity by causing loss of preservative. Examples of factors that can require a sampler to perform indirect sampling include:

- Confined spaces
- Restricted access
- Slip and fall hazard near ponds
- High or uncontrolled discharge rate
- Use of preservatives

Where these – or other – conditions require the use of indirect sampling, samplers will use an appropriately-size transfer container to first collect the leachate sample before transferring it to the sample container. Prolonged exposure to the atmosphere will alter sample chemistry; therefore, once samples are collected, they must be transferred to the sample containers as soon as possible. When filling the sample containers the objective is to minimize disturbance of the sample and avoid losing any preservative by overfilling the bottle. Ensure that all indirect and sample containers are either disposable or thoroughly decontaminated.

8.5 Common Challenges to Collecting a Representative Leachate Sample

Samplers may encounter challenges to collecting representative leachate samples. The following sections discuss common challenges that samplers may encounter and provides Waste Management's protocols for addressing them. In addition to the described protocols, samplers may confer with the WM Representative and address the problems using other techniques not described here.

8.5.1 Reactivity

If samples react with preservatives in the bottles causing foaming or bubbles where none were present, follow these steps:

- Flush all preservative from bottle with leachate or distilled/deionized water.
    - Collect the leachate sample without preservative.
- Note on sample bottle label, the FIF, and the COC that the sample is unpreserved.
- Contain all discarded water and leachate for proper disposal.
- Document the reactivity of the sample on the FIF and COC.

8.5.2 Bubbles or Foam

If the leachate contains bubbles or foam unrelated to the sampling process, follow these steps:

- Use the indirect sampling method
- Collect a sufficient volume of leachate in a disposable or decontaminated container or bucket
- Allow the foam and bubbles to subside
- Fill sample bottles
- Describe the condition on the FIF

8.5.3 Dry Sample Location

If the leachate sample location is dry or not producing leachate:

- Contact the WM Representative.
- Work with the WM Representative and determine if or how a sample can be collected.
- Whether a sample cannot be collected or is collected using alternate means, complete a FIF for the location and document the attempt or the procedures used to obtain a sample.

8.5.4 Other Problems or Observations

Samplers may encounter other problems or observe unusual circumstances when collecting leachate samples. Unusual circumstances could include leachate with unusual color or odor, visible oils, excessive solids, or the sample location has become unsafe for collection. Notify the WM Representative of any problems or unusual conditions.

9.0 DOCUMENTATION

Proper documentation is a crucial part of the monitoring program's quality assurance and quality control (QA/QC). Complete, consistent, and accurate documentation of field measurements, procedures, meter calibration, and field observations is required.

During each sampling event, the sampling team must fill out 2 forms: (1) FIF, and (2) COC Form. Complete the sampling documentation as specified in the Environmental Media Sampling Standard.

10.0 SAMPLE PACKAGING AND SHIPMENT

Leachate samples must be packed for shipment as specified in the Environmental Media Sampling Standard. Unless the cooler contains short-hold-time samples, samples must be delivered to the analytical laboratory within 48 hours of collection. Typically overnight sample shipment is pre-arranged by WM's contract laboratory. It is the sampling team's responsibility to verify shipping arrangements or arrange for sample delivery within the hold times. Leachate samples must not be packed in the same cooler as samples of other media.

ATTACHMENTS

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Laboratory Use Only / Lab I.D.: ____

Site Name: ____

Sample I.D. ____

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: ☐ D - Direct / I - Indirect / V - Visual

Sampling Equipment: ☐ D - Dipper / T - Transfer Vessel / S - Sample Bottle / O - Other ____

Sample Type: ☐ Grab / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25"C)	Temp 'C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: ____ Color: ____ Other: ____

Sheen Present ☐ Y or ☐ N Foam Present: ☐ Y or ☐ N Floating Solids: ☐ Y or ☐ N

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: ____ Precipitation: ☐ Y or ☐ N

Specific Comments: ____

____

____

____

Date	Name	Signature	Company
/ /			
/ /			

WASTE MANAGEMENT

Well Condition Summary Form

Facility: ____________________________ Well/Piezometer Name: _____________________

Evaluator: __________________________ Evaluation Date: ___________________________

	Y	N	N/A
Is the well's location appropriately shown on a facility map?			
Is the well adequately flagged if hard to find?			
Is the well elevation information inscribed at or on the well correct?			
Is the well: ☐ flush with surface? ☐ above ground?			
Is the well free of physical damage?			
Is the well labeled on the inside?			
Is the well labeled on the outside?			
Does the well have protective posts, if necessary?			
Do above ground wells have weep holes at the base of the protective casing?			
Does the area around the well appear clean?			
Is the casing secure (attempt to move along two perpendicular axes)?			
Is the surface seal void of differential erosion around and under the base?			
Is the surface seal free of cracks that might affect the integrity of the seal?			
Is the surface seal sloped to prevent ponding around the well?			
Is the well free from standing or ponded water?			
Is the well locked to prevent unauthorized access?			
Is the protective casing cap void of large gaps which would breach security?			
Is the locking cap free of rust?			
Is there a survey mark on the riser/wellhead assembly cap?			
Is the riser cap vented?			
Is the annular space free of animal/insect nests?			
Is the annular space appropriately filled with filtering material?			
If a pump, can it be lifted a few inches? (do not test prior to sampling)			
Is the well free of kinks or bends?			

COMMENTS: ____

____

____

Attachment B

Test America – Buffalo - Laboratory Quality Assurance Manual

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Buffalo Quality Memorandum

Date: November 12, 2013

From: Brad Prinzi, Quality Assurance Manager

To: TestAmerica Buffalo

Subject: Lab Quality Manual - Sample Acceptance Policy

The purpose of this memorandum is to update the Sample Acceptance Policy for TestAmerica Buffalo to include our policy for Radiation Screening as outlined in BF-SR-002. Section 23.3 Sample Acceptance Policy will add the following bullet to the acceptance criteria:

- Every sample cooler is given a radiation screen with a standardized Radiation Monitor (Monitor 4 model). This screen has no analytical repercussions; it is just a gross screen for employee safety purposes. Contact TestAmerica Buffalo's Technical Director, Environmental Health and Safety Coordinator or Sample Control Manager immediately if screening indicates radioactivity in excess of 0.02 mR/hr.

Figure 23-2, as noted below, replaces Figure 23-2 in the Quality Manual.

Figure 23-2.

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - ➢ *Client name, address, phone number and fax number (if available)*
   - ➢ *Project name and/or number*
   - ➢ *The sample identification*
   - ➢ *Date, time and location of sampling*
   - ➢ *The collectors name*
   - ➢ *The matrix description*
   - ➢ *The container description*
   - ➢ *The total number of each type of container*
   - ➢ *Preservatives used*
   - ➢ *Analysis requested*
   - ➢ *Requested turnaround time (TAT)*
   - ➢ *Any special instructions*
   - ➢ *Purchase Order number or billing information (e.g. quote number) if available*
   - ➢ *The date and time that each person received or relinquished the sample(s), including their signed*

name.

- ***The date and time of receipt must be recorded between the last person to relinquish the samples and the person who receives the samples in the lab, and they must be exactly the same.***
- **Information must be legible**

2) Every sample cooler is given a radiation screen with a standardized Radiation Monitor (Monitor 4 model). This screen has no analytical repercussions; it is just a gross screen for employee safety purposes. Contact TestAmerica Buffalo's Technical Director, Environmental Health and Safety Coordinator or Sample Control Manager immediately if screening indicates radioactivity in excess of 0.02 mR/hr.

3) Samples must be properly labeled.
    - Use durable labels (labels provided by TestAmerica are preferred)
    - Include a unique identification number
    - Include sampling date and time & sampler ID
    - Include preservative used.
    - Use indelible ink
    - **Information must be legible**

4) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

5) Samples must be preserved according to the requirements of the requested analytical method. See lab Sampling Guide.
   Note: Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

    - Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

    - For Volatile Organic analyses in drinking water (Method 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:
        - 1. Test for residual chlorine in the field prior to sampling.
            - If no chlorine is present, the samples are to be preserved using HCl as usual.
            - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.
        - 2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.
    - **FOR WATER SAMPLES TESTED FOR CYANIDE – for NPDES samples by Standard Methods or EPA 335**
        - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

            - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.

  - It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

  - The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

6) Sample Holding Times
   - TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (2 working days) remaining on the holding time to ensure analysis.

   - Analyses that are designated as “field” analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for “field” analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis.

7) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply this blank with the bottle order.

8) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

9) Recommendations for packing samples for shipment.

   - Pack samples in Ice rather than “Blue” ice packs.

   - Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.

   - Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.

   - Fill extra cooler space with bubble wrap.

Approvals

	11/12/2013
Laboratory Director – Chris Spencer	Date
	11/12/2013
Quality Assurance Manager - Brad Prinzi	Date
Jennifer Pierce	11/12/2013
Operations Manager – Jennifer Pierce	Date
Michelle	11/12/2013
Organic Preparation Manager – Michelle Freeman	Date
Denise L Giglia	11/12/2013
GC/MS Volatiles Manager – Denise Giglia	Date
James F Rojecki	11/12/2013
Wet Chemistry Manager – James Rojecki	Date
	11/12/2013
GC Semivolatiles / Volatiles Manager – Gary Rudz	Date
E. Scott Wagner	11/12/2013
Metals Manager – Scott Wagner	Date
David C. Wilkes	11/12/2013
GC/MS Semivolatiles / IC Manager – David Wilkes	Date

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Quality Assurance Manual

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Quality Assurance Manual
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SECTION 2

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CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CA-Q-S-008	Management Systems Review
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CA-L-S-002	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-L-P-004	Ethics Policy

CA-L-P-002	Contract Compliance Policy
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-007	Controlled Purchases Policy
CW-F-S-018	Vendor Selection
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual

REFERENCED LABORATORY SOPs

SOP Reference	Title
BF-GP-001	Calibration of Autopipettes and Repipetters
BF-GP-002	Support Equipment: Maintenance, Record Keeping and Corrective Actions
BF-GP-005	Sample Homogenization and Subsampling
BF-GP-012	Technical Data Review
BF-GP-013	Manual Integration
BF-GP-015	Record Storage and Retention
BF-GP-018	Strict Internal Chain or Custody
BF-GP-019	Standard Traceability and Preparation
BF-GP-020	Thermometer Calibration
BF-PM-001	Project Information Requirements
BF-PM-003	Bottle Order Set-up
BF-PM-005	Correctness of Analysis
BF-QA-001	Determination of Method Detection Limits
BF-QA-002	Quality Control Limits
BF-QA-003	Procedure for Writing, Reviewing and Revising Controlled Documents

SECTION 3

INTRODUCTION, SCOPE AND APPLICABILITY

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Buffalo's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards, The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025(E) In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition September 1986, Final Update I, July 1992, Final Update II A, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261. New York State Analytical Services Protocol, July 2005
- Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005).
- Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, and on-line Editions. 21st.
- *U.S. Department of Energy* Order 414.1B, *Quality Assurance*, Approved April 29, 2004.
- *U.S. Department of Energy* Order 414.1C, *Quality Assurance*, June 17, 2005.
- *U.S. Department of Energy*, *Quality Systems for Analytical Services*, Revision 3.6, November 2010.

- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Section 19.0. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director/Manager and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director/Manager and the QA Manager must determine if it is in the lab’s best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. The manual itself is reviewed every two years by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory’s clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & updating procedures (refer to BF-QA-003)

SECTION 4

MANAGEMENT REQUIREMENTS

4.1 OVERVIEW

TestAmerica Buffalo is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Executive Officer, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Buffalo is presented in Figure 4-1.

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Buffalo laboratory.

4.2.2 Laboratory Director

TestAmerica Buffalo's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

The Laboratory Director has the authority to affect those policies and procedures to ensure that only data of the highest level of excellence are produced. As such, the Laboratory Director is responsible for maintaining a working environment which encourages open, constructive problem solving and continuous improvement.

Specific responsibilities include, but are not limited to:

- Provides one or more department managers for the appropriate fields of testing. If the Department Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Department Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary NELAC accrediting authority must be notified in writing.

- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.

Leads the management team, consisting of the QA Manager, the Technical Director, Customer Service Manager, and the Operations Manager as direct reports.

4.2.2 Quality Assurance (QA) Manager or Designee

The QA manager has responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.

The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA department to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.

- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems, data authenticity and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a subset of all final data reports for internal consistency.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Leads the QA team to enable communication and to distribute duties and responsibilities.

- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.

- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.

- Evaluation of the thoroughness and effectiveness of training.

- Compliance with ISO 17025.

4.2.3 Technical Director or Designee

The Technical Director reports directly to the Laboratory Director and is responsible for assessing the construction and management of the facility design, maintaining environmental conditions, technical and financial evaluation of capital equipment and capital budgeting and asset valuation.

In addition, the Technical Director solves day to day technical issues, provides technical training and guidance to staff, project managers and clients, investigates technical issues identified by operations personnel or QA, and directs evaluation of new methods. Specific responsibilities include but are not limited to:

- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Compliance with ISO 17025 Standard.

4.2.4 Operations Manager

The Operations Manager reports to the Laboratory Director and oversees the daily operations of the analytical laboratory, maintaining a working environment that encourages open, constructive problem solving and continuous improvement.

The Operations Manager is responsible for supervision of laboratory staff, setting goals and objectives for the laboratory, ensuring compliance with project/client requirements and ensuring on-time performance, supervises maintenance of equipment and scheduling of repairs. Responsibilities also include implementation of the quality system in the laboratory and ensuring timely compliance with audit and QA corrective actions.

In addition, the Operations Manager works with the Technical Director in evaluating technical equipment, assessing capital budget needs and determining the most efficient instrument utilization. More specifically he:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Director and QA Manager and in compliance with regulatory requirements.
- Works with the Preventive Maintenance Coordinator to ensure that scheduled instrument maintenance is completed.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.5 Department Managers

Department Managers report to the Operations Manager. The Department Managers serve as the technical experts on assigned projects, provide technical liaison, assist in resolving any technical issues within the area of their expertise; and implement established policies and procedures to assist the Operations Manager in achieving section goals. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training, and development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Human Resources

Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Director, Operations Manager, and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.6 Environmental Health & Safety / Hazardous Waste Coordinator

The Health and Safety Coordinator is responsible for the safety and well-being of all employees while at the laboratory. This includes, but is not limited to, administering the Corporate Safety Manual that complies with federal regulations, MSDS training and review, conducting laboratory safety orientation and tours for all new employees, providing instructions on safety equipment, cleaning up laboratory spills, and instructing personnel of laboratory procedures for emergency situations. The Health and Safety Coordinator is on-call 24-hours a day, 7-days a week for all laboratory situations.

The Health and Safety Coordinator responsibilities additionally include waste management of laboratory generated hazardous waste in accordance with appropriate regulations. This includes maintenance of required documentation, such as waste manifests, segregation of waste in accordance with requirements, and training of personnel in proper segregation of waste and preparation of Safety related SOPs. The EHSC maintains overall EH&S program oversight, but may delegate specific day-to-day activities as necessary.

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.
- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by Test America’s medical consultants.

4.2.7 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.

- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Director, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

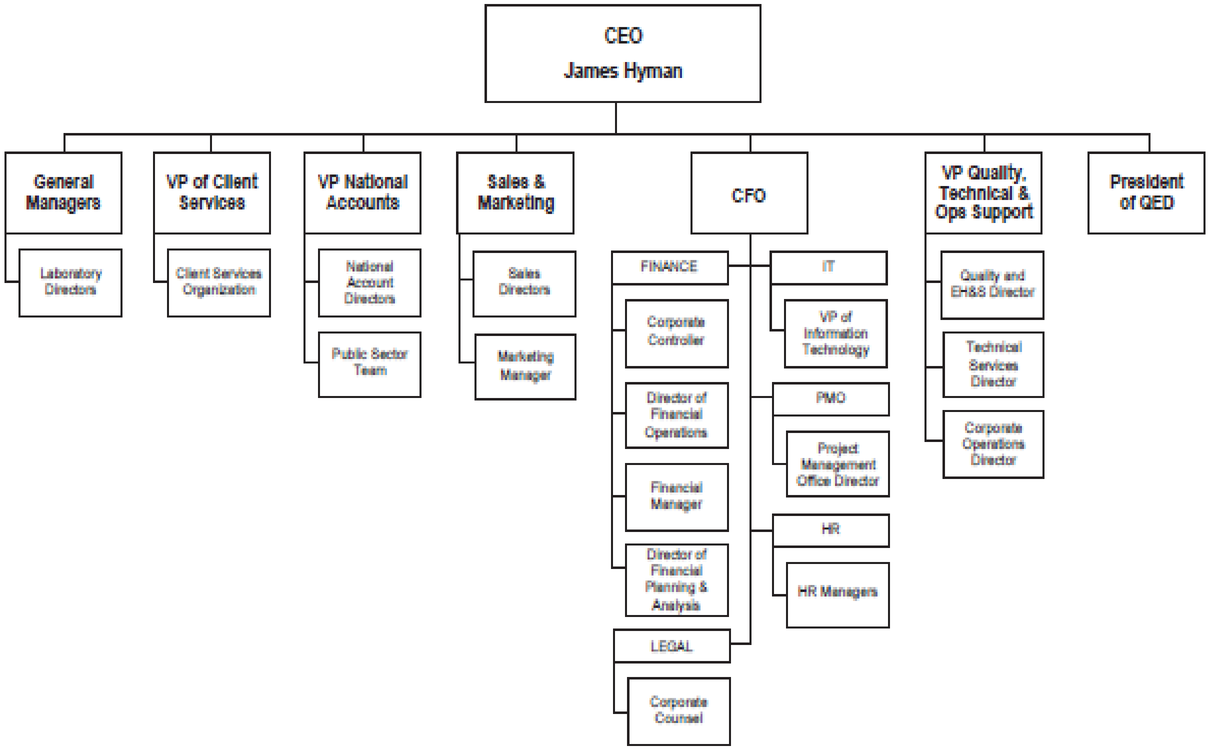
4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director	Operations Manager (1) Technical Director (2)	
QA Manager	QA Specialist (1) Operations Manager (2)	
Technical Director	Laboratory Director (1) Operations Manager (2)	
Operations Manager	Department Manager (1) Department Manager (2)	Selected based on availability
Customer Service Manager	Project Mng't Manager (1) Laboratory Director (2)	
Project Management Manager	Customer Srv. Manager (1) Project Manager (2)	(2) Selected based on availability
Project Manager	Project Manager (1) Project Management Asst. (2)	(1) 2° team PM (2) Team PMA
Organic Department Manager	Analyst (1) Analyst (2)	Selected based on department, experience and availability
Inorganic Department Manager	Analyst (1) Analyst (2)	Selected based on department, experience and availability
Data Validation / Data Packaging Manager	Data Validation Specialist Data Packaging Specialist	Selected based on department and availability
EHS Coordinator	Safety Officer (1) Sample Mng't Manager (2)	
Sample Management Manager	Sample Custodian (1) EHS Coordinator (2)	
Bottle Preparation / Shipping Manager	Bottle Prep Technician (1) Sample Mng't Manager (2)	

Figure 4-1.
Corporate and Laboratory Organization Charts

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING



Oct 2012

TestAmerica
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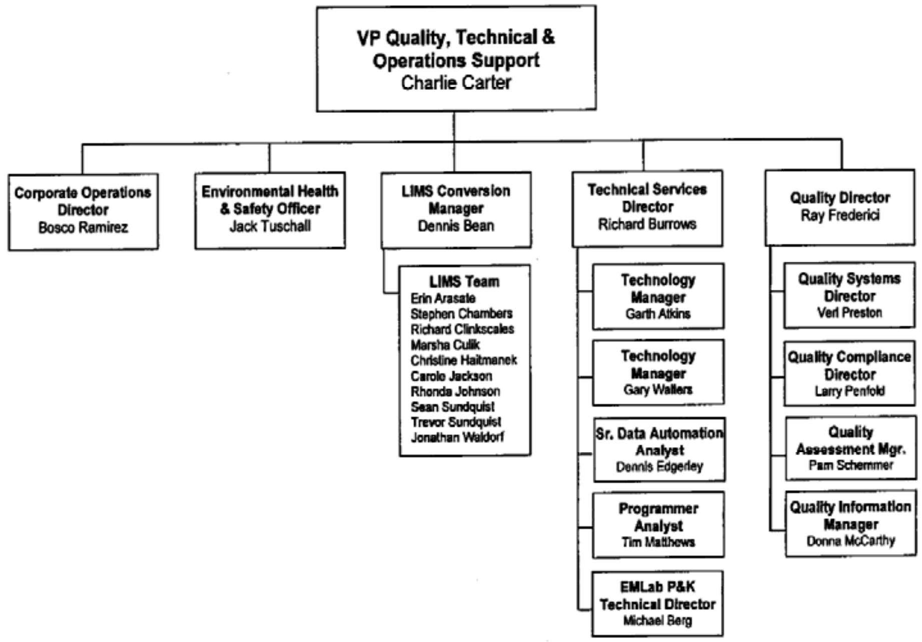
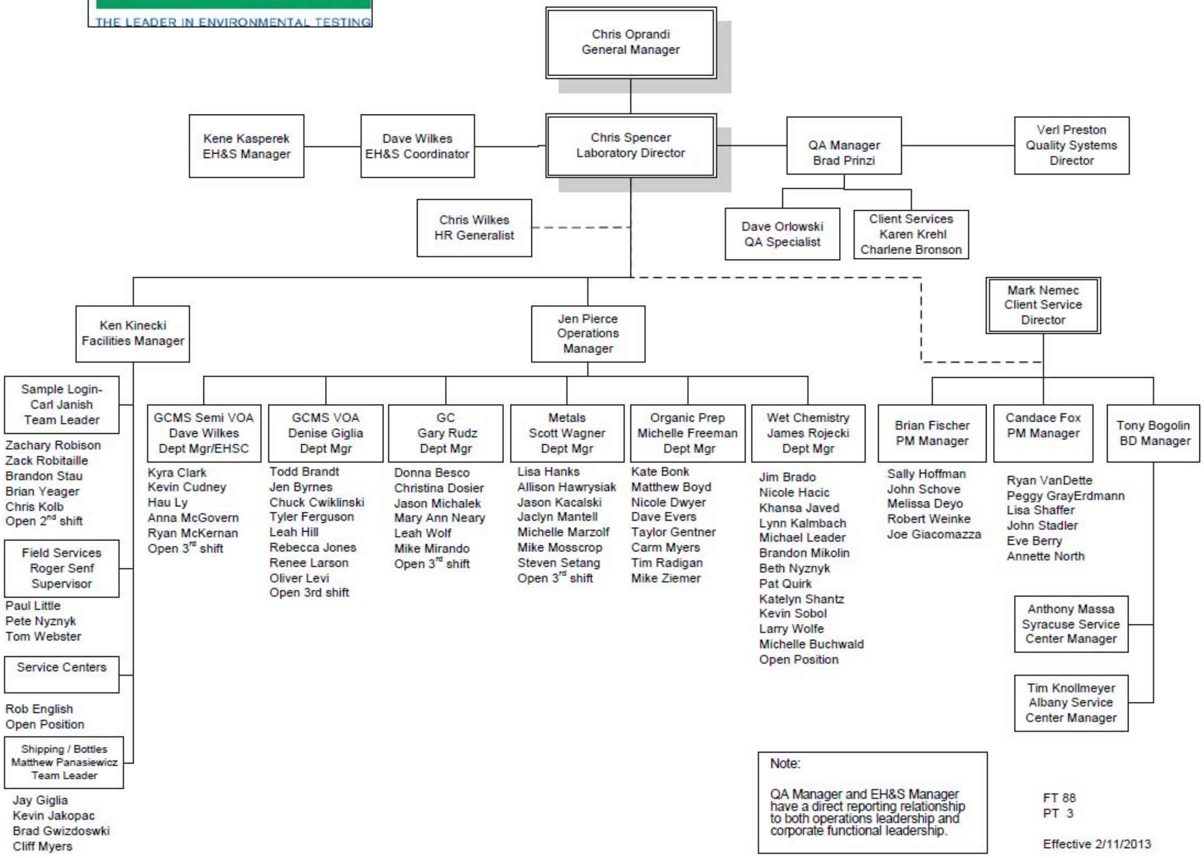
Quality, Technical & Operations Support



Note:
QA Managers and EH&S Managers have a direct reporting relationship to both operations leadership and corporate functional leadership.

4 Aug 2011

Buffalo Laboratory Organization



Note:

QA Manager and EH&S Manager have a direct reporting relationship to both operations leadership and corporate functional leadership.

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SECTION 5

QUALITY SYSTEM

5.1 QUALITY POLICY STATEMENT

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the NELAC Standards (2003), ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The 7 elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A training program.
- Self-governance through disciplinary action for violations.
- A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-L-S-002).

- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents:

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratories normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
-

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

-
- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory maintains *Quality Control Limit Data in their LIMS system.* A summary report is generated from LIMS to check the precision and accuracy acceptability limits for performed analyses on request. The summary report is generated and is managed by the laboratory's QA department. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in Section 24.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The procedure for determining the statistical limits may be found in SOP BF-QA-002, Quality Control Limits. The analysts are instructed to use the current limits in the laboratory (dated and approved the QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory through date sensitive tables within the LIMs System. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate recoveries are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The QA Manager periodically evaluates these to determine if adjustments need to be made or for corrective actions to methods (SOP No. BF-QA-002). All findings are documented and kept on file.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. BF-QA-003.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action notices. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item, or an 'end of document' page, the effective date, revision number and the laboratory's name. The Quality personnel are responsible for the maintenance of the system.

Controlled documents are authorized by the QA Department and other management. In order to develop a new document, a Department Manager submits an electronic draft to the QA

Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retain that document as the official document on file. That document is then provided to all applicable operational units. Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years for the majority of procedures and every 1 year for Drinking Water programs. Changes to documents occur when a procedural change warrants.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual, refer to SOP No. BF-QA-003, “Writing, Reviewing and Revising Controlled Documents”. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. A controlled electronic copy of the current version is maintained on the laboratory Intranet site and is available to all personnel.

For changes to SOPs, refer to SOP No. BF-QA-003, “Writing, Reviewing and Revising Controlled Documents”.

Forms, worksheets, work instructions and information are organized by department in the QA office. Electronic versions are kept in a controlled access electronic folder in the QA department. As revisions are required, a new version number and revision date is assigned and the document placed on the laboratory Intranet (BufNet) for use.

6.4 OBSOLETE DOCUMENTS

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. BF-GP-015.

SECTION 7

SERVICE TO THE CLIENT

7.1 OVERVIEW

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Legal & Contracts Director
- General Manager
- Customer Service Manager
- Operations Manager
- Laboratory and/or Corporate Technical Directors
- Corporate Information Technology Managers/Directors
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Legal Contracts Director, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts. The Customer Service Manager at the TestAmerica Buffalo facility also maintains copies of these documents.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote will be filed with the laboratory PM and the Customer Service Manager.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements. Specific information related to project planning may be found in SOP BF-PM-001, Project Information Requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the management staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation.

Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during production meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager.

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 SPECIAL SERVICES

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

Note: ISO/IEC 17025 states that a laboratory "shall afford clients or their representative's cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 CLIENT COMMUNICATION

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Managers are available to discuss any technical questions or concerns that the client may have.

7.6 REPORTING

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

TestAmerica’s Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase “work sharing” refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica’s Corporate SOP’s on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process SOP (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client’s Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client’s analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Customer Service Managers (CSM), or Regional Account Executives (RAE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: In addition to the client, some regulating agencies, such as the Department of Energy and the USDA, may require notification prior to placing such work**.**

Approval may be documented through reference in a quote / contract or e-mail correspondence.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Regional Account Executive (RAE) or Customer Service Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was

designated by the client must be maintained with the project file. This documentation can be

- as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica. A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site. Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable (e.g. on the subcontractors TNI, A2LA accreditation or State certification.
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- TNI or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work-sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process.

When the potential sub-contract laboratory has not been previously approved, then to begin the process, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site and notify the finance group for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and
- Corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report (Form No. CW-F-WI-009)**.**
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories and Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Laboratory Directors/Managers, QA Managers and Sales Personnel.

8.3 OVERSIGHT AND REPORTING

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or RAE or CSM, etc.) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on a Subcontract Laboratory Certification Verification Form (Figure 8-1) and the form is retained in the project folder. For TestAmerica laboratories, certifications can be viewed on the company TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must also be included with all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilities successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data are incorporated into the laboratories EDD (i.e. imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. . The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

Figure 8-1 Subcontracting Laboratory Approval Form (Initial / Renewal)

SUBCONTRACTING LABORATORY APPROVAL

Reference: Section 8 – Quality Assurance Manual

Date: ____________________
Laboratory: ____
Address:____
____
Contact and e-mail address: ____
Phone: Direct ______________________________ Fax ____________________________

Requested Item[3]	Date Received	Reviewed/ Accepted	Date
1. Copy of State Certification[1]			
2. Insurance Certificate			
3. USDA Soil Permit			
4. Description of Ethics Program[3]			
5. QA Manual[3]			
6. Most Recent (and relevant) 2 Sets of WP/WS Reports with Corrective Action Response[1,3]			
7. State Audit with Corrective Action Response (or NELAC or A2LA Audit)[3]			
8. Sample Report[3]			
9. SOQ or Summary list of Technical Staff and Qualifications [3]			
10. SOPs for Methods to Be Loadshifted[2,3]			
11. For DoD Work: Statement that Lab quality system complies with QSM.			
12. For DoD Work: Approved by specific DoD Component laboratory approval process.			

1 - Required when emergency procedures are implemented.
2 - Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable. This requirement may also be fulfilled by supplying a table of SOPs with effective dates.
3 – If the laboratory has NELAC accreditation, Item #s 4 through 10 are not required.

On Site Audit Planned: YES NO If yes, Date Completed: __________ By Whom: ______________

Comments:

Lab Acceptable for Subcontracting Work: YES NO Limitations: _________________________

QA Manager (Signature): _____________________________________ Date: ________________

☐ Forwarded to Contract Coordinator, by: _______________________________ Date: ________________

SECTION 9

PURCHASING SERVICES AND SUPPLIES

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007

Contracts will be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Purchasing guidelines for equipment and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001 and TestAmerica Buffalo SOP on Solvent Purity, SOP BF-OP-013.

9.3.1 Purchasing

Chemical reagents, solvents, glassware and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. Purchase requisitions are placed into the J.D. Edwards system by designated departmental personnel. The listing of items available in the J.D. Edwards system has been approved for use by the corporate purchasing staff. Each purchase requisition receives final approval by the laboratory Operations Manager or purchasing coordinator before the order is submitted.

The analyst may also check the item out of the on-site consignment system that contains items approved for laboratory use.

9.3.2 Receiving

It is the responsibility of the purchasing coordinator to receive the shipment. It is the responsibility of the department that ordered the materials to date the material when received. Once the ordered reagents or materials are received, the department that submitted the order compares the information on the label or packaging to the original order to ensure that the purchase meets quality level specified. Material Safety Data Sheets (MSDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOP expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date cannot not be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.

- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained along with the calibration raw data for which the reagent was used.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- umho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Department Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in the LIMS system, files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Director or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. DOC No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Director and/or the Laboratory Director. If they agree with the request the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, is followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers, Operations Manager and/or Technical Director.

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Corporate Finance documents on Vendor Selection (SOP No. CW-F-S-018) and Procurements & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers /vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form (available on the intranet site).

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10

COMPLAINTS

10.1 OVERVIEW

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures ‘client knowledge’ that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, e.g., communications, responsiveness, data, reports, invoicing and other functions expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing with both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following the laboratory SOPs related to Data Quality Review (BF-QA-006) and Corrective Action (BF-QA-005).

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to SOPs BF-QA-006 and BF-QA-005.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likely hood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 13. In addition, Corporate Management, Sales and Marketing and Information Technology (IT) may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16)

SECTION 11

CONTROL OF NON-CONFORMING WORK

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory standard procedures, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the department manager for resolution. The department manager may elect to discuss it with the Technical Director, QA Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratory's job exception and corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director, Technical Director, Operations Manager or QA Manager, documented and included in the project folder. Deviations must also be noted on the final report with a statement that the compound is not reported in compliance with the analytical method requirements and the reason.

11.2 RESPONSIBILITIES AND AUTHORITIES

TestAmerica's Corporate SOP entitled Internal Investigation of Potential Data Discrepancies and Determination for Data Recall (SOP No. CW-L-S-002) outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances the Laboratory Director, the Technical Director, the Operations Manager or the QA Manager may exceptionally authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's job exception and corrective action procedures described in Section 12. This information may also need to be documented in logbooks and/or data review checklists as appropriate**.** Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility senior laboratory management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, Technical Director, Operations Manager, QA Manager, Customer Service Manager, Human Resources Manager and Business Development Manager. Suspected misrepresentation issues may also be reported to any member of the corporate staff as identified in Ethics Policy, CA-L-P-001. The data integrity hotline (1-800-736-9407) may also be used. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, General Managers and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CW-L-S-002 distinguishes between situations when it would be appropriate for laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-L-S-002.

11.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system.

On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (i.e., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Director, Operations Manager, QA Manager, Department Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Customer Service Manager and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION

12.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Report (NCR) also know as Job Exception Reports (JER) and Corrective Action Reports (CAR) (refer to Figure 12-1).

12.2 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution

12.2.1 Non-Conformance Report (NCR) - (previously known as Job Exception Report and Data Quality Review (DQR) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non matrix related)
- Isolated reporting / calculation errors
- Client complaints
- Project Management concerns regarding specific analytical results
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of JERs.
- Issues found while reviewing JERs that warrant further investigation.
- Questionable trends that are found in the monthly review of DQRs or client complaints

- Internal and External Audit Findings
- Failed or Unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic Reporting / Calculation Errors
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. A NCR or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Department Manager, Operations Manager, Technical Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCR or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Department Manager, Operations Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Department Managers and the Operations Manager are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCR and DQR are entered into a database and each CAR is entered into a spreadsheet for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.
- The QA Manager reviews monthly NCR and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.
- Also refer to Section 15.1.4, Special Audits)

12.4 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of a NCR or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, work instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly at a minimum by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCR and appropriate corrective action (e.g., reanalysis) is taken and documented.

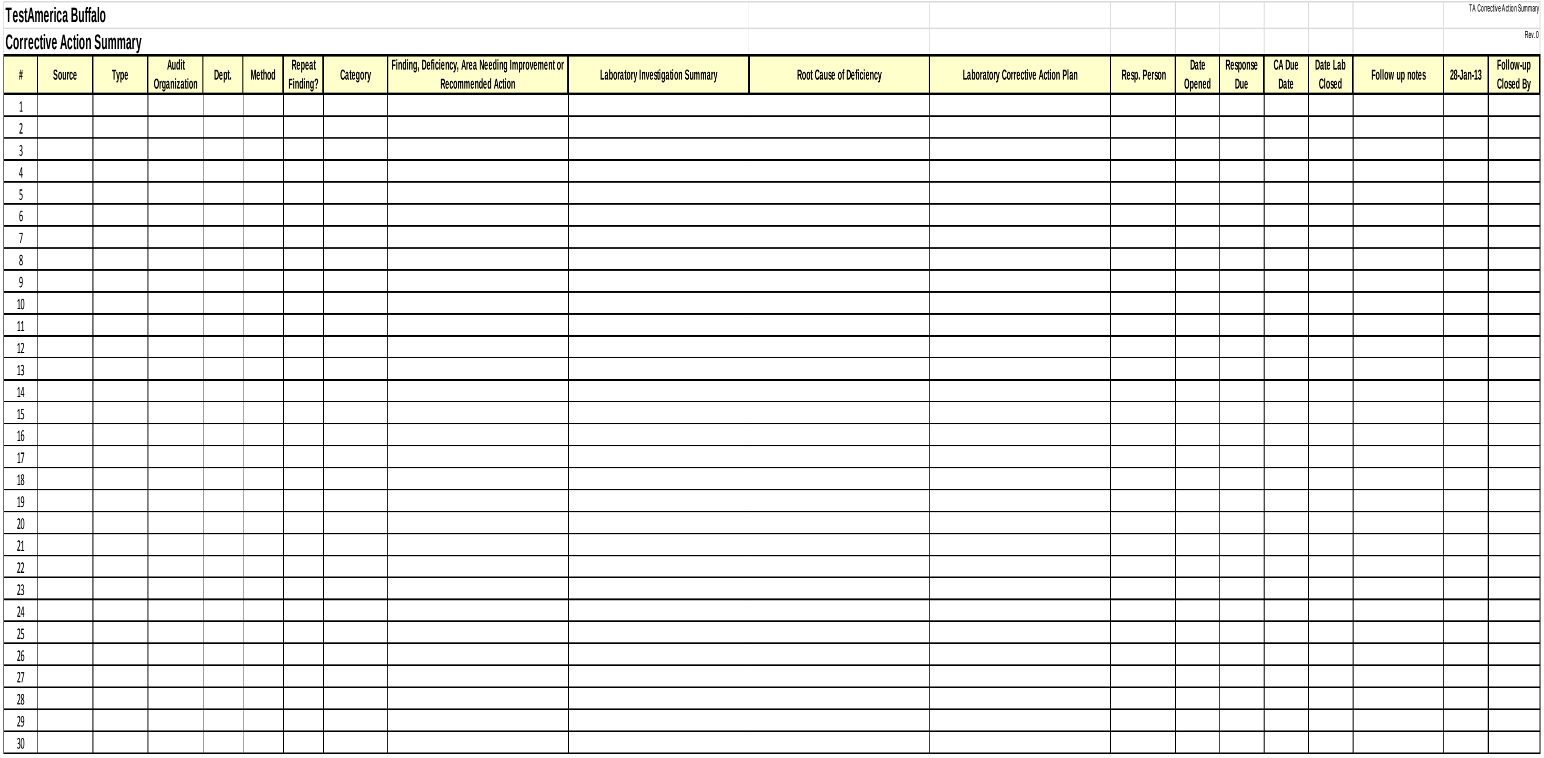
12.5 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, not obliterated (e.g. no white-out), and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example – Corrective Action Notice



TestAmerica Buffalo — TA Corrective Action Summary

Corrective Action Summary — Rev. 0

#	Source	Type	Audit Organization	Dept.	Method	Repeat Finding?	Category	Finding, Deficiency, Area Needing Improvement or Recommended Action	Laboratory Investigation Summary	Root Cause of Deficiency	Laboratory Corrective Action Plan	Resp. Person	Date Opened	Response Due	CA Due Date	Date Lab Closed	Follow up notes	28-Jan-13	Follow-up Closed By
1																			
2																			
3																			
4																			
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Table 12-1.

Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Department Manager)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Department Manager)*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in LIMs.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. -For matrix spike or duplicate results outside criteria the data for the data for that sample shall be reported with qualifiers.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMs.	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) When the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Department Manager)*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Internal / External Audits *(QA Manager, Department Manager, Operations Manager, Technical Director, Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc.	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting / Calculation Errors *(Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager, QA Manager, Corporate QA, Corporate Management)*	- SOP CW-L-S-002, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002.
Client Complaints *(Project Managers, Lab Director, Sales and Marketing, QA Manager)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 17 for an example) *(QA Manager, Lab Director, Operations Manager Department Managers)*	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation *(EH&S Coordinator, Lab Director, Operations Manager, Department Manager)*	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through EH&S office.

Note:

1. Except as noted below for certain compounds, the method blank should be below the reporting limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, acetone, 2-butanone and phthalates provided they appear in similar levels in the reagent blank and samples. This allowance presumes that the reporting limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and the other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

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SECTION 13.0

PREVENTIVE ACTION / IMPROVEMENT

13.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and client satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the monthly QA Metrics Report, evaluation of internal or external audits, results & evaluations of proficiency testing (PT) performance, data analysis & review processing operations, client complaints, staff observation, etc.

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's Corrective Action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.

- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process and management review

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Systems Review (Section 17). A highly detailed report is not required; however a summary of success and failure within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division’s Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes.

SECTION 14.0

CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. TestAmerica Buffalo SOP BF-GP-015, Record Storage and Retention specify additional storage, archiving and retention procedures.

14.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA department in a database which is backed up as past of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Hardcopy technical records are maintained by the Data Deliverables Manager while electronic technical records are maintained by the IT Administrator.

Table 14-1. Record Index[1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - Policy Memorandums - SOPs - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)

	Record Types [1]:	**Retention Time:**
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	All HR docs have different retention times: Refer to HR Manual
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. Retention of records is maintained on-site at the laboratory for at least 3 months after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement. All records shall be protected against fire, theft, loss, environmental deterioration and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to the data is limited to laboratory and company employees and shall be documented with an access log.

Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for at least 1 year after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data. Specific Information related to archival of data for greater than 5 years may be found in TestAmerica Buffalo SOP BF-GP-015.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	5 years (project records) 10 years-Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	5 years
NY Potable Water NYCRR Part 55-2	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1] Note: Extended retention requirements are noted with the archive documents or addressed in TestAmerica Buffalo facility-specific records retention procedure BF-GP-015.

14.1.3 All records are held secure and in confidence. Records maintained at the laboratory are located in the locked on-site storage room. Records archived off-site are stored in a secure location. Access to the off-site storage facility is controlled and logs are maintained for the documented removal/return of records

14.1.4 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. TestAmerica Buffalo SOP BF-GP-015 also contains specific information for archival of scanned data.

14.1.5 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (records stored off site should be accessible within 2 business days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the chain of custody is stored with the project file and the Job Number in TALS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. Calibration data for a given sequence are maintained in the order of the analysis. Sample data are stored on a job number basis in the project file or as part of the daily batch or sequence. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks, bench sheets or excel spreadsheets are used to record and file data. Standard and reagent information is recorded in logbooks or on the raw data for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in TestAmerica SOP BF-GP-015.

- Also refer to Section 19.14.1 ‘Computer and Electronic Data Related Requirements’**.**

14.2 TECHNICAL AND ANALYTICAL RECORDS

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing of results.

14.2.2 Observations, data and calculations are recorded real-time.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.
The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code**;**
- Date of analysis; time of analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a bench sheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in the method specific SOPs, in the instrument method detail records or the instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, separation protocols, incubation periods, ID codes, volumes, weights, instrument printouts, meter readings, temperatures, calculations, reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware

audits, backups, and records of any changes to automated data entries.

- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- Procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

14.5.4 The laboratory has a record management system (also known as document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per instrument or analysis basis, and are numbered sequentially as they are issued. No instrument or analysis has more than one active notebook at a time, so all data are recorded sequentially within a series of sequential notebooks. Bench sheets and raw data sequence files are filed sequentially by date. Standard and reagent information is maintained in LIMS and logbooks which are maintained on a departmental basis and are numbered sequentially as they are issued or as they are archived by QA.

14.5.5 Records are considered archived when noted as such in the records management system (also known as document control). Access to archived hard-copy information is documented with an access log and in/out records is used to note data that is removed and returned.

14.5.6 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.7 Records Disposal

14.5.7.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

14.5.7.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.7.3 If a third party records Management Company is hired to dispose of records, a “Certificate of Destruction” is required**.**

SECTION 15

AUDITS

15.1 INTERNAL AUDITS

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CA-Q-S-004. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee or Corporate QA	All areas of the laboratory annually
Method Audits *	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CA-Q-S-004)	Methods Audits Frequency: 50% of methods annually
Special	QA Department or Designee	Surveillance or spot checks performed as needed to monitor specific issues
Performance Testing	Coordinated by Corporate QA	Two successful per year for each TNI -NELAC field of testing or as dictated by regulatory requirements

* = all methods receive a QA Technical Audit or an SOP Method Compliance Audit annually.

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, NELAC quality systems client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action.

The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, Chrom AuditMiner is used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Director or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Nonpotable Water, Soil, and Air.

It is TestAmerica’s policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 AUDIT FINDINGS

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. . When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS

16.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director for review and comments. The final report shall be submitted to the Operation Manager as well as the appropriate Quality Director and General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Director prepares a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Director, Operations Manager, Customer Service Manager, and QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CA-Q-S-008 & Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective; therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.

- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources.
    - Adequacy of policies and procedures.
    - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes.

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. The TestAmerica Corporate Data Investigation/ Recall SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica’s CEO, VP of Quality, Technical & Operations Support, General Managers and Quality Directors receive a monthly report from the Corporate Quality Director summarizing any current data integrity or data recall investigations. The General Manager’s are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL

17.1 OVERVIEW

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

The laboratory makes every effort to hire analytical staff that possesses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located in the TestAmerica Buffalo Human Resource office (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, pipette, quantitation techniques, etc. are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC)	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Directors/Department Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 TRAINING

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	**Time Frame**	**Employee Type**
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics - Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 20).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- The Human Resource office maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in TestAmerica Buffalo SOP BF-QA-004, Laboratory Personnel Training.

17.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica*.* It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy No. CW-L-P-004 and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 OVERVIEW

TestAmerica Buffalo is a 32,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for field operations, bottle kit preparation, sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis and administrative functions.

18.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory. Key equipment has been provided with back-up power supply in the event of a power outage.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 FLOOR PLAN

A floor plan can be found in Appendix 1.

18.5 BUILDING SECURITY

Building pass cards and alarm codes are distributed to all facility employees.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. [The reason for this is that it is important to know who is in the building in case of a safety emergency. The visitors logbook is used to ensure that everyone got out of the building safely.] In addition to signing into the

laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.
Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19.0

TEST METHODS AND METHOD VALIDATION

19.1 OVERVIEW

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 STANDARD OPERATING PROCEDURES (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory:

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP CW-Q-S-002, Writing a Standard Operating Procedure (SOP) and Laboratory SOP BF-QA-003, Procedure for Writing, Reviewing and Revising Controlled Quality Documents (QAM, SOP, etc)
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

19.4.1.1 The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999*
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996.*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*

- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th / on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008*.
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)* ***(DW labs only)***
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *New York State DEC Analytical Services Protocol, 2005*
- *New York State DOH Methods Manual*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory’s recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (BF-QA-004) is performed whenever there is a significant change in instrument type (e.g., new instrumentation), method or personnel.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Operations Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

Procedures for generation of IDOCs are detailed below and in laboratory SOP BF-QA-004, Laboratory Personnel Training.

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 20.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (see Figure 19-1) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 19.7.10). Generally the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used.

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. BF-QA-001 for details on the laboratory's MDL process.

19.8 INSTRUMENT DETECTION LIMITS (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation. (For CLP procedures, the IDL is determined using the standard deviation of 7 replicate spike analyses on each of 3 non-consecutive days.)

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

19.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

19.9.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, CVAA, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified or see section 20.7.9 for other options. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirement.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory's SOPs.

19.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, and specific electrode response factors.

19.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

19.12.1 Uncertainty is “a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result’s validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an “expanded uncertainty”: the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 ±0.5 mg/L.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g. 524.2, 525, etc) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 SAMPLE REANALYSIS GUIDELINES

Because there is a certain level of uncertainty with any analytical measurement, a sample repreparation (where appropriate) and subsequent analysis (hereafter referred to as "reanalysis") may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within ± 1 reporting limit for samples ≤ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Department Supervisor or Laboratory Director/Manager if unsure.

19.14 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently running the 'TALS Data System' which is a LIMs system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes a SQL server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity

Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, and data change requirements, as well as an internal LIMS permissions procedure.

  - LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.

- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 Ensure Information Availability

Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 Maintain Confidentiality

Ensure data confidentiality through physical access controls such as password protection or website access approval, when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The data review sheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, *Acceptable Manual Integration Practices*.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the project job folder, computer file, and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1%. Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, final inorganic results are reported to 2 significant figures for values less than 10 and 3 significant figures for values greater than 10 on the final report. Organic results are generally reported to 1 significant figure for values less than 10 and 2 significant figures for values greater than 10 on the final report. The number of significant figures may be adjusted based on client or project requirements.

19.14.2.4 For those methods that do not have an instrument printout, an instrumental output or a calculation spreadsheet upload compatible with the LIMS System, the final results and dilution factors are entered directly into LIMS by the analyst, and the software formats the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument’s printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is automatically transferred to the network server and, eventually, to a back-up tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out ‘real time’ and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be “Z”’d out, signed and dated.
- Worksheets are created with the approval of the Technical Director/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are out lined in several laboratory SOPs (e.g. BF-SR-002, "Receipt of Analytical Samples", BF-GP-012, "Technical Data Review", and BF-PM-001, "Project Information Requirements") to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data (BF-GP-013, Manual Integration). The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 The data review process at the laboratory starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Project Managers perform review of the chain-of-custody forms and inputted information and approve the input in LIMs to make the samples available to the laboratory departments for batching and processing.

19.14.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add any manual data qualifiers or dilution codes if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, initial and continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Where calibration is not required on a daily basis, secondary review of the initial calibration results may be conducted at the time of calibration. Approximately 10% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

- Results deviate from historical trends (if history available)

19.14.4.3 Unacceptable analytical results may require reanalysis of the samples. Any unusual or uncharacteristic circumstances are brought to the attention of the Department Manager. The Department Manager may involve the Project Manager, the Technical Director and/or the QA Manager for further investigation depending on the issue. Corrective action is initiated whenever necessary.

19.14.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report and creates the invoice. When complete, the report is issued to the client.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using SOP CA-Q-S-002 as the guidelines**.**

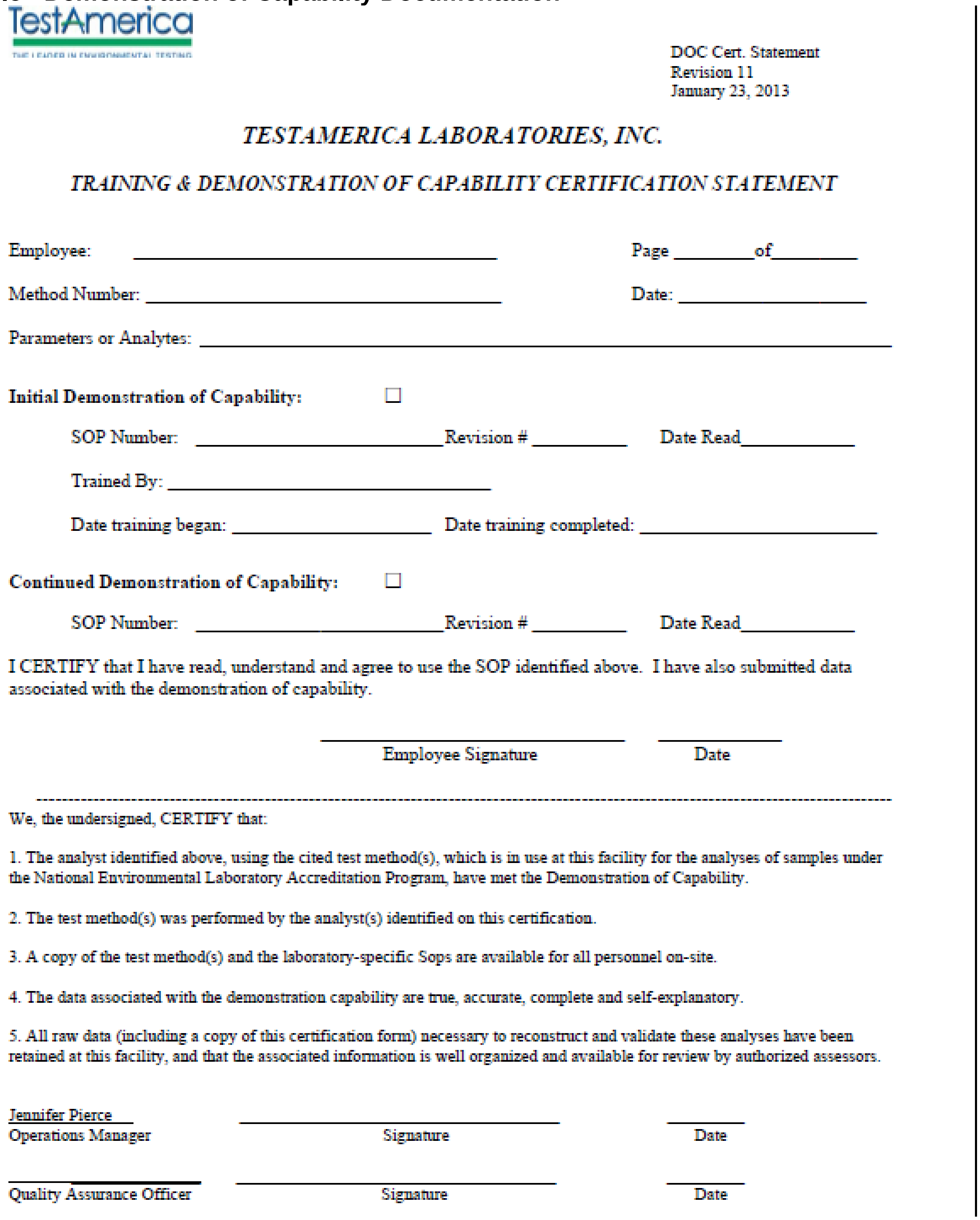
19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

DOC Cert. Statement
Revision 11
January 23, 2013

TESTAMERICA LABORATORIES, INC.

TRAINING & DEMONSTRATION OF CAPABILITY CERTIFICATION STATEMENT

Employee: ______________________ Page ______ of ______

Method Number: ______________________ Date: ______________

Parameters or Analytes: ______________________________________

Initial Demonstration of Capability: ☐

SOP Number: ______________ Revision # ________ Date Read ________

Trained By: ______________________

Date training began: ______________ Date training completed: ______________

Continued Demonstration of Capability: ☐

SOP Number: ______________ Revision # ________ Date Read ________

I CERTIFY that I have read, understand and agree to use the SOP identified above. I have also submitted data associated with the demonstration of capability.

______________________ ____________
Employee Signature Date

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2. The test method(s) was performed by the analyst(s) identified on this certification.

3. A copy of the test method(s) and the laboratory-specific Sops are available for all personnel on-site.

4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory.

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at this facility, and that the associated information is well organized and available for review by authorized assessors.

Jennifer Pierce ______________________ ________
Operations Manager Signature Date

______________ ______________________ ________
Quality Assurance Officer Signature Date

SECTION 20

EQUIPMENT (AND CALIBRATIONS)

20.1 OVERVIEW

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory equipment and instrumentation is presented in Table 20-1***.***

Equipment is only operated by authorized and trained personnel. Manufacturer’s instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 PREVENTIVE MAINTENANCE

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as lubrication, cleaning, and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrumentation records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance. Laboratory SOPs BF-GP-001,"Calibration of Autopipettes and Repipetters" and BF-GP-002, "Support Equipment: Maintenance, Record Keeping and Corrective Actions of Analytical Balances, Temperature Control Devises and Reagent Water" provide additional detail on the monitoring and record keeping for support equipment.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All reusable thermometers are calibrated on an annual basis with a NIST-traceable thermometer at temperatures bracketing the range of use. Disposable thermometers are discarded upon expiration and replaced with newly purchased thermometers. IR thermometers should be calibrated over the full range of use, including ambient, iced (4 degrees) and frozen (0 to -5 degrees), per the Drinking Water Manual. The IR thermometers are verified daily and calibrated annually. Digital probes and thermocouples are calibrated quarterly.

The NIST Mercury thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST digital thermometer is recalibrated every one year (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories) and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the laboratory SOP BF-GP-020, “Thermometer Calibration”.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically at a minimum on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.3.6 Field Sampling Devices (Isco Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated monthly (or if not utilized monthly, immediately prior to its usage) by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 10%, the procedure is repeated and if the result is still greater than 10%, then the Auto Sampler is taken out of service until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

Additional calibration and use information is detailed in laboratory SOP BF-FS-006, “Calibration of Field Meter”.

20.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points (exception being ICP and ICP/MS methods) will be used.

20.4.1.1 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

20.4.1.2 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

20.4.1.3 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules are methods where the referenced method does not specify two or more standards.

20.4.1.4 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.2 Calibration Verification

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, Section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met i.e., RPD, per NELAC (2003) Standard, Section 5.5.5.10.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions:

a).when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b).when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.2.1 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. See laboratory SOP's BF-MB-005 and BF-MV-007 for guidelines for making tentative identifications

Note:
For general reporting if TICs are requested, the ten (10), largest non-target analyte peaks whose area count exceeds 10% of the nearest internal standard will be termed "Tentatively Identified Compounds" (TICs). More or fewer TICs may be identified based on client requirements.

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

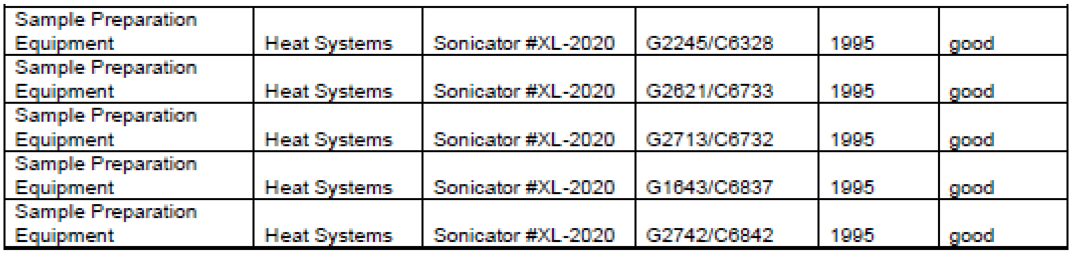
Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Laboratory Equipment and Instrumentation – TestAmerica Buffalo

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
GC/MS Instrumentation	Agilent	5975	CN10833020	2009	good
GC/MS Instrumentation	Agilent	5975	US80838844	2008	good
GC/MS Instrumentation	Agilent	5973	US44621446	2005	good
GC/MS Instrumentation	Agilent	5973	US52420646	2005	good
GC/MS Instrumentation	Agilent	5973	US41720721	2004	good
GC/MS Instrumentation	Agilent	5973	US35120354	2004	good
GC/MS Instrumentation	Agilent	5973	US41720707	2004	good
GC/MS Instrumentation	Agilent	5973	US10241053	2003	good
GC/MS Instrumentation	Agilent	5973	US30965634	2003	good
GC/MS Instrumentation	Agilent	5973	US03965692	2003	good
GC/MS Instrumentation	Agilent	5973	US05060076	2001	good
GC/MS Instrumentation	Agilent	5973	US05060084	2001	good
GC/MS Instrumentation	Agilent	5973	US03950346	2001	good
GC/MS Instrumentation	Agilent	5973	US82321636	2001	good
GC Instrumentation	Perkin Elmer	Clarus 608 dual uECD	680S10042901	2012	good
GC Instrumentation	Perkin Elmer	Clarus 600 dual FID	665S10020401	2012	good
GC Instrumentation	Agilent	6890 dual uECD	CN10520009	2005	good
GC Instrumentation	Agilent	6890 dual uECD	CN10520010	2005	good
GC Instrumentation	Agilent	6890 dual uECD	CN10448015	2005	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53126	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A63465	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53464	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53463	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A54409	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A54408	1994	good
GC Instrumentation	Hewlett Packard	5890II FID/FID	3115A34892	1994	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3336A60622	1994	good
GC Instrumentation	Hewlett Packard	5890II Hall/PID	3235A54089	1994	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3336A53465	1994	good
GC Instrumentation	Hewlett Packard	5890II dual FID	3336A53727	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3310A47661	1993	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53325	1993	good

GC Instrumentation	Hewlett Packard	5890II PID/FID	3133A37157	1993	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3203A42206	1992	good
GC Instrumentation	Hewlett Packard	5890II dual FID	3019A28433	1991	good
GC Instrumentation	Hewlett Packard	5890II Hall/PID	3121A35782	1990	good
Metals Instrumentation	Perkin Elmer	Elan 9000 ICP-MS	P0230202	2002	good
Metals Instrumentation	Leeman	PS200 II	HG9045	2000	good
Metals Instrumentation	Leeman	PS200 II	HG0033	2000	good
Metals Instrumentation	Thermo	ICAP 6000 Duo	ICP-20094603	2010	good
Metals Instrumentation	Thermo	ICAP 6000 Duo	ICP-20094602	2010	good
Water Quality Instrumentation	Konelab	Aqua20	SEA032	2009	good
Water Quality Instrumentation	Flash Point Analyzer		Herzog	2007	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	A54TB0578P	2006	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	E616130020E	2006	good
Water Quality Instrumentation	Thermo	ECA 1200 TOX	2006.0373	2006	good
Water Quality Instrumentation	Horizon	Speed Vap	03-0415	2005	good
Water Quality Instrumentation	Konelab	20XT	E3719731	2005	good
Water Quality Instrumentation	Thermo	ECA 1200 TOX	2004.901	2004	good
Water Quality Instrumentation	Dionex	Ion Chromatograph #DX-120	20126	2004	good
Water Quality Instrumentation	Konelab	20	S5019455	2004	good
Water Quality Instrumentation	Glastron	CN Midi-distillation	2502	2003	good
Water Quality Instrumentation	Glastron	Phenol Midi-distillation	2069	2003	good
Water Quality Instrumentation	Glastron	Phenol Midi-distillation	2053	2003	good
Water Quality Instrumentation	Labtronics	BOD Magic - Autoanalyzer	270H3XB531	2004	good
Water Quality Instrumentation	Labtronics	BOD Magic - Autoanalyzer	270J2XB669	2003	good
Water Quality Instrumentation	ManTech	PC Titrator	MS-OK2-607	2003	good
Water Quality Instrumentation	HACH	Spectrophotometer #DR/2500	30200004886	2003	good
Water Quality Instrumentation	Dionex	Ion Chromatograph #DX-120	2060196	2002	good
Water Quality Instrumentation	Spectronic	Genesis 4001/4	3SGC199091	2000	good

Water Quality Instrumentation	Lachat	Quickchem 8000 Autoanalyzer	A83000-1527	2000	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1010 #1	H92170411	1999	good
Water Quality Instrumentation	Lachat	Quickchem 8000 Autoanalyzer	A83000-1439	1999	good
Water Quality Instrumentation	Dionex	Ion Chromatograph #DX-120	99010157	1999	good
Water Quality Instrumentation	Dionex	Ion Chromatograph #DX-120	99110569	1999	good
Water Quality Instrumentation	Orion	Ion Meter #230A	2229	1999	good
Water Quality Instrumentation	VWR	Ion Meter #2100	1063	1997	good
Water Quality Instrumentation	YSI	Oxygen Meter #57	93J09826	1995	good
Water Quality Instrumentation	BOD chamber		Revco	1994	good
Sample Preparation Equipment	TurboVap	II	TV0529N12427	2006	good
Sample Preparation Equipment	TurboVap	II	TV0529N12428	2006	good
Sample Preparation Equipment	J2	ACCUPREP GPC	03F-10723	2003	good
Sample Preparation Equipment	TurboVap	II	TV9445N5816	1996	good
Sample Preparation Equipment	TurboVap	II	TV9427N4133	1996	good
Sample Preparation Equipment	TurboVap	II	TV944N5819	1996	good
Sample Preparation Equipment	TurboVap	II	TV944N5820	1996	good
Sample Preparation Equipment	TurboVap	II	TV0024N9623	2000	good
Sample Preparation Equipment	TurboVap	II	TV0022N9604	2000	good
Sample Preparation Equipment	TurboVap	II	TV0312N11592	2003	good
Sample Preparation Equipment	TurboVap	II	TV0312N11591	2003	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16902	1999	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16907	1999	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16913	1999	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G1647/C5659	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2665/C5674	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2620/C5660	1994	good



Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2245/C6328	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2621/C6733	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2713/C6732	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G1643/C6837	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2742/C6842	1995	good

Table 20-2.

Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Change dryer tube Fill reductant bottle with 10% Stannous Chloride	Daily Daily As Needed Daily
ICP & ICP/MS	Check pump tubing Check liquid argon supply Check fluid level in waste container Check re-circulator levels Clean or replace filters Check torch Check sample spray chamber for debris Clean and align nebulizer Change pump oil Change Cones Change printer cartridge Replace pump tubing	Daily Daily Daily Monthly As required Daily Monthly Monthly Monthly As required As required As required
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Annually
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Oil rollers/chains/side rails Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly
Agilent GC/MS	Pump oil-level check Pump oil changing Analyzer bake-out Analyzer cleaning Resolution adjustment COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	Monthly Annually As required As required As required As required As required As required As required As required

Instrument	Procedure	Frequency
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Glass wool replacement Check system for gas leaks with SNOOP Check for loose/frayed power wires and insulation Bake injector/column Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	Daily Daily via use of known compound retention Daily As required As required W/cylinder change as required As Required As Required As Required As Required As Required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Photoionization Detector (PID)	Change O-rings Clean lamp window	As required As required
HPLC	Change guard columns Change lamps Change pump seals Replace tubing Change fuses in power supply Filter all samples and solvents Change autosampler rotor/stator	As required As required Semi-annually or as required As required As required Daily As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
Centrifuge	Check brushes and bearings	Every 6 months or as needed

Table 20-3.

Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using "S" NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily, when used Annual	± 0.2%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using "S" NIST traceable. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily, when used Annual	± 0.5%	Clean. Replace.
NIST Certified Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
NIST-Traceable Thermometer-Mercury	Accuracy determined by accredited measurement laboratory.	3 years	As per certificate.	Replace.
NIST-Traceable Thermometer-Digital	Accuracy determined by accredited measurement laboratory.	1 year	As per certificate	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 1.2°C	Replace
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 1.5°C	Replace

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
InfraRed Temperature Guns	Against NIST-traceable thermometer Accuracy determined by accredited measurement laboratory.	Daily at appropriate temperature range for intended use. Annual	± 1.5°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily. If out of range, check again in two hours.	0-6°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10)-(-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water or solvent of use, dispense into tared vessel. Record weight with device ID number. Calibrate using 4 replicate gravimetric measurements	Each day of use Quarterly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Glass Microliter Syringes	None	Accuracy must be initially demonstrated if syringe was not received with a certificate attesting to established accuracy.	± 1%	Not applicable.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Inorganics Department.	Daily	<1.0 µmho at 25°C	Record on log. Report discrepancies to QA Manager, Operations Manager or Technical Director.

SECTION 21

MEASUREMENT TRACEABILITY

21.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g. bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory accreditation Cooperation) or APLAC (Asia – Pacific Laboratory Accreditation Cooperation)..A certificate and scope of accreditation is kept on file at the laboratory.

The calibration report or certificate submitted to ***TestAmerica Buffalo*** contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. Opinions and interpretations of results are presented along with the basis upon which they were made and identified as such. The report may be submitted by facsimile or other electronic means as long as the requirements of the International Standard are achieved. If significant amendments are made to a calibration certificate, a supplemental certificate for the serial-number-specified piece of equipment is so identified. When a new certificate is offered, it uniquely identifies and references the one it replaces. All calibration reports are filed in the QA Office.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA or NVLAP with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the ‘true’ value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer’s requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. Method specific information may also be found in the laboratory method SOPs in the “Standards and Reagents” sections. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. Refer to SOP No. CA-Q-S-001, Solvent and Acid Lot Testing and Approval.

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained by each department in bound or electronic folders. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer laboratory SOP BF-GP-019, “Standard Traceability and Preparation” and also to the method specific SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory department’s chemical history log and are assigned a unique identification number. Preparation of working standards or reagents prepared from the stock is documented in the laboratory Department’s Standard Preparation Log. The following information is typically recorded:

- Standard ID
- Description of Standard
- Department
- Preparer’s name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment section

Records are maintained for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date
- Standard ID from LIMS.
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained ***in the LIMS system.***

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOPs.

SECTION 22.0

SAMPLING

22.1 OVERVIEW

The laboratory provides sampling services. Sampling procedures are described in the following SOPs:

BF-FS-001	Chain of Custody Documentation
BF-FS-002	Sample Packaging and Shipment Off-Site
BF-FS-003	Groundwater Sampling Field Data Collection
BF-FS-004	Equipment Decontamination
BF-FS-005	Groundwater/Surface Water Sampling
BF-FS-006	Calibration of Field Meter
BF-FS-007	Low Flow Sampling Procedures
BF-FS-008	Surface and Subsurface Soil/Sediment Sampling

22.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the chain-of-custody (COC) form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in “days” (e.g. 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in “hours” (e.g. 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time for time critical parameters ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is. These programs will be addressed on a case-by-case basis.

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the following tables are derived from the source documents for the methods. If method required holding times, this info is in the SOP or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or “ASAP” is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory’s responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

The following information provides general guidance for homogenization and subsampling. For laboratory specific procedures refer to SOP BF-GP-005, “Sample Homogenization and Subsampling”.

SECTION 23

HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The shipping documents are retained with the project files.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC or in the project notes, sample management will initiate Strict Chain of Custody procedures as defined in SOP BF-GP-018, "Strict Internal Chain-of-Custody".

23.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on the Sample Login Form – and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 480 - 9608 - A - 1

Location ID (480)
Login ID
Container Occurrence
Sample Number

The above example states that TestAmerica Buffalo Laboratory (Location 480). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container (“A”) of Sample #1.

If the primary container goes through a prep step that creates a “new” container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: XXX - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 220-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 SAMPLE ACCEPTANCE POLICY

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;

- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- The project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks described in Section 23.1.1.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. BF-SR-002.

23.4 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. Aqueous samples designated for metals analysis are stored at ambient temperature. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed at a minimum of every two weeks.

Analysts and technicians provide a request form to the cooler custodian who then retrieves the requested samples. In the absence of the cooler custodian, the analysts may personally retrieve the sample containers allocated to their analysis from the designated refrigerator. The samples are placed on carts, transported the analytical area and analyzed. Following analysis the remaining sample is returned to the refrigerator from which it originally came. All unused portions of samples are returned to the secure sample control area. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. After two to four weeks the samples are moved to dry room temperature, sample archive area where they are retained a minimum of 2 weeks after the final report has been issued to the client at which time disposal occurs. Special arrangements may be made to store samples for longer periods of time. Extended archival periods allow additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, samples which are known or suspected to be hazardous are segregated and a notification is issued to all laboratory personnel.
All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm. All soil samples, including foreign soil samples are heat treated or incinerated in accordance with USDA permit requirements and are transported / disposed by USEPA approved facilities.

Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

23.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). For sample shipments which include water/solid volatile organic analyses (see Note), a trip blank is enclosed when required by method specifications or state or regulatory programs. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will analyze the trip blanks that were supplied.

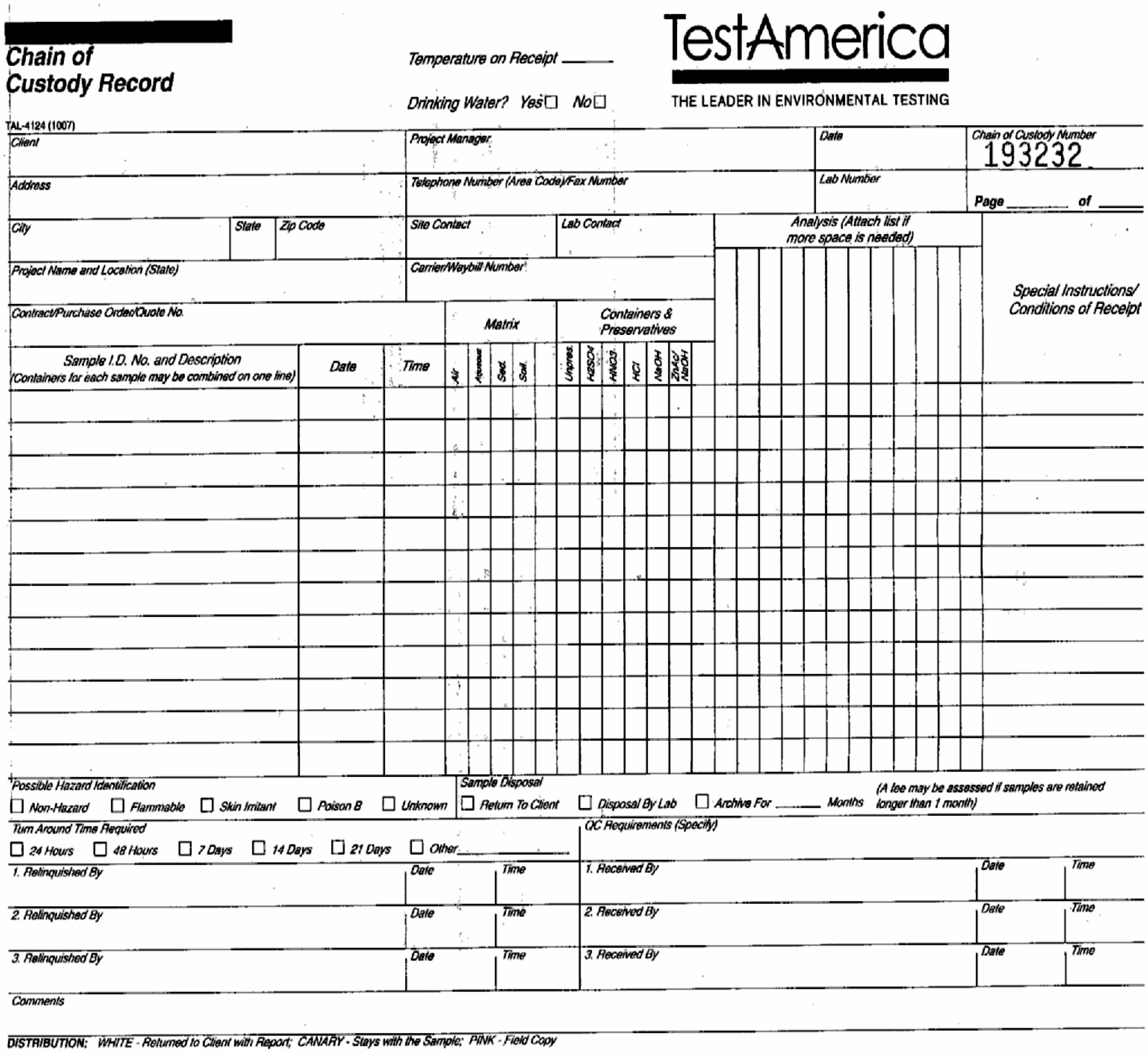
23.7 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP: BF-WM-001, "Waste Management".) All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than six weeks from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample may request to participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal and nature of disposal (such as sample depletion, hazardous waste facility disposal, and return to client). All disposal of sample containers is accomplished through incineration. A Waste Disposal Record should be completed.

Figure 23-1.

Example: Chain of Custody (COC)



Chain of Custody Record

Temperature on Receipt ____

Drinking Water? Yes☐ No☐

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TAL-4124 (1007)

Client	Project Manager	Date	Chain of Custody Number 193232
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ____ of ____
City / State / Zip Code	Site Contact / Lab Contact		
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix					Containers & Preservatives							Analysis (Attach list if more space is needed)												Special Instructions/ Conditions of Receipt
			Air	Aqueous	Sed.	Soil		Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH														

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Figure 23-2.

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
    - *Client name, address, phone number and fax number (if available)*
    - *Project name and/or number*
    - *The sample identification*
    - *Date, time and location of sampling*
    - *The collectors name*
    - *The matrix description*
    - *The container description*
    - *The total number of each type of container*
    - *Preservatives used*
    - *Analysis requested*
    - *Requested turnaround time (TAT)*
    - *Any special instructions*
    - *Purchase Order number or billing information (e.g. quote number) if available*
    - *The date and time that each person received or relinquished the sample(s), including their signed name.*
    - ***The date and time of receipt must be recorded between the last person to relinquish the samples and the person who receives the samples in the lab, and they must be exactly the same.***
    - **Information must be legible**

2) Samples must be properly labeled.
    - Use durable labels (labels provided by TestAmerica are preferred)
    - Include a unique identification number
    - Include sampling date and time & sampler ID
    - Include preservative used.
    - Use indelible ink
    - **Information must be legible**

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

4) Samples must be preserved according to the requirements of the requested analytical method. See lab Sampling Guide.
   Note: Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

- Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

- For Volatile Organic analyses in drinking water (Method 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:
  - 1. Test for residual chlorine in the field prior to sampling.
    - If no chlorine is present, the samples are to be preserved using HCl as usual.
    - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.
  - 2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.
- **FOR WATER SAMPLES TESTED FOR CYANIDE – for NPDES samples by Standard Methods or EPA 335**
  - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

    - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.

  - It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

  - The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

5) Sample Holding Times
   - TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (2 working days) remaining on the holding time to ensure analysis.

   - Analyses that are designated as "field" analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for "field" analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis.

6) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply this blank with the bottle order.

7) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

8) Recommendations for packing samples for shipment.

   - Pack samples in Ice rather than “Blue” ice packs.

   - Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.

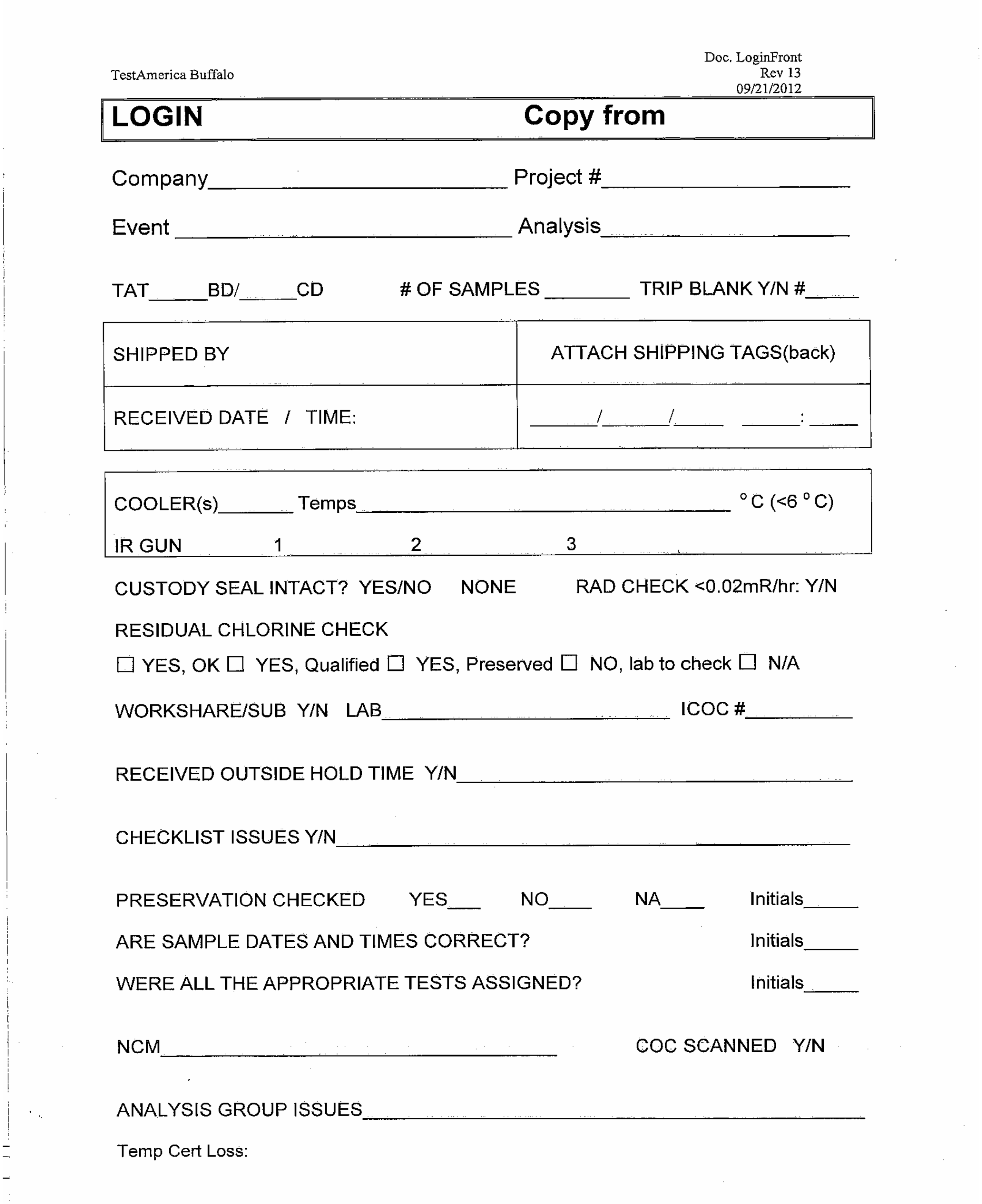
   - Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.

   - Fill extra cooler space with bubble wrap.

Figure 23-3.

Example: Cooler Receipt Form

Doc. Login Front



TestAmerica Buffalo

Doc. LoginFront
Rev 13
09/21/2012

LOGIN **Copy from**

Company________________________ Project #____________________

Event ___________________________ Analysis____________________

TAT_____BD/_____CD # OF SAMPLES ________ TRIP BLANK Y/N #_____

SHIPPED BY	ATTACH SHIPPING TAGS(back)
RECEIVED DATE / TIME:	______/______/_____ ______: _____

COOLER(s)_______ Temps_______________________________ °C (<6 °C)

IR GUN 1 2 3

CUSTODY SEAL INTACT? YES/NO NONE RAD CHECK <0.02mR/hr: Y/N

RESIDUAL CHLORINE CHECK

☐ YES, OK ☐ YES, Qualified ☐ YES, Preserved ☐ NO, lab to check ☐ N/A

WORKSHARE/SUB Y/N LAB________________________ ICOC #_________

RECEIVED OUTSIDE HOLD TIME Y/N_________________________________

CHECKLIST ISSUES Y/N____

PRESERVATION CHECKED YES___ NO____ NA____ Initials_____

ARE SAMPLE DATES AND TIMES CORRECT? Initials_____

WERE ALL THE APPROPRIATE TESTS ASSIGNED? Initials_____

NCM________________________________ COC SCANNED Y/N

ANALYSIS GROUP ISSUES____

Temp Cert Loss:

Section 24.0

ASSURING THE QUALITY OF TEST RESULTS

24.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 NEGATIVE CONTROLS

Table 24-1.

Control Type	Details
Method Blank (MB)	Are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	Are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

Table 24-1.

Control Type	Details
Instrument Blanks	Are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blank [1]	Are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan) Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	Are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	Are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard may be reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

24.4.1.5.1 For methods that have 1-10 target analytes, spike all components.

24.4.1.5.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

24.4.1.5.3 For methods with more than 20 target analytes, spike at least 16 components.

24.4.1.5.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

24.4.1.5.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 SAMPLE MATRIX CONTROLS

Table 24-5. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	Used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	Essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable.

24.6.3.4 The maximum acceptable recovery limit will be 150%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by ≤ 5% from previous, the data points are inspected and, using professional judgment, the limits may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits.

24.6.4.1 The control limits are maintained in the laboratory LIMs system. The limits for each analyte/method/matrix combination are assigned effective and expiration dates. The QA department is able to query the LIMs system and print an active list of control limits based on this database. The most current laboratory limits (based on the effective/expiration dates) are reflected on the laboratory worksheets and final reports unless superseded by project specific limits.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 13) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples.

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 22.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 19.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25.0

REPORTING RESULTS

25.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. A variety of report formats are available to meet specific needs. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) with a “sample results” column header.

25.2.2 Each report cover page is printed on company letterhead which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as # / ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

- In most cases, the applicable COC is paginated and is an integral part of the report.

- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (e.g. Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Practical quantitation limits or client reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits (if requested).

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda). Sample temperatures are recorded in the report case narrative and on the COC. Deviations from normal conditions (e.g., preservation, breakage) are recorded in the report case narrative.

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.20 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not.

25.2.21 The laboratory includes a cover letter.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When Soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g, partial report). A complete report must be sent once all of the work has been completed.

25.2.26 Any non-TestAmerica subcontracted analysis results are provided as an addendum to the report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.3 REPORTING LEVEL OR REPORT TYPE

TestAmerica Buffalo offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 26.7.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. ***TestAmerica Buffalo*** offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in Section 8.

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.6 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. It is our policy that facsimiles are intended for and should be used for business purposes only. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify the sender.

25.7 FORMAT OF REPORTS

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "R". The revised report will have the word "revised" appended to the cover letter.

When the report is re-issued, a notation of "revised" is placed on the cover/signature page of the report. A brief explanation of reason for the re-issue is included in the report case narrative.

25.9 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.9.1 Policy on Data Omissions or Reporting Limit Increases

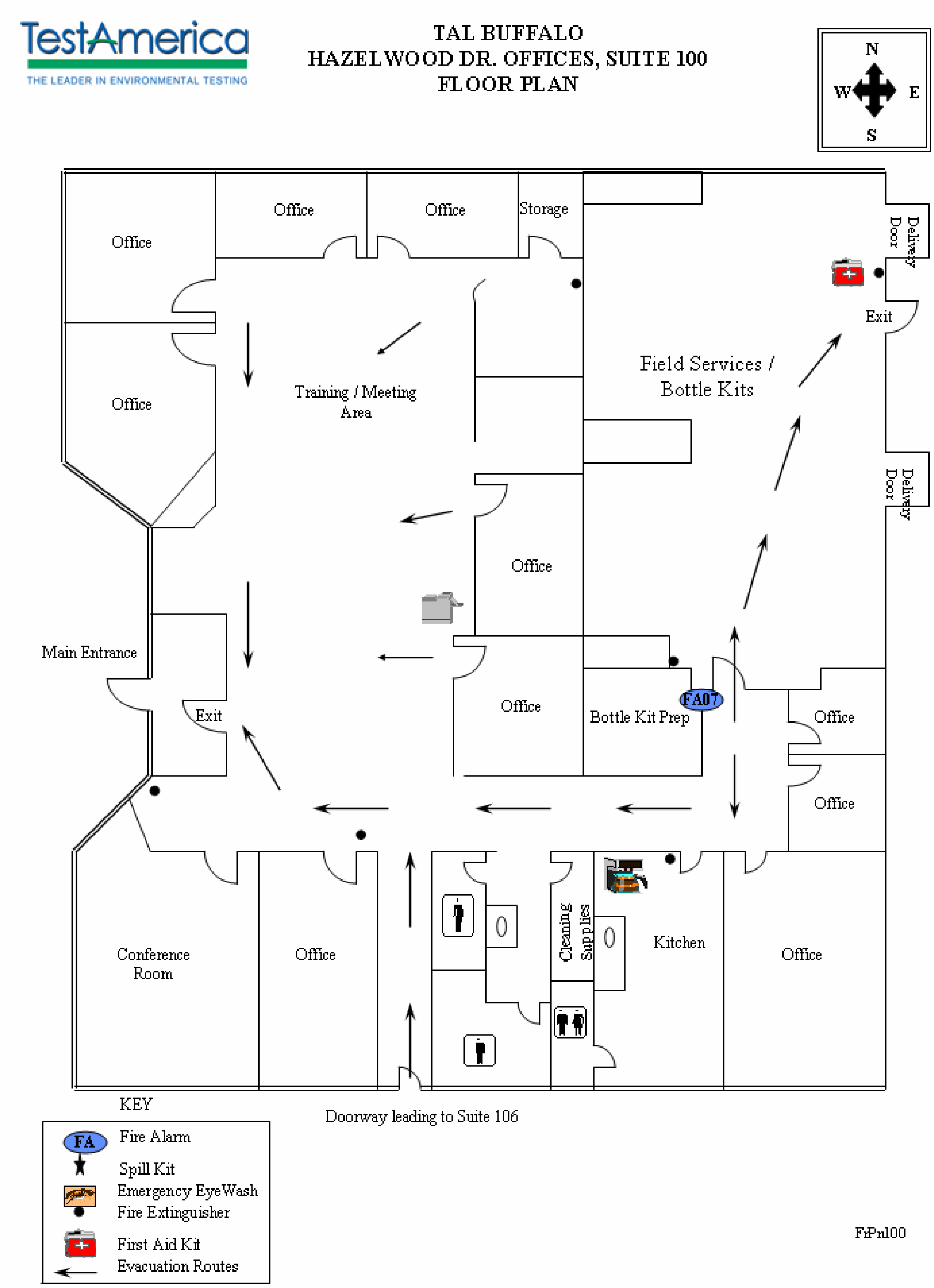
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.


TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 100
FLOOR PLAN
N
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Office
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Storage
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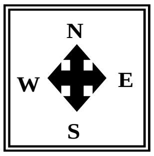
Bottle Kit Prep
FA07
Office
Office
Conference Room
Office
Cleaning Supplies
Kitchen
Office
Doorway leading to Suite 106
KEY
FA
Fire Alarm
Spill Kit
Emergency EyeWash
Fire Extinguisher
First Aid Kit
Evacuation Routes
FrPnl00

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 106
CLIENT SERVICES/REPORT PREP
FLOOR PLAN



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TAL BUFFALO
HAZELWOOD DR. NY OFFICES, SUITE 106
LABORATORY AREA
FLOOR PLAN

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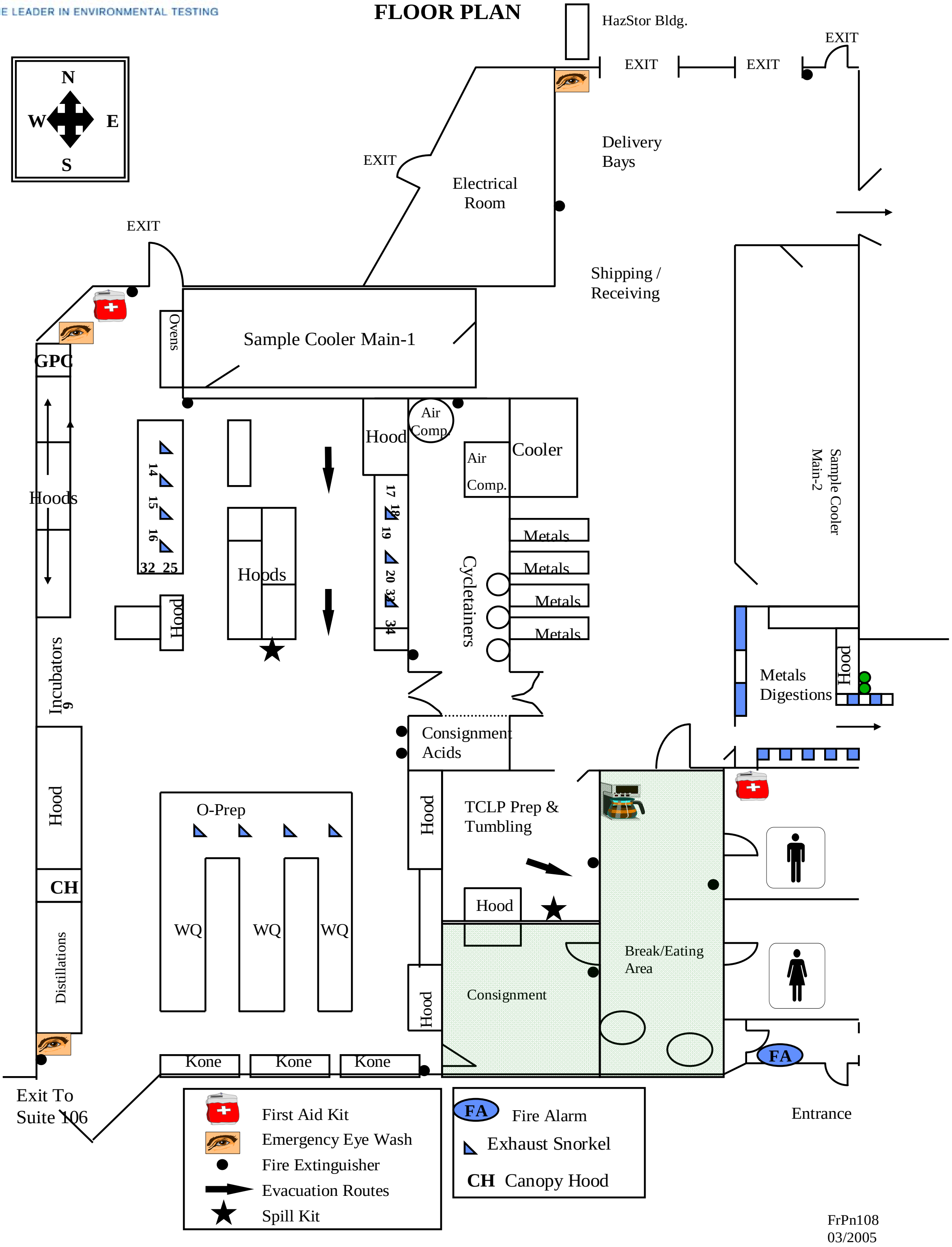
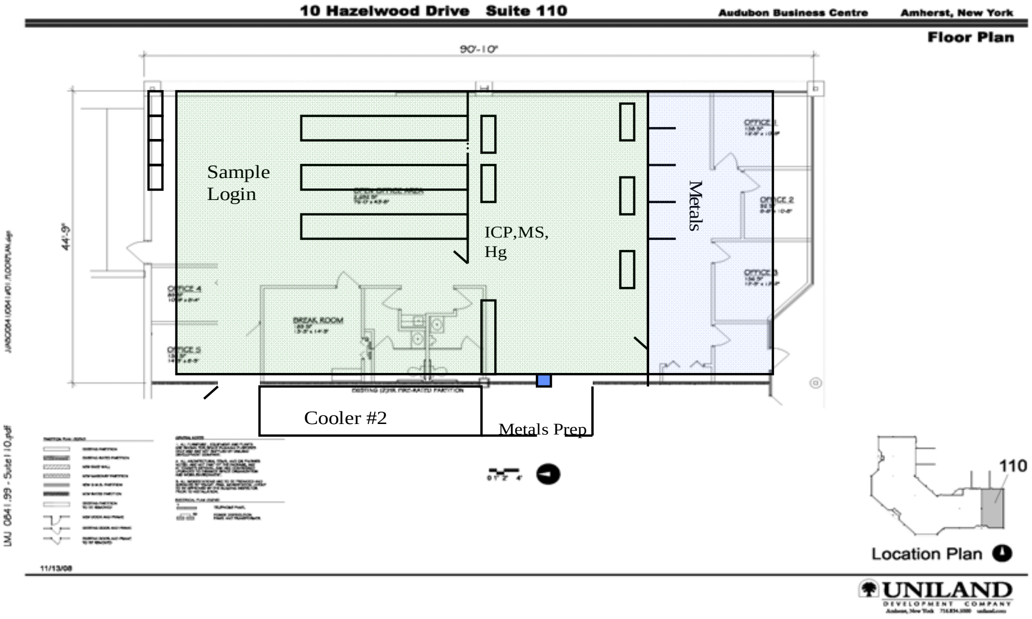
TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 108
FLOOR PLAN

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Audubon Business Centre
Amherst, New York
Floor Plan
90'-10"
44'-9"
Sample Login
ICP,MS, Hg
Metals
OFFICE 1
OFFICE 2
OFFICE 3
OFFICE 4
OFFICE 5
BREAK ROOM
OPEN OFFICE AREA
EXISTING (2)HR FIRE-RATED PARTITION
Cooler #2
Metals Prep
110
Location Plan
11/13/08
UNILAND
DEVELOPMENT COMPANY

Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (TNI)

Accrediting Authority: The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (TNI)

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (TNI)

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI).

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (TNI)

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength

Derivitization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures
(TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (TNI)

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for Inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

> *Aqueous*: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
>
> *Drinking Water*: any aqueous sample that has been designated as a potable or potential potable water source.
>
> *Saline/Estuarine*: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
>
> *Non-aqueous Liquid*: any organic liquid with <15% Settleable solids.
>
> *Biological Tissue*: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
>
> *Solids*: includes soils, sediments, sludges, and other matrices with >15% Settleable solids.
>
> *Chemical Waste*: a product or by-product of an industrial process that results in a matrix not previously defined.
>
> *Air & Emissions*: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (TNI)

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (TNI)

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (TNI)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (TNI)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (NELAC)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI) [2.1]

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of NELAC standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or and which is accepted as the method for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS-ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
NELAC – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

TestAmerica Buffalo maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

State	***Program***	***Cert # / Lab ID***
Arkansas	*CWA, RCRA, SOIL*	*88-0686*
California*	*NELAP CWA, RCRA*	*01169CA*
Connecticut	*SDWA, CWA, RCRA, SOIL*	*PH-0568*
Florida*	*NELAP CWA, RCRA*	*E87672*
Georgia*	*SDWA,NELAP CWA, RCRA*	*956*
Illinois*	*NELAP SDWA, CWA, RCRA*	*200003*
Iowa	*SW/CS*	*374*
Kansas*	*NELAP SDWA, CWA, RCRA*	*E-10187*
Kentucky	*SDWA*	*90029*
Kentucky UST	*UST*	*30*
Louisiana*	*NELAP CWA, RCRA*	*2031*
Maine	*SDWA, CWA*	*NY0044*
Maryland	*SDWA*	*294*
Massachusetts	*SDWA, CWA*	*M-NY044*
Michigan	*SDWA*	*9937*
Minnesota	*SDWA,CWA, RCRA*	*036-999-337*
New Hampshire Primary*	*NELAP SDWA, CWA, RECRA*	*2973*
New Hampshire Secondary*	*NELAP SDWA, CWA, RECRA*	*2337*
New Jersey*	*NELAP,SDWA, CWA, RCRA,*	*NY455*
New York*	*NELAP, AIR, SDWA, CWA, RCRA*	*10026*
North Dakota	*CWA, RCRA*	*R-176*
Oklahoma	*CWA, RCRA*	*9421*
Oregon*	*CWA,RCRA*	*NY200003*
Pennsylvania*	*NELAP CWA,RCRA*	*68-00281*
Rhode Island	*SDWA, CWA*	*LAO00328*
Tennessee	*SDWA*	*02970*
Texas*	*NELAP CWA, RCRA*	*T104704412-08-TX*
USDA	*FOREIGN SOIL PERMIT*	*S-41579*
Virginia	*SDWA*	*278*
Washington*	*NELAP CWA,RCRA*	*C1677*
Wisconsin	*CWA, RCRA*	*998310390*
West Virginia	*CWA,RCRA*	*252*

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, and in the QA Department.